IMPROVING THE MECHANISM OF REDUCING FINANCIAL RISKS OF INNOVATIVE ACTIVITIES IN TEXTILE ENTERPRISES

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Abstract: The dynamic development of Uzbekistan's textile industry, accounting for over 60% of the country's non-commodity exports in 2024, demands new mechanisms to mitigate financial risks associated with innovation. This study identifies the primary financial vulnerabilities faced by innovative textile enterprises, such as credit risk, cash flow volatility, and innovation investment uncertainty. Through comparative analysis, the paper proposes a multi-layered mechanism incorporating financial hedging instruments, innovation insurance models, and government-backed risk-sharing schemes. Empirical data from 130 Uzbek textile firms highlight that adopting structured financial risk management systems could reduce financial losses by up to 18% annually. The findings serve as a theoretical and practical guide to enhancing financial sustainability in the context of Uzbekistan's ongoing industrial modernization.

Keywords: financial risk management, innovation risks, textile industry, risk mitigation mechanisms, Uzbekistan, investment risks, innovation insurance, financial sustainability.

INTRODUCTION

In the context of increasing global competition and the accelerated technological transformation of industries, the textile sector of Uzbekistan stands at a critical juncture. Over the past decade, Uzbekistan has systematically pursued industrial diversification, and the textile industry, traditionally one of the country's major sectors, has assumed a leading role in this strategic realignment. According to the State Committee of Statistics of Uzbekistan (2024), the textile and garment sector contributed approximately 11% to national GDP and accounted for 60.5% of non-resource exports, demonstrating its significance to both economic growth and employment. However, sustaining and enhancing this growth trajectory increasingly depends on the industry's capacity to embrace and integrate innovation. Yet, with innovation comes a substantial rise in financial risks — a reality that textile enterprises are grappling with amidst limited financial resilience and nascent risk management frameworks.

Innovation activities in textile enterprises encompass a wide array of processes — from introducing new fabrics such as organic cotton and smart textiles to investing in automation technologies, digital platforms, and green manufacturing methods. While these innovations offer significant opportunities for value creation, market differentiation, and operational efficiency, they simultaneously expose firms to heightened financial vulnerabilities. These risks include high upfront capital requirements, uncertain return

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horizons, technology obsolescence, supply chain disruptions, and market acceptance risks. In Uzbekistan, where the innovation ecosystem is still maturing, the financial risks linked to innovative activities are particularly acute. The lack of sophisticated financial instruments, underdeveloped innovation insurance markets, and limited access to venture capital exacerbate the exposure of textile firms to potential financial distress.

Empirical evidence from recent surveys by the Chamber of Commerce and Industry of Uzbekistan (CCIU, 2023) suggests that over 67% of textile enterprises identify financial risk as the primary obstacle to pursuing innovation. Among firms that engaged in innovation-driven projects between 2021 and 2023, approximately 22% reported partial or complete project failures due to financial constraints and risk mismanagement. Notably, financial volatility stemming from raw material price fluctuations, particularly in cotton markets, played a crucial role in undermining profitability and financial stability. Between 2022 and 2024, global cotton prices exhibited an average annual volatility rate of 13.5%, complicating cost forecasts and budgeting processes for textile enterprises. Additionally, interest rate fluctuations in Uzbekistan's banking sector — which saw average lending rates rise from 18% to 23% over two years — further constrained the availability of affordable financing for innovation.

The Uzbek government's policy measures have sought to mitigate these challenges. Initiatives such as the "Textile Industry Development Strategy 2021–2025" and financial support schemes under the Innovative Development Fund have provided partial relief. However, as highlighted in the World Bank's (2023) "Uzbekistan Economic Update," significant structural weaknesses persist. Most notably, risk-sharing mechanisms between public institutions and private enterprises remain underdeveloped, and there is a lack of tailored financial products addressing the specific risk profiles of innovative textile projects. As a result, innovation activity remains concentrated among larger, financially stronger firms, while small and medium-sized enterprises (SMEs) — which constitute over 78% of textile enterprises — remain largely marginalized in the innovation process.

The theoretical foundations of financial risk management suggest that effective risk reduction mechanisms in innovation-intensive sectors must be multi-layered, integrating proactive risk identification, diversification strategies, financial hedging, insurance schemes, and adaptive financing structures (Teece, 2018; Rothaermel, 2019). In leading textile-exporting countries such as China, Turkey, and India, financial innovation — including the use of futures contracts, specialized innovation insurance products, venture financing models, and public-private risk-sharing funds — has proven instrumental in de-risking innovation activities. Lessons from these contexts underline the necessity for Uzbekistan to develop a similarly comprehensive and context-sensitive mechanism to support its textile sector's innovation ambitions.

Despite the increasing recognition of these imperatives, academic and policy-oriented research specifically addressing financial risk reduction in innovative textile activities in Uzbekistan remains scarce. Existing studies tend to focus broadly on investment climate reforms, innovation system development, or SME financing without adequately

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examining the unique intersection of financial risk management and innovation within the textile sector. Consequently, there is a pressing need for more granular, sector-specific analyses that can inform targeted policy interventions and strategic decision-making at the enterprise level.

The strategic importance of addressing financial risks in textile innovation is further underscored by Uzbekistan's ambitious economic targets. By 2027, the government aims to expand textile exports to $5 billion, increase the share of value-added products in total textile exports to 50%, and attract at least $1 billion in foreign direct investment (FDI) into the sector (Ministry of Investments, Industry and Trade, 2024). Achieving these goals necessitates a vibrant, innovation-driven textile industry capable of navigating financial uncertainties effectively. Failure to enhance financial risk management mechanisms could not only impede the realization of these targets but also expose the industry to heightened systemic vulnerabilities, particularly in an increasingly volatile global economic environment characterized by supply chain realignments, technological disruptions, and shifting consumer preferences toward sustainability.

Within this context, the central research question guiding this study is: How can financial risks associated with innovative activities in Uzbekistan's textile enterprises be effectively identified, assessed, and mitigated through improved mechanisms? To address this question, the study sets the following objectives:

- To diagnose the primary financial risks confronting innovative textile enterprises in Uzbekistan;
- To analyze the limitations of existing financial risk management practices in the sector;
- To develop a conceptual framework for a comprehensive financial risk reduction mechanism tailored to the needs of innovative textile enterprises;
- To propose practical recommendations for enterprises, financial institutions, and policymakers aimed at enhancing the financial resilience of innovation activities.

The methodological approach of this study combines both quantitative and qualitative techniques. Quantitative data are derived from structured surveys conducted among 130 textile enterprises of varying sizes, supplemented by statistical data from the State Committee of Statistics, the Ministry of Economy and Finance, and international databases (e.g., World Bank, OECD). Qualitative insights are drawn from semi-structured interviews with financial managers, innovation officers, and policymakers involved in the textile sector. Additionally, econometric modeling techniques are employed to examine the relationship between financial risk mitigation practices and enterprise performance indicators such as innovation success rates, profitability, and financial stability.

Preliminary findings suggest that without intervention, the probability of financial distress among innovative textile enterprises in Uzbekistan could rise by **up to 28%** over the next five years. Conversely, enterprises that institutionalize comprehensive financial risk management practices could enhance their financial stability by **20–25%**, reduce innovation failure rates by **15–18%**, and achieve superior export performance relative to their peers.

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These findings affirm the critical importance of developing and operationalizing effective financial risk reduction mechanisms as an integral part of Uzbekistan's broader industrial modernization strategy.

In conclusion, this research contributes to the academic discourse and policy debates on innovation financing, financial risk management, and industrial competitiveness in emerging economies. By focusing on the specific challenges and opportunities within Uzbekistan's textile sector, it offers actionable insights that can inform both enterprise-level strategies and national policy frameworks. In doing so, it seeks to advance the goal of creating a robust, innovation-capable, and financially resilient textile industry that can sustain Uzbekistan's economic growth in an increasingly complex global environment.

MATERIALS AND METHODS

This study adopts a mixed-methods research design, combining quantitative and qualitative approaches to ensure a comprehensive analysis of financial risk mechanisms in the innovation activities of textile enterprises in Uzbekistan. The rationale for utilizing a mixed-methods framework is based on the multidimensional nature of financial risks, which cannot be fully captured by a single methodological lens. Quantitative methods allow for statistical generalization across the textile sector, while qualitative methods facilitate a deeper understanding of the contextual and behavioral aspects influencing financial risk management practices.

The research is exploratory, descriptive, and explanatory in nature:

- Exploratory, because limited prior research specifically addresses the nexus between innovation activities and financial risks in Uzbekistan's textile sector.
- Descriptive, in mapping the types and sources of financial risks faced by textile enterprises.
- Explanatory, in analyzing causal relationships between risk management mechanisms and innovation success or failure outcomes.

Primary data were collected through:

- Structured surveys distributed to 130 textile enterprises (including micro, small, medium, and large firms) operating across Uzbekistan's major textile hubs: Tashkent, Namangan, Samarkand, and Andijan.
- Semi-structured interviews conducted with 20 financial managers, innovation project leaders, and senior executives from selected textile companies.
- Expert consultations with policymakers from the Ministry of Investments, Industry, and Trade and officials from the Uzbekistan Textile and Garment Association (UzTextileProm).

Survey respondents were selected using stratified random sampling, ensuring a representative distribution based on enterprise size, innovation activity level, and regional location.

Secondary data sources included:

- Statistical reports from the State Committee of Statistics of Uzbekistan (2019–2024);

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• Sectoral reports from the Ministry of Economy and Finance;

• Annual financial statements of listed textile companies (e.g., Uztex Group, Bukhara Cotton Textile Cluster);

• International databases such as the World Bank's Enterprise Surveys, OECD Innovation Statistics, and UNIDO Industrial Development Reports;

• Academic literature accessed via Scopus, Web of Science, and Google Scholar.

The survey questionnaire comprised five sections:

1. Enterprise profile and innovation activity characteristics;
2. Financial structure and funding sources for innovation projects;
3. Identification and assessment of financial risks;
4. Existing risk mitigation practices;
5. Perceptions of institutional support mechanisms.

A 5-point Likert scale was employed to measure respondents' attitudes toward risk severity, risk management effectiveness, and institutional support satisfaction.

To ensure validity and reliability:

• The survey instrument was pre-tested with a pilot group of 15 textile companies, leading to refinements in question phrasing and sequence.

• Cronbach's alpha coefficient was calculated for internal consistency, yielding a score of 0.87, indicating high reliability.

• Content validity was established through expert reviews involving three professors specializing in financial management and industrial innovation.

• Chi-square tests were applied to examine associations between categorical variables, such as enterprise size and adoption of financial risk management practices.

• T-tests and ANOVA were used to assess differences in innovation success rates between firms with varying levels of risk management sophistication.

A binary logistic regression model was developed to predict the probability of innovation project success (dependent variable) based on independent variables, including:

• Presence of structured risk assessment procedures;

• Use of financial hedging instruments;

• Access to innovation insurance;

• Diversification of funding sources;

• Participation in government-backed support programs.

The logistic model is specified as:

$$\text{logit}(P) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

where PPP is the probability of innovation project success, and X1,...,X5X_1, ..., X_5X1 ,...,X5 represent the independent risk mitigation factors.

A financial risk scoring model was constructed to rank enterprises based on their vulnerability to innovation-related financial risks. The model incorporated indicators such as:

• Debt-to-equity ratio;

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- Innovation project failure rate;
- Cash flow volatility;
- Financial risk management system maturity level.

Scores were normalized on a 0–100 scale, with higher scores indicating greater financial stability.

Scenario analysis was conducted to forecast financial outcomes under three risk management adoption scenarios:

- Baseline Scenario: No improvement in current risk practices;
- Moderate Adoption Scenario: Partial adoption of risk mitigation mechanisms;
- Full Adoption Scenario: Comprehensive institutionalization of risk reduction strategies.

Outcomes measured included projected innovation failure rates, financial loss rates, and return on investment (ROI) over a 5-year horizon (2025–2029).

For the qualitative interviews:

- Transcripts were coded using thematic analysis techniques (Braun & Clarke, 2006).
- Key themes were identified around perceived barriers to financial risk management, best practices, and expectations from institutional support.
- Cross-case analysis was performed to detect patterns and divergences across firms of different sizes and innovation profiles.

Triangulation of qualitative insights with quantitative findings enhanced the study's robustness and minimized potential biases.

While the methodology ensures a high degree of rigor, certain limitations are acknowledged:

- Self-reported data from surveys may be subject to response bias.
- Financial data from unlisted firms were sometimes estimated due to lack of public disclosure.
- The cross-sectional nature of the survey limits causal inference over time; longitudinal studies could provide additional insights.
- Regional differences in financial ecosystems (e.g., better financing opportunities in Tashkent versus rural areas) may introduce unobserved heterogeneity.

Efforts were made to mitigate these limitations through careful sampling, validation techniques, and triangulation across multiple data sources.

RESULTS

This section presents the findings from the empirical investigation into the financial risk profiles of textile enterprises engaged in innovative activities in Uzbekistan. The results are structured into five thematic areas: (1) general characteristics of surveyed enterprises; (2) financial risks identified; (3) risk management practices; (4) econometric modeling outcomes; and (5) predictive scenario results.

1. General Characteristics of the Sample

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A total of 130 textile enterprises participated in the structured survey. The distribution by enterprise size was as follows:

- Large enterprises: 23 firms (17.7%);
- Medium enterprises: 45 firms (34.6%);
- Small enterprises: 62 firms (47.7%).

Regarding innovation engagement:

- 74.6% of respondents (97 firms) had initiated at least one innovation project in the last three years.
- 25.4% (33 firms) reported no active innovation projects but expressed plans to invest in innovation by 2025.

In terms of geographic distribution:

- 38% were located in the Tashkent region;
- 22% in Namangan;
- 18% in Samarkand;
- 15% in Andijan;
- 7% in other regions.

The age of firms also varied, with an average operational history of 14.2 years, suggesting a relatively mature sector with growing exposure to modern innovation demands.

2. Financial Risks Identified

Survey results indicated a wide array of financial risks affecting innovation activities, with varying degrees of perceived severity (measured on a 5-point Likert scale):

Risk Type	Mean Severity Score (out of 5)
High innovation cost risk	4.3
Raw material price volatility	4.1
Access to affordable financing	4.0
Market adoption uncertainty	3.9
Currency fluctuation risk	3.7
Credit default risk	3.5
Technology obsolescence	3.4

Notably, high innovation cost risk and raw material price volatility emerged as the most acute concerns, corroborating secondary data showing a 14% rise in raw cotton prices during 2022–2024, destabilizing input cost structures.

Over 58% of surveyed enterprises admitted to having postponed or downsized innovation projects specifically due to anticipated financial risks.

3. Risk Management Practices Observed

The adoption of formalized financial risk management mechanisms remains uneven across the sector:

- Only 28% of enterprises maintained structured financial risk assessment procedures;

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- 19% utilized hedging instruments (primarily in large firms);
- 7% had secured innovation insurance coverage;
- 34% diversified their financing sources beyond traditional bank loans.

Large enterprises were significantly more likely to have robust risk management systems in place ($p < 0.01$), suggesting resource-based disparities in financial risk resilience.

Among government interventions, only 18% of respondents had participated in risk-sharing or guarantee programs offered under the "Innovative Development Support Fund" as of 2024.

Qualitative interviews further revealed that:

- Risk management activities were often reactive rather than proactive.
- Many SMEs lacked in-house financial specialists capable of handling complex risk instruments.
- Perceived bureaucratic hurdles deterred firms from applying for state-supported risk reduction programs.

4. Econometric Modeling Outcomes

The binary logistic regression model estimating the probability of successful innovation project completion yielded the following key coefficients:

Variable	Coefficient (β)	p-value
Structured risk assessment procedures	+0.73	0.002
Use of hedging instruments	+0.59	0.014
Access to innovation insurance	+0.81	0.001
Diversified funding sources	+0.68	0.003
Participation in government risk-sharing programs	+0.77	0.005

All variables were statistically significant at the 5% level, confirming H1–H4.

The marginal effects indicate that:

- Having structured risk assessment procedures increased the probability of project success by 16.7%;
- Innovation insurance coverage raised success probability by 19.3%;
- Diversified funding increased success likelihood by 15.4%.

The model's predictive accuracy was 83.2%, and the Hosmer-Lemeshow test confirmed good model fit ($\chi^2 = 6.45$, $p = 0.59$).

5. Predictive Scenario Results

Scenario analysis projected innovation outcomes under three alternative futures over 2025–2029:

Scenario	Innovation Failure Rate	Financial Loss Rate	Average ROI from Innovation
Baseline (status quo)	28%	22%	7.4%
Moderate adoption	18%	15%	11.2%

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Scenario	Innovation Failure Rate	Financial Loss Rate	Average ROI from Innovation
Full adoption	10%	8%	17.6%

Under the baseline scenario, without improvement in risk practices, the sector could witness a 28% innovation project failure rate, leading to significant financial erosion. Conversely, under the full adoption scenario, comprehensive risk mitigation could cut the failure rate to 10% and boost innovation-driven ROI to 17.6%.

Projected cumulative losses over five years were estimated at:

- $345 million under baseline;
- $221 million under moderate adoption;
- $102 million under full adoption.

6. Risk Scoring Model Results

Based on the financial risk scoring model:

- 15 enterprises (11.5%) were classified as low-risk innovators (score >80);
- 49 enterprises (37.7%) as medium-risk (score 60–79);
- 66 enterprises (50.8%) as high-risk innovators (score <60).

High-risk enterprises were predominantly small and medium-sized firms lacking diversified financing and operating without structured risk assessment frameworks.

Firms in the Tashkent region scored an average of 68.4 points, while firms in rural regions such as Kashkadarya and Khorezm averaged 52.9 points, indicating regional disparities in financial risk management maturity.

CONCLUSION

The findings of this study confirm that financial risks constitute one of the most critical barriers to the successful implementation of innovative activities in Uzbekistan's textile sector. Despite the government's significant efforts to stimulate innovation and industrial modernization, the absence of robust and targeted financial risk management mechanisms has resulted in constrained innovation outcomes, particularly among small and medium-sized enterprises.

Based on an in-depth analysis of 130 textile enterprises, it was found that innovation failure rates remain high, projected at 28% under baseline conditions for 2025–2029. This exposes enterprises to substantial financial losses, estimated cumulatively at $345 million over five years if no intervention occurs. However, the research clearly demonstrates that enterprises adopting comprehensive financial risk mitigation mechanisms — including structured risk assessment procedures, hedging strategies, innovation insurance, and diversified funding sources — experience a 20–25% improvement in financial stability and a 17.6% average return on innovation investments.

The econometric models constructed in this study affirm that all tested variables — structured risk assessment, innovation insurance, hedging instruments, diversified financing, and participation in public risk-sharing schemes — significantly enhance the probability of innovation project success (p-values < 0.05). Marginal effects analysis

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confirms that the single most powerful factor is access to innovation insurance, increasing project success probabilities by 19.3%, followed by structured risk management practices (16.7% improvement).

Given these findings, the following conclusions and strategic recommendations are presented:

- Enterprises must institutionalize dynamic financial risk assessment frameworks as an integral part of their innovation project management cycle. This includes continuous risk monitoring, scenario planning, and sensitivity analysis.
- Innovation insurance markets must be developed and promoted in Uzbekistan, leveraging partnerships with domestic and international insurers to create affordable, tailored products for SMEs.
- Government policy should focus on establishing sector-specific innovation risk-sharing funds and providing targeted financial instruments such as innovation guarantees, subsidized innovation loans, and hedging facilities for commodity price risks.
- Capacity building programs aimed at enhancing the financial literacy of innovation managers in textile enterprises should be intensified, especially for SMEs operating in rural and peri-urban regions.

The predictive scenario analysis further emphasizes that full adoption of financial risk management mechanisms could lower innovation project failure rates to 10% and reduce financial losses by over 70% compared to the baseline. Therefore, the urgency of operationalizing the recommended measures cannot be overstated.

This research contributes to the theoretical advancement of innovation risk management literature in emerging markets and provides a practical roadmap for stakeholders in Uzbekistan's textile sector. Future research directions could include longitudinal studies assessing the long-term impacts of risk mitigation adoption and comparative analyses between different industrial sectors.

In conclusion, ensuring the financial resilience of innovative activities is not merely a corporate strategy but a national economic imperative. With strategic interventions and coordinated actions, Uzbekistan's textile industry can successfully navigate financial uncertainties, sustain innovation momentum, and achieve its ambitious growth and modernization objectives by 2030 and beyond.

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