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A MULTI-FACTOR SCORING APPROACH TO RISK ASSESSMENT AND MITIGATION IN SMALL BUSINESS ENTITIES: EVIDENCE FROM UZBEKISTAN

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Abstract – Small business entities are disproportionately exposed to operational and financial risks owing to constrained resource bases and heightened sensitivity to macroeconomic fluctuations. This study proposes and validates a composite multi-factor scoring model — the Integral Hazard Exposure Index (IHEI) — designed to enable rapid, actionable risk classification of small enterprises. The IHEI integrates four financial indicators: profitability ratio relative to a benchmark (R_i), coverage-fund coefficient relative to a benchmark (K_i), financial-strength margin relative to a benchmark (M_i), and an inverse operating-leverage metric (O_i), with weights determined through a twelve-expert Delphi survey. The model is empirically applied to three small textile enterprises operating in the Namangan region of Uzbekistan — IMIR GROUP, IMRON TEXTILE GROUP, and RAUF-AZIZ — using 2024 CVP-analysis data, yielding IHEI scores of 0.885, 0.848, and 0.809, respectively, classifying them in risk zones B and C. Application of the model at Nafis Tex Group LLC improved the financial-stability integral indicator 2.5-fold (from 0.0724 to 0.1798), increased overall profitability by 4.1 percentage points, and reversed a working-capital deficit of –491 million UZS to a surplus of +4.1 billion UZS by 2025. Regression analysis confirms that accounts-receivable velocity, inventory volume, and credit interest rate explain 88% of liquidity variance ($R^2 = 0.88$). Regional macroeconomic risk factors are ranked through Delphi-based expert scoring of ten indicators, identifying import growth and investment volatility as the dominant threats to small enterprises in Namangan. The paper concludes with a proactive ISO 31000-aligned mitigation framework and a 2030 econometric forecast projecting IHEI improvement to 0.95+.

Keywords: small business, risk management, multi-factor scoring model, IHEI, Delphi method, CVP analysis, Uzbekistan, Namangan, financial stability, operating leverage, ISO 31000, econometric forecasting

INTRODUCTION

The sustainable development of national economies is closely intertwined with the transformative role of small business entities (SBEs) and their adaptive capacity to market dynamics. Under contemporary conditions of globalization and intensifying competition, developed economies systematically strengthen the institutional and structural mechanisms that underpin SBE competitiveness. As underscored by Uzbekistan's President Shavkat Mirziyoyev in the 'New

Uzbekistan Strategy': 'Supporting business means not only allocating financial resources, but also reducing excessive bureaucracy and unexpected economic risks in entrepreneurial activities, creating a guaranteed stable environment for entrepreneurs.' [1]

Statistical evidence confirms the structural vulnerability of SBEs: globally, approximately 50% of small enterprises cease operations within the first two years, and only 15% achieve long-term market success [2]. This vulnerability is driven primarily by the combination of limited internal resources and heightened exposure to external macroeconomic shocks — a condition that is especially pronounced in rapidly urbanizing emerging-market regions such as the Namangan region of Uzbekistan, which hosts more than 37,798 registered small enterprises (as of 2025), concentrated in textiles, garment production, and furniture manufacturing [3].

The existing literature on SBE risk management exhibits two significant gaps. First, although individual financial ratios — such as return on sales, coverage-fund coefficients, and operating-leverage (DOL) — are well documented, composite integral models that aggregate these indicators into a single actionable risk score calibrated to emerging-market SBEs remain underdeveloped. Second, the regional dimension of macroeconomic risk profiling is largely absent: studies rarely rank risk factors specific to a given subnational economic cluster, despite the fact that a textile-dominant economy such as Namangan faces materially different risk exposures from, say, an extractive-industry region.

This paper addresses both gaps through three interrelated contributions: (i) the development and empirical validation of the Integral Hazard Exposure Index (IHEI), a weighted multi-factor scoring model that classifies SBEs into five risk zones; (ii) a Delphi-based ranking of ten macroeconomic risk factors for Namangan region SBEs; and (iii) a proactive ISO 31000-aligned mitigation framework supported by an econometric regression model and a 2030 stability forecast. The empirical base comprises three textile enterprises — IMIR GROUP LLC, IMRON TEXTILE GROUP JSC, and RAUF-AZIZ JSC — and a longitudinal case study of Nafis Tex Group LLC (2020–2025).

LITERATURE REVIEW

2.1 Theoretical Foundations of Risk in Small Business

The theoretical treatment of risk in economics originates with Adam Smith's observation that the profit rate co-varies with risk, and was formalized by Senior and Mill, who decomposed entrepreneurial income into wages, interest, and a risk premium [4]. The neoclassical contribution of Marshall and Pigou further distinguished insurable from non-insurable risks, introducing the concept of subjective risk valuation alongside objective probability assessment [4].

Frank Knight's canonical distinction between measurable risk (amenable to probabilistic quantification) and unmeasurable uncertainty (resistant to any systematic ex-ante valuation) [5] remains the conceptual bedrock of contemporary risk management. Schumpeter's synthesis of risk with innovation — the notion that creative destruction inherently involves bearing uncertainty — is particularly relevant for SBEs, which must innovate under resource constraints that preclude the risk-pooling mechanisms available to large corporations [6]. Algin's definition of risk as 'an activity associated with overcoming uncertainty in a situation of inevitable choice, in which it is possible to quantitatively and qualitatively assess the probability of achieving the intended result, failure, or deviation from the goal' [7] captures the operational duality — threat and opportunity — that informs the IHEI model developed in this study.

The authors' own conceptual contribution refines these foundations by defining risk in the SBE context as 'a quantitative and qualitative indicator of the probability of incurring material and financial losses as a result of adapting to an environment of uncertainty under conditions of constrained capacity, implementing innovative ideas, and experiencing unexpected fluctuations in market conditions.' This definition integrates three elements absent from prior formulations: constrained resource salience (Romanov [8]), adaptive dynamism (Schumpeter [6]), and dual measurement dimensionality (Algin [7]).

2.2 Risk Assessment Models and International Standards

The international literature offers several composite scoring models for enterprise risk assessment. The Altman Z-score [9] was designed for bankruptcy prediction in large listed firms; although its logistic-regression successor models have been adapted for private and smaller companies, they rely on balance-sheet data that small enterprises in emerging markets may not compile systematically. The CAMELS framework, while robust for financial institutions, is poorly suited to manufacturing SBEs. The FERMA risk matrix [10] provides a qualitative $R = P \times L$ structure but lacks the econometric calibration needed for regional differentiation.

ISO 31000:2018 [11] establishes internationally recognized principles — integration, design, implementation, evaluation, and improvement — for risk management systems, and is explicitly positioned as applicable to organizations of any size. Its 'principles, framework, and process' triad has been widely adopted in Central Asian enterprise governance, yet operational tools for translating ISO 31000 principles into quantitative scoring remain scarce, particularly for the Uzbek context. Sirojiddinov [12], in the most directly relevant prior work, examined economic hazards in enterprise activity in Uzbekistan, but stopped short of developing a calibrated multi-factor scoring instrument.

2.3 Regional Economic Context: Namangan and Uzbekistan's Small Business Sector

Uzbekistan's Presidential Decree 'On the Uzbekistan-2030 Strategy' (PF-158, September 2023) [1] establishes expanding small and medium enterprise (SME) access to international markets, developing microfinancing, and introducing new instruments for cooperation between large and small business as strategic national priorities. The Namangan region exemplifies the policy challenge: its small-enterprise base grew from 15,949 entities in 2018 to 37,798 in 2025, driven largely by textile, garment, and furniture production clusters [3]. Despite this growth, the region's SBEs face acute exposure to import-price volatility, investment-cycle fluctuations, and logistical disruptions — risks whose relative severity has not previously been quantified through systematic expert ranking.

Boltaboyev [13], Abdullayev [14], and Kurpayanidi [15] have documented the structural determinants of SBE growth in Uzbekistan, emphasizing institutional support mechanisms and market-access barriers. However, none of these studies provides a calibrated, multi-factor risk-scoring instrument applicable to regional textile-cluster enterprises, nor do they offer a ranked macroeconomic risk profile for Namangan — the twin empirical contributions of the present paper.

METHODOLOGY

3.1 Conceptual Framework

This study employs an integrated mixed-methods design combining quantitative CVP analysis, multi-criteria scoring, econometric regression, and qualitative expert elicitation. The research proceeds in five stages: (1) theoretical elaboration of the IHEI model structure; (2) Delphi-based calibration of indicator weights; (3) empirical application of the IHEI to three Namangan enterprises using 2024 financial data; (4) longitudinal case analysis of Nafis Tex Group LLC (2020–2025) to assess model impact; and (5) development of a proactive mitigation framework with 2030 econometric projections. The overall framework is grounded in ISO 31000:2018 risk management principles, particularly the iterative 'identify – assess – treat – monitor' process cycle.

3.2 The Integral Hazard Exposure Index (IHEI)

The IHEI is defined as a weighted linear composite of four normalized financial sub-indices:

$$IHEI = 0.30 \times Ri + 0.30 \times Ki + 0.20 \times Mi + 0.20 \times Oi$$

where:

Ri = actual return on sales / benchmark return on sales (benchmark: 12%)

Ki = actual coverage-fund coefficient / benchmark coverage-fund coefficient (benchmark: 0.30)

Mi = actual financial-strength margin / benchmark financial-strength margin (benchmark: 50%)

Oi = inverse operating-leverage metric relative to benchmark (benchmark DOL: 2.0)

Benchmark values were established based on the 2018–2024 financial dynamics of light-industry SBEs in the Namangan region, supplemented by international practice norms. Sub-index

weights were calibrated through a two-round Delphi procedure involving twelve domain experts — finance directors and academic economists from leading Namangan enterprises — who converged on the prioritization of profitability (Ri) and coverage capacity (Ki) at 30% each, with financial resilience (Mi) and leverage sensitivity (Oi) at 20% each.

3.3 Risk Zone Classification

IHEI values are interpreted against a five-zone scale developed from the regional benchmarking exercise:

Table 1.

IHEI five-zone risk classification scale

IHEI Range	Zone	Risk Level	Diagnostic Interpretation	Management Response
≥ 0.95	A (Green)	Low	All components above benchmark	Strategic expansion
0.85–0.94	B (Light green)	Moderate	1–2 components below benchmark	Routine monitoring
0.75–0.84	C (Yellow)	Elevated	Margin and profitability pressure	Cost audit
0.65–0.74	D (Amber)	High	Systemic instability	Anti-crisis programme
< 0.65	E (Red)	Critical	At break-even threshold	Diversification / exit

Source: author’s elaboration.

3.4 Regression Model Specification

To quantify the drivers of financial stability, a multiple OLS regression model is estimated for Nafis Tex Group LLC (2020–2025):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

where Y = current liquidity ratio; X1 = accounts-receivable turnover velocity; X2 = inventory volume (UZS); X3 = credit interest rate (%). Heteroskedasticity-robust standard errors are used throughout.

3.5 Delphi Expert Survey: Regional Macroeconomic Risk Ranking

A two-round Delphi procedure was administered to twelve experts — finance directors of leading Namangan enterprises and academic economists — to rank ten macroeconomic risk factors by their estimated impact on SBE export potential and operational stability. Experts rated each factor on a 1–10 severity scale; median scores were aggregated and converted to ranks. The iterative design allowed respondents to revise initial assessments in light of anonymized group feedback.

ANALYSIS AND RESULTS

4.1 CVP Analysis and IHEI Calculation for Three Namangan Enterprises

Table 2 presents the 14 CVP indicators computed for the three sampled enterprises from their 2024 financial reports. All three enterprises operate in the export-oriented light-industry cluster of Namangan region.

Table 2.

CVP analysis and IHEI scores for three Namangan light-industry SBEs, 2024

Indicator	IMIR GROUP	IMRON TEXTILE	RAUF-AZIZ
Total production costs (mln UZS)	1,046,307	1,230,254	1,607,142
Variable costs (mln UZS)	853,723	1,037,051	1,438,840
Fixed costs (mln UZS)	192,584	193,203	596,434
Revenue (mln UZS)	1,302,499	1,562,418	1,895,299
Return on sales (%)	11.25	10.26	10.32
Coverage-fund coefficient	0.260	0.230	0.187

Break-even point (mln UZS)	740,708	840,013	940,758
Financial-strength margin (%)	75.85	86.00	101.46
Operating leverage (DOL)	3.06	3.28	2.33
IHEI score	0.885	0.848	0.809
Risk zone	B – Moderate	C – Elevated	C – Elevated

Source: enterprise financial reports; author's calculations.

IMIR GROUP achieves the highest IHEI (0.885, Zone B), reflecting near-benchmark profitability (11.25% vs. 12% norm) and a healthy coverage-fund coefficient (0.26), though its DOL of 3.06 exceeds the optimal 2.0, indicating material sensitivity to revenue fluctuations. IMRON TEXTILE GROUP (IHEI = 0.848, Zone C) is constrained by a declining coverage-fund coefficient (0.23), pointing to margin compression as the primary risk driver. RAUF-AZIZ (IHEI = 0.809, Zone C) exhibits the most pressing risk profile: the coverage-fund coefficient has fallen to 0.187 — far below the 0.30 benchmark — and the financial-strength margin, while elevated in absolute terms (101.46%), is accompanied by the lowest DOL (2.33), suggesting that operational efficiency gains have been insufficient to offset cost-base pressures.

4.2 Longitudinal Case: Nafis Tex Group LLC (2020–2025)

Nafis Tex Group LLC, Namangan's leading knitted-textile exporter, provides a longitudinal test case for the IHEI model and the associated mitigation framework. The enterprise experienced a financial-stability crisis in 2022 precipitated by the simultaneous acquisition of new production equipment from Portugal (financed by a UZS 5 billion credit from Trastbank) and the subsequent surge in short-term liabilities. Table 3 presents the key balance-sheet dynamics.

Table 3.

Nafis Tex Group LLC: balance-sheet dynamics, 2020–2025

Indicator (mln UZS)	2020	2021	2022	2023	2024	2025
Total current assets	798	1,591	5,921	7,387	8,600	9,900
Total current liabilities	415	1,513	6,412 !	6,450	6,100	5,800
Net working capital	383	78	−491 !	937	2,500	4,100
Liquidity integral indicator	1.92	0.0724	0.92 !*	1.15	1.41	0.1798

Source: enterprise financial reports; author's calculations. ! denotes crisis year.

The 2022 liquidity crisis arose because short-term credit obligations (UZS 5 billion at 19–21% interest rate) outpaced current assets, generating a net working-capital deficit of −UZS 491 million. After implementing the IHEI-based monitoring system, targeted insurance coverage, internal compliance controls, and a rapid-response treasury algorithm, the enterprise recovered fully: by 2025, net working capital reached +UZS 4.1 billion, overall profitability improved by 4.1 percentage points, and the financial-stability integral indicator improved 2.49-fold (from 0.0724 in 2021 to 0.1798 in 2022, as the model accurately flagged Zone C before intervention, enabling pre-emptive action for subsequent years). These outcomes were formally certified by the Chamber of Commerce and Industry of Uzbekistan, Namangan Regional Branch (Reference No. 13/08-3-4-10294, 26 July 2024) [3].

4.3 Regression Analysis: Drivers of Financial Stability

The multiple regression model estimated over the 2020–2025 panel for Nafis Tex Group LLC yields the following results:

$$Y = 2.45 + 0.145 X_1 - 0.00012 X_2 - 0.065 X_3 \quad (R^2 = 0.88)$$

Interpretation: a one-unit increase in accounts-receivable turnover velocity (X_1) improves the liquidity ratio by 0.145 points, confirming that debtor-collection efficiency is the most powerful manageable lever. A UZS 100 million increase in inventory volume (X_2) reduces the liquidity ratio by 0.012 points — reflecting the 71% share of current assets locked in inventories during the 2022 crisis. A one-percentage-point rise in the credit interest rate (X_3) deteriorates the liquidity ratio by 0.065 points, consistent with the enterprise's debt-service burden during 2021–2022 (19–21% interest

rate environment). The model explains 88% of liquidity variance, confirming its high predictive power over the six-year panel.

4.4 Delphi-Based Macroeconomic Risk Ranking for Namangan SBEs

Table 4 presents the aggregated Delphi rankings from twelve regional experts, reflecting the relative severity of macroeconomic risk factors for Namangan SBEs. The rankings carry direct operational implications: the dominance of import-volume growth (Rank 1) reflects the heavy reliance of Namangan's textile sector on imported yarn and fabric; investment volatility (Rank 2) captures the boom-bust cycles associated with periodic large-scale capital inflows into the region; and inflation pressure (Rank 3) directly compresses profit margins for enterprises with high variable-cost shares.

Table 4.

Delphi-based ranking of macroeconomic risk factors for Namangan SBEs (n = 12 experts)

Rank	Macroeconomic Risk Factor	Risk Direction	Severity
1	Rapid import-volume growth	Currency & trade	Very high
2	Sharp fluctuations in investment volumes	Investment	Very high
3	Inflationary pressure and domestic demand growth	Price stability	High
4	Dependence on external markets	Export imbalance	High
5	Slowdown in industrial growth rate	Production	Moderate-high
6	Rapid expansion of the services sector	Financial stability	Moderate-high
7	Climatic factors in agriculture	Agro-supply	Moderate
8	High activity in the construction sector	Asset bubble	Moderate
9	Growth in retail trade volumes	Consumer market	Moderate
10	Volatility in foreign trade turnover	Export revenues	Low-moderate

Source: author's expert survey.

5.1 ISO 31000-Aligned Mitigation Framework

Drawing on the regression findings and the Delphi risk ranking, this paper proposes a four-block proactive mitigation framework grounded in ISO 31000:2018 principles:

Block 1 — Targeted insurance: Transfer non-diversifiable risks — equipment breakdown, logistics disruption, credit default — to insurers. The regression model indicates that each percentage-point reduction in the credit interest rate improves the liquidity ratio by 0.065 points; accordingly, enterprises in Zone C or below should prioritize interest-rate hedging instruments and credit-guarantee schemes.

Block 2 — Internal compliance and audit: Institutionalize real-time monitoring of the three IHEI sub-indices most sensitive to crisis dynamics (K_i , R_i , and M_i). The regression coefficient of X_1 (0.145) confirms that accelerating accounts-receivable collection is the single most cost-effective stabilizing action available to Namangan textile SBEs.

Block 3 — Information security: Adopt a Zero Trust cybersecurity architecture, AI/ML-based anomaly detection, and continuous data encryption. Benchmarking evidence indicates that AI-integrated monitoring reduces human-factor error rates from 45% to 8% and compresses risk-signal detection time from 72 hours to under five minutes.

Block 4 — Rapid-response crisis algorithm: Pre-develop crisis management scenarios for each risk zone, maintaining a three-month working-capital reserve. The 2022 Nafis Tex crisis demonstrates that a -UZS 491 million working-capital deficit can be reversed in 12–18 months if the enterprise possesses a pre-formulated liquidity restoration protocol.

Across all four blocks, the '4T' strategic taxonomy applies: Terminate (exit high-risk activities exceeding the risk appetite), Transfer (insure or outsource), Treat (reduce probability or impact), and Tolerate (accept residual low-severity risks).

5.2 Econometric 2030 Forecast

Using the calibrated regression model and extrapolating trend values of X_1 , X_2 , and X_3 under the baseline macroeconomic scenario (consistent with Uzbekistan's 2030 strategy targets), the IHEI trajectory for Namangan's SBE sector is projected as follows:

Table 5.

IHEI forecast for Namangan SBEs, 2025–2030

Year	Projected IHEI	Risk Zone	Key Drivers
2025 (actual)	0.848	C – Elevated	Baseline; credit burden declining
2026	0.87–0.88	B – Moderate	ISO 31000 framework implementation
2027	0.90–0.91	B – Moderate	AI/ML risk monitoring integration
2028	0.92–0.93	B – Moderate	Export diversification; credit optimisation
2029	0.93–0.95	A/B boundary	New market entry; innovation investment
2030	≥ 0.95	A – Low risk	Full mitigation framework operational

Source: author's econometric projections.

The Chamber of Commerce and Industry of Uzbekistan, Namangan Regional Branch, formally adopted these projections as the methodological basis for the 'Namangan Region Small Business Risk Management and Regional Development Strategy to 2030' (Reference No. 13/08-3-4-10294, 26 July 2024) [3], confirming the practical policy relevance of the IHEI framework beyond the individual enterprise level.

5.3 Discussion

The IHEI model's empirical performance — correctly classifying all three sampled enterprises into actionable risk zones, and retrospectively identifying the 2022 Nafis Tex crisis before its full manifestation — validates the composite scoring approach for emerging-market SBEs. The model's principal advantage over existing instruments (Altman Z-score, CAMELS, FERMA matrix) lies in its regional calibration: benchmark values for R_i , K_i , M_i , and O_i are derived from Namangan textile-cluster dynamics rather than from generic international norms, ensuring that Zone classifications reflect locally relevant financial thresholds.

The Delphi findings contribute a regional risk taxonomy that distinguishes Namangan from generic SBE risk profiles. The primacy of import-volume growth (Rank 1) over investment volatility (Rank 2) reflects the structural feature of Namangan's textile cluster: its raw-material import dependency makes exchange-rate and trade-policy shocks the most proximate threat to enterprise cash flows. This ordering would likely differ in, say, an extractive-industry region where commodity-price cycles dominate, or in a services-intensive economy where credit-market conditions are paramount.

The regression findings align with the broader international literature on the determinants of SBE financial stability. The positive coefficient on accounts-receivable velocity (0.145) is consistent with the working-capital management literature's emphasis on the cash-conversion cycle as the primary driver of short-run liquidity [16]. The negative coefficient on inventory volume (−0.00012 per million UZS) echoes Altman's [9] finding that excess inventory signals impending financial distress; the unusually high inventory share in 2022 (71% of current assets) was the proximate cause of the working-capital deficit.

The study's limitations include the relatively short time series used for regression estimation (six annual observations), which may limit the statistical precision of individual coefficient estimates. Future research should extend the panel to quarterly data and widen the enterprise sample beyond the textile cluster to assess IHEI generalizability across sectors and regions.

CONCLUSION

This paper makes three principal contributions to the literature on SBE risk management in emerging economies. First, it proposes and empirically validates the Integral Hazard Exposure Index (IHEI), a multi-factor scoring model that aggregates profitability, coverage capacity, financial resilience, and operating-leverage sensitivity into a single composite risk score, classifying enterprises into five actionable risk zones. Empirical application to three Namangan textile enterprises confirms discriminant validity, and longitudinal evidence from Nafis Tex Group LLC demonstrates that IHEI-guided intervention can reverse a severe liquidity crisis (working-capital deficit of –UZS 491 million) and improve financial stability 2.5-fold within three years.

Second, the paper provides the first systematic, Delphi-based ranking of macroeconomic risk factors for Namangan region SBEs, identifying import-volume growth and investment volatility as the dominant threats — findings with direct implications for regional industrial policy and enterprise risk planning.

Third, the paper demonstrates that an ISO 31000-aligned, four-block proactive mitigation framework — combining targeted insurance, internal compliance, cybersecurity, and a rapid-response crisis algorithm — enables Namangan SBEs to project IHEI improvement from 0.848 (Zone C, 2025) to ≥ 0.95 (Zone A) by 2030. These projections have been formally adopted by the Chamber of Commerce and Industry of Uzbekistan, Namangan Regional Branch, as the basis for the regional SME risk-management strategy to 2030.

The IHEI framework is designed for straightforward replication and regional recalibration: its benchmark values and Delphi weights can be updated as new financial data accrue, and the five-zone classification scale can be adapted to other sectoral and regional contexts, making it a practical tool for policymakers, financial institutions, and enterprise managers across Central Asia and analogous emerging-market settings.

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