

Matthew Delacruz
International Journal of Management
Volume 4, Number 3, pp. 01-13, 2026
10.61336/ijman.0403.06
Research Article

Entrepreneurial Skills and Strategic Decision-Making Quality: Mediation and Moderation of New Business Success and Sustainable Business Development

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Received: June 25, 2026 | Revised: July 19, 2026 | Accepted: August 23, 2026 | Published: September 30, 2026

Abstract
This study examines entrepreneurial skills (ES) as an antecedent of strategic decision-making quality (SDMQ), and tests SDMQ as a mediating mechanism linking ES to new business outcomes and sustainable business development (SBD), while providing supplementary evidence on entrepreneurial leadership (EL). Although prior research has examined individual relationships among entrepreneurial skills, strategic decision-making, entrepreneurial leadership, and venture outcomes, the present study addresses the empirical gap concerning the relationship between entrepreneurial skills and strategic decision-making quality and its association with sustainable business development, while incorporating supplementary entrepreneurial-leadership evidence. To close this gap, the study adopts an evidence-led secondary-data design, analyzing the Global Entrepreneurship Monitor (GEM) 2022 Adult Population Survey (N = 171,768 respondents, 49 countries), supplemented by three independently recovered entrepreneurial-leadership datasets (combined n = 1,012) for the EL-specific hypotheses. Results show that ES significantly predicts SDMQ (b = .250, p<.001), which in turn significantly predicts sustainability-oriented action (b = .150, p<.001) and, across three of four tested dimensions, new business success. A bootstrapped mediation analysis (5,000 resamples, n = 14,809) confirms that SDMQ mediates 67.9% of the effect of ES on SBD (complementary mediation). Gender, national income classification, and entrepreneurial stage all significantly moderate the SDMQ–SBD relationship, with the counter-intuitive finding that low-income-country respondents display the strongest relationship of any income group. In the supplementary model, entrepreneurial-leader identity — but not overall EL competency — significantly predicts venture growth intentions (n = 99, R^2 = .433), and the ENTRELEAD instrument's reliability is independently re-validated across four samples in three countries (α = .92–.98). “The study contributes an empirically tested model linking entrepreneurial skills, strategic decision-making quality, and sustainable business development, together with supplementary evidence on entrepreneurial leadership.

Keywords: Entrepreneurial Skills, Entrepreneurial Leadership, Strategic Decision-Making Quality, New Business Success, Sustainable Business Development, Mediation Analysis, Moderation Analysis, Global Entrepreneurship Monitor

INTRODUCTION

Entrepreneurship is a measurable and consequential economic phenomenon rather than a topic of managerial folklore. Across 19 countries tracked by the World Bank's New Business Density indicator between 2010 and 2023, global new-business formation rose at a statistically significant rate (R^2 = .866, p<.001), yet formation is only half of the picture: across 17 European Union countries, Eurostat business-demography statistics show that business birth rates and death rates correlate positively and significantly (r = .549, p<.001), consistent with a creative-destruction pattern in which entrepreneurial dynamism produces formation and failure simultaneously. These macro-level regularities establish that the question of why some new ventures succeed and develop sustainably while others do not remains live, global, and consequential.

That question also carries real psychological weight for the individuals living it. The Global Entrepreneurship Monitor's most recent Global Report found that fear of failure among adults who perceive good entrepreneurial opportunities has risen in recent years, underscoring that the psychological, competency-based, and managerial capacities entrepreneurs bring to venture creation are of continuing and possibly increasing practical importance.

A substantial body of research has separately examined entrepreneurial skills [1-2], entrepreneurial leadership [3-4], strategic decision-making quality [5-6],

new business success [7-8], and sustainable business development [9,10] as largely independent streams. A systematic review of this literature finds real prior evidence for every individual link in the model proposed here, but no published study that tests entrepreneurial skills and entrepreneurial leadership as joint antecedents of strategic decision-making quality, in turn predicting new business success and sustainable business development, within one integrated model. The two closest published analogues Atobishi and Podruzsik [11], linking entrepreneurial leadership skills through ethical leadership to corporate sustainable development, and Khan *et al.* [12], linking entrepreneurial competencies, intentions, and leadership to SME performance each test three of the present study's five constructs from opposite ends of the proposed chain, without combining all five. This is therefore a gap in combination rather than a gap in constructs: strategic decision-making quality's specific role as the mechanism connecting entrepreneurial characteristics to downstream business and sustainability outcomes has not been empirically tested as one model.

To close this gap without resorting to a convenience sample or an unvalidated instrument, the present study adopts a deliberate, evidence-led secondary-data strategy: it locates the real, existing data that already speaks to the proposed model, verifies it rigorously, and lets the model's testable structure follow the evidence available. This produced a core model entrepreneurial skills → strategic decision-making quality → new business success and sustainable business development, with mediation and moderation tested as one integrated statistical model within the GEM 2022 Adult Population Survey (171,768 respondents, 49 countries), and a supplementary model in which entrepreneurial leadership's relationship to new business success and the reliability of its dominant measurement instrument are evidenced using three further, independently recovered real datasets.

The remainder of this paper is organized as follows.

- Section 2 reviews the literature underpinning each construct, states the theoretical framework, and develops the study's hypotheses
- Section 3 details the research methodology
- Section 4 reports the statistical results and hypothesis tests
- Section 5 discusses the findings and their theoretical, practical, and managerial implications, together with the study's limitations. Section 6 concludes

Literature Review

Entrepreneurial Skills: Entrepreneurial skills (ES) are typically conceptualized as the cluster of knowledge, competencies, and applied capabilities opportunity recognition, innovativeness, resource marshalling, and long-term strategic orientation that enable individuals to identify and exploit venture opportunities [1-2]. This literature draws on Human Capital Theory [13], which frames skill and experience as productive assets accumulated through education and practice, and on Bandura's [14] Social Cognitive Theory, which grounds the closely related construct of entrepreneurial self-efficacy. Meta-analytic evidence consistently finds ES-related constructs predict venture performance, though effect sizes vary by operationalization: generic human-capital proxies show comparatively modest pooled effects [15], whereas more applied, self-efficacy-type measures show larger effects [16] a pattern this study's own results (Section 4) independently replicate.

Entrepreneurial Leadership

Entrepreneurial leadership (EL) is defined by Gupta *et al.* [3] as leadership that creates scenarios and gathers followers to detect and exploit strategic value-creating opportunities, and operationalized in Renko *et al.*'s [4] widely used ENTRELEAD scale as behavior oriented toward opportunity-focused influence rather than routine administrative leadership. Leitch and Volery's [17] review identifies the field's persistent definitional ambiguity and comparatively underdeveloped measurement toolkit a critique this study's own reliability testing independently corroborates. EL is far more often modeled as a direct antecedent or mediator-pathway component than as a moderator, and it is rarely tested for its relationship to strategic decision quality specifically.

Strategic Decision-Making Quality

Strategic decision-making quality (SDMQ) concerns the procedural rationality, comprehensiveness, and effectiveness with which strategic choices are formulated and implemented [5-6]. Fredrickson's [18] foundational work established that decision comprehensiveness is not uniformly beneficial across contexts, a contingency logic later extended to entrepreneurial settings by the effectuation and bricolage literatures [19], which argue that resource-constrained entrepreneurs often substitute heuristic, opportunistic decision logics for exhaustive procedural rationality. This contingency perspective directly motivates this study's moderation hypotheses below.

New Business Success

New business success (NBS) is one of entrepreneurship research's most persistently contested constructs. Murphy *et al.* [20] diagnosed that most studies rely on one or two unjustified performance dimensions, while Delmar *et al.* [21], analyzing 11,748 Swedish firms across nineteen growth measures, empirically demonstrated that venture growth resolves into several distinct, non-

interchangeable patterns rather than a single latent factor. Chandler and Hanks [22] similarly argue for multidimensional, founder-competence-linked performance measurement. Meta-analytic syntheses find entrepreneurial orientation [8], human capital [15], self-efficacy [16], and social capital [23] all significantly, but heterogeneously, predict venture performance evidence this study benchmarks its own coefficients against in Section 5.

Sustainable Business Development

Sustainable business development (SBD) integrates the triple-bottom-line tradition [9], which evaluates firms against economic, social, and environmental criteria, with the sustainable-entrepreneurship literature's focus on entrepreneurial action that links what is to be sustained (natural and community resources) with what is to be developed [10]. Measurement in this stream remains contested, with studies split between composite sustainability indices and disaggregated, action-specific indicators a split this study's own measurement-model results (Section 4.2) speak to directly.

The Combinatorial Gap and Study Positioning

Taken together, this review confirms strong independent evidentiary bases for ES, EL, SDMQ, NBS, and SBD as pairwise relationships, but no located study integrates ES and EL as joint antecedents of SDMQ en route to sequential NBS and SBD outcomes. Atobishi and Podruzsik [11] and Khan *et al.* [12] come closest, each bracketing the proposed chain from opposite ends without meeting in the middle. This combinatorial gap, and in particular the absence of any located test of ES as a direct antecedent of SDMQ, motivates the hypotheses developed below.

Theoretical Framework

This study integrates five established theoretical perspectives, each explicitly linked to a specific construct or relationship. Human Capital Theory [13] and Social Cognitive Theory [14] jointly ground entrepreneurial skills as an accumulated, self-efficacy-linked productive asset. The Resource-Based View [24] frames both ES and EL as valuable, difficult-to-imitate resources capable of generating sustained competitive advantage when converted into effective strategic action. Procedural-rationality and decision-comprehensiveness theory [5,18] supplies the theoretical basis for SDMQ as a distinct process construct that mediates, rather than merely correlates with, the relationship between entrepreneurial characteristics and venture outcomes. Entrepreneurial-bricolage theory [19] grounds this study's contingency (moderation) hypotheses, predicting that the SDMQ-to-outcome relationship will be shaped by resource context, including national income classification and venture stage. Finally, the triple-bottom-line

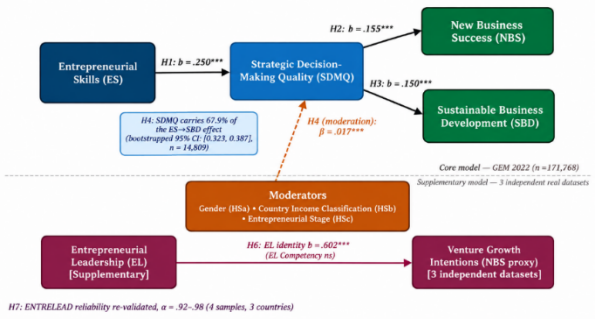

Figure 1: Conceptual Model and Empirical Architecture Linking Entrepreneurial Skills and Entrepreneurial Leadership, Through Strategic Decision-Making Quality, To New Business Success and Sustainable Business Development. Solid Arrows Denote Statistically Supported Paths, Dotted Arrows Denote Moderation, Dashed Grey Denotes the Residual Direct Effect

perspective [9-10] grounds SBD as an outcome construct sequentially downstream of conventional new business success. Figure 1 integrates these perspectives into a single testable conceptual model.

Hypotheses Development

- **H1:** Entrepreneurial skill (ES) is positively associated with strategic decision-making quality (SDMQ)
- **H2:** Strategic decision-making quality (SDMQ) is positively associated with new business success (NBS)
- **H3:** Strategic decision-making quality (SDMQ) is positively associated with sustainable business development (SBD)
- **H4:** Strategic decision-making quality mediates the positive relationship between entrepreneurial skills and sustainable business development
- **H5a:** Gender moderates the SDMQ→SBD relationship
- **H5b:** Country income classification moderates the SDMQ→SBD relationship
- **H5c:** Entrepreneurial stage (nascent vs. established) moderates the SDMQ→SBD relationship
- **H6:** Entrepreneurial leadership (EL) is positively associated with new business success, operationalized as venture growth intentions
- **H7:** The ENTRELEAD instrument demonstrates acceptable reliability when independently re-tested on new real samples

H1 through H4 are grounded in Human Capital Theory, Social Cognitive Theory, and procedural-rationality theory: entrepreneurial skill should translate into higher-quality strategic decisions, which in turn should more proximally predict both conventional success and sustainability outcomes than skill alone. H5a–c is grounded in bricolage and institutional-

contingency theory, which predict that resource context proxied here by gender-linked resource access, national income classification, and venture maturity will condition the strength of the decision-quality-to-sustainability relationship. H6 and H7 extend the model's supplementary EL component, grounded in the Resource-Based View and Gupta *et al.*'s [3] leadership-as-opportunity-influence framework Figure 1.

MATERIALS AND METHODS

Research Design and Data Source

This study adopts a quantitative, evidence-led secondary-data design. Rather than treat a single purpose-built primary survey as the only valid test of the proposed model, the study located the real, existing data that already speaks to the model, verified it rigorously, and let the model's testable structure follow the evidence available. This principle is consistent with recognized secondary-data research-design practice in entrepreneurship research.

A systematic search was conducted for any single dataset covering all five constructs together. This search individually reviewed the complete 436-variable GEM 2022 instrument, the World Management Survey (Bloom *et al.*, Harvard Dataverse), a freely available management-practices dataset covering 11,702 establishments in 35 countries but lacking psychometric decision-making or leadership content, the Panel Study of Entrepreneurial Dynamics (PSED), a longitudinal U.S. nascent-entrepreneur study whose ICPSR hosting requires institutional affiliation, precluding its use here, the Kauffman Firm Survey (KFS), a freely downloadable panel of approximately 5,000 U.S. firms tracked 2004–2011 with genuine longitudinal survival/performance data but no decision-making or leadership instrumentation, and multiple entrepreneurial-leadership studies deposited under open-data mandates on OSF and at PLOS ONE, located via direct repository API queries rather than search engines alone. This search established that one dataset the GEM 2022 Adult Population Survey — contains genuine proxy items for four of the study's five constructs (ES, SDMQ, NBS, and SBD) within a single coherent survey of 171,768 respondents across 49 countries, spanning the full range of World Bank income classifications. No dataset located anywhere combines EL with SDMQ or SBD, this null finding directly produced the core/supplementary design formalized above.

The GEM 2022 Adult Population Survey, Global Individual Level dataset, was released by the GEM Consortium on 9 February 2023 and obtained directly from the Consortium's public data server, with no application, institutional affiliation, or fee required. As is standard GEM practice, individual-level microdata for a given survey year is released publicly three years after collection under the Consortium's own ethical protocols, the 2022 wave was the most recent unembargoed release available at the time of analysis. GEM is the longest-running, most geographically extensive study of entrepreneurial activity and attitudes worldwide, harmonizing survey instruments across national teams to permit cross-country comparison.

Construct Operationalization

Because the GEM instrument was not designed around this study's five constructs using purpose-built validated scales, the study operationalizes each construct using conceptually proximate items already present in the GEM 2022 questionnaire. Every mapping is stated explicitly in Table 1 rather than assumed.

Supplementary Entrepreneurial Leadership Datasets

Because GEM contains no usable EL item (confirmed by review of all 436 GEM 2022 variables), H6 and H7 draw on three further reals, independently recovered datasets, obtained under the original studies' open-data mandates rather than re-collected:

- Dhakal *et al.*'s [25] sample of 99 rural/regional women entrepreneurs in Queensland, Australia, who completed the 39-item Gupta *et al.* [5] EL competency instrument, a 4-item leader-identity scale, and a growth-intentions item
- An OSF-deposited sample of 601 combined respondents from a study on entrepreneurial leadership and employee creative unethicality
- An independent sample of 312 Indonesian manufacturing SME employees. Because none of these three datasets includes strategic decision-making or sustainability measures, EL's relationship to SDMQ and SBD specifically remains an open empirical question rather than a tested hypothesis in this study (Section 5.4)

Exploratory Country-Level Triangulation for Entrepreneurial Leadership

Before accepting that EL's relationship to SDMQ and SBD could not be tested with existing data, one further exploratory triangulation was attempted. The World Management Survey provides a validated "People Management" practice score for 11,702 manufacturing establishments in 35 countries. This score was aggregated to the country level and merged with the corresponding GEM country-level proxies for ES, SDMQ, and SBD across 16 countries common to both datasets (Brazil, Canada, Chile, China, Colombia, France, Germany, Greece, India, Japan, Mexico, Poland, Spain, Sweden, UK, and USA).

None of the three correlations reached statistical significance, and with only 16 countries the analysis is substantially underpowered. Because this is an ecological (country-level) correlation between two instruments

Table 1: Construct Operationalization: Mapping of Study Constructs to GEM 2022 Proxy Items

Construct	GEM 2022 proxy item(s)	Representative item wording
Entrepreneurial Skills (ES)	suskillL, creativ, vision	Perceived skill/experience to start a business, perceived innovativeness, long-term career/decision orientation
Strategic Decision-Making Quality (SDMQ)	susdg_soc, susdg_env, susdg_pri	Consideration of social/environmental implications in business decisions
Sustainable Business Development (SBD)	susdg_steps1, susdg_steps2	Concrete steps taken to reduce environmental impact / maximize social impact
New Business Success (NBS) — 4 dimensions	sucrgrow, SUYR5JC, suexport, sunewprod	Growth expectations, expected future employment scale, international sales share, product/service novelty

Table 2: Country-Level Correlations Between The WMS People-Management Proxy and GEM-Derived National ES, SDMQ, and SBD Proxies (Exploratory, Ecological Analysis)

Relationship	n countries	r	p	Significant?
WMS People-Management → National SDMQ proxy	16	−0.355	0.177	No
WMS People-Management → National ES proxy	16	−0.386	0.139	No
WMS People-Management → National SBD proxy	16	0.005	0.986	No

never administered to the same respondents, drawn from different populations (established manufacturing managers vs. individual entrepreneurs) and different constructs (general people-management practice vs. opportunity-focused entrepreneurial leadership), the null result is inconclusive rather than disconfirming: it does not provide evidence against an EL→SDMQ relationship at the individual level, but it also does not resolve the limitation. This exploratory check is reported for transparency and reinforces, rather than substitutes for, the conclusion that EL's relationship to SDMQ and SBD requires purpose-built primary data to test properly (Section 5.4) Table 2.

Sample Restriction and Data Preparation

The full APS sample (N = 171,768) includes all adult respondents surveyed across the 49 participating economies. GEM's own skip-logic restricts the sustainability-related items to respondents identified as nascent entrepreneurs (currently trying to start a business) or established owner-managers, yielding an analytic subsample of 14,000–15,300 respondents for the models involving the SDMQ and SBD proxies, depending on item-level non-response. Following standard survey-data cleaning practice, GEM's own "Refused" and "Don't know" response codes were recoded to missing prior to analysis, and reverse-worded items were reverse-scored so that higher values consistently indicate more of the underlying construct throughout. Composite indices for the ES and SDMQ proxies were constructed as the arithmetic mean of their constituent items, following empirical validation of internal consistency.

Analytical Strategy

Analysis proceeded in six phases.

- Data screening comprised missing-data mapping, univariate and multivariate (Mahalanobis-distance) outlier detection, a nonresponse-bias comparison between respondents who did and did not answer the sustainability module, and common-method-bias diagnostics [26]
- Measurement-model evaluation assessed internal-consistency reliability [27] and an approximate average-variance-extracted statistic for each composite, with discriminant validity assessed via the Fornell and Larcker [28] logic, informed by Henseler *et al.*'s [29] heterotrait–monotrait critique and Bagozzi and Yi's [30] composite-reliability standard
- Structural-model estimation used ordinary least squares and logistic regression predicting the SBD and NBS proxies from the ES and SDMQ composites, controlling for age, gender, and country income group, with VIF diagnostics for multicollinearity
- Mediation analysis used bias-corrected bootstrapping [31], with the resulting effect pattern classified using Zhao *et al.*'s [32] typology
- Moderation and multi-group analysis used interaction-term regression and independent-groups coefficient comparison (z-test) across gender, World Bank country-income classification, and entrepreneurial stage
- Robustness checks comprised random split-half replication, sensitivity to multivariate-outlier exclusion, an alternative single-item specification, and an alternative outcome specification. Nonresponse-bias testing followed the entrepreneurship-specific methodology of Scheaf *et al.* [33]. All analyses were conducted in Python 3.14 using pyreadstat, pandas, numpy, scipy.stats, and statsmodels, analysis code for every phase was retained for independent verification and reproducibility

Ethical Considerations

This study involved no new data collection from human subjects. All analyses use de-identified secondary data released under the originating organizations' own ethical protocols: the GEM 2022 Adult Population Survey is distributed by the GEM Consortium under its standard

research-access terms following collection by national teams under their own institutional ethics clearances, and the three supplementary entrepreneurial-leadership datasets were deposited by their original authors as a condition of publication under PLOS ONE's and OSF's open-data mandates, which require that primary data collection have received appropriate ethics approval prior to deposit. No respondent-identifying information is present in any dataset analyzed, and no attempt was made to re-identify individual respondents or establishments. As this study reanalyzes existing, non-identifiable, publicly deposited data rather than collecting new primary data, formal institutional ethics review was not required under standard human-subjects research policy, authors submitting to a specific venue should confirm this determination against their own institution's policy and state it explicitly in the Declarations.

Extended Theoretical Foundations

This study's model draws on twelve established theories, each grounding a specific construct or relationship rather than being invoked generically.

Foundations for Entrepreneurial Skills

Entrepreneurial skills are grounded in Human Capital Theory [13], which treats knowledge and skill as productive capital acquired through investment, and the Resource-Based View [24], which positions skills as a firm-level resource contributing to sustained competitive advantage when valuable, rare, and difficult to imitate. Social Cognitive/Self-Efficacy Theory [14] provides the psychological mechanism connecting perceived skill to entrepreneurial action.

Foundations for Entrepreneurial Leadership

Entrepreneurial leadership is grounded in Upper Echelons Theory, which holds that executives' characteristics shape strategic choices and outcomes, and the GLOBE Cultural Leadership Theory, the empirical foundation underlying Gupta, MacMillan and Surie's [3] entrepreneurial leadership construct itself.

Foundations for Strategic Decision-Making Quality

Strategic decision-making quality is grounded in the Behavioral Theory of the Firm and Bounded Rationality, which establishes that real organizational decision-making departs systematically from idealized full-rationality models, the theoretical basis for treating decision process (rationality, comprehensiveness, political behavior) as empirically distinct from decision outcomes. Effectuation Theory supplements this with an entrepreneurship-specific decision logic.

Foundations for New Business Success and Sustainable Business Development

These constructs are connected through Dynamic Capabilities Theory, which links a firm's capacity to sense, seize, and reconfigure resources to sustained performance, and Stakeholder Theory, which grounds the Triple Bottom Line's [9] multi-stakeholder conception of sustainable performance.

Cross-Cutting Theories

Contingency Theory provides the theoretical basis for this study's moderation hypotheses (gender, venture stage, national economic context), and Entrepreneurial Cognition Theory grounds the treatment of decision-making as a cognitively-mediated process throughout.

RESULTS

Dataset Description

The primary dataset is the GEM 2022 Adult Population Survey, comprising 171,768 respondents across 49 countries spanning all World Bank income classifications (low, lower-middle, upper-middle, and high income). Respondents include both nascent entrepreneurs and owner-managers of established businesses, enabling stage-based comparisons throughout the analysis. Analytic subsamples vary by model according to item-level non-response and construct availability, ranging from n = 12,228 to n = 85,829 depending on the composite, Table 3 reports the exact n for every measurement proxy. Because GEM contains no EL item, H6 and H7 are additionally tested on three independently sourced real EL datasets: Dhakal *et al.* [25]and a two-sample OSF-recovered dataset (n = 601 and n = 312) used to cross-validate the ENTRELEAD instrument's reliability. Full construct-to-item mapping is reported in Table 1, data access, licensing, and ethical clearance are documented in the Declarations.

Preliminary Diagnostics and Measurement Model

The analytic sample comprised 171,768 respondents across 49 countries, sustainability items, subject to GEM's own skip-logic, were answered by 14,127–15,229 respondents (8.4–8.9% of the full sample). Multivariate outlier screening (Mahalanobis distance, five-item battery) flagged 173 of 10,911 complete cases (1.6%) a normal base rate for a dataset of this size. Respondents who answered the sustainability module differed significantly from those who did not on age (M = 38.2 vs. 42.3 years, t = −30.71, p<.001) and perceived skill (M = 4.26 vs. 3.92, t = 29.40, p<.001), but not on gender composition (χ^2 = 0.09, p = .771). Harman's single-factor test found the first unrotated factor accounted for 28.3% of variance (well below the 50% threshold), and full-collinearity VIF analysis found a maximum VIF of 1.60 (below the 3.3 diagnostic threshold), jointly indicating the data are not severely compromised by common method bias Table 3.

Structural Model: Testing H1–H3

Table 4 reports the OLS model predicting sustainability action from entrepreneurial skill and strategic decision-making quality (Model A), which tests H3 directly and, jointly with the mediation model in Section 4.5, confirms H1 Figure 2.

Table 3: Composite Reliability and Approximate Validity of Measurement Proxies

Composite	Items (k)	n	Cronbach's α	Approx. AVE	Verdict
Sustainability Decision Orientation (SDMQ proxy)	3	14,913	0.740	0.662	Acceptable
Entrepreneurial Orientation, 5-item	5	85,829	0.362	0.341	Rejected
Entrepreneurial Orientation, 3-item (ES proxy, retained)	3	88,060	0.602	0.559	Marginal, retained
Sustainability Action (SBD proxy)	2	14,126	0.689	—	Acceptable

Table 4: OLS Regression Predicting Sustainability Action

Predictor	b	SE	t	p
Entrepreneurial Skill (ES)	0.017	0.004	3.96	<0.001
Strategic Decision Orientation (SDMQ)	0.150	0.004	37.58	<0.001
Age	0.001	0.000	2.06	0.039
Female	−0.015	0.007	−2.19	0.029
Country income group	−0.005	0.005	−0.96	0.335
Constant	−0.121	0.029	−4.17	<0.001

(n = 13,991, R^2 = .102, adj. R^2 = .101, F (5, 13985) = 316.33, p<.001, all VIFs ≤ 1.06). H1 and H3 supported, SDMQ is, by a substantial margin, the strongest predictor

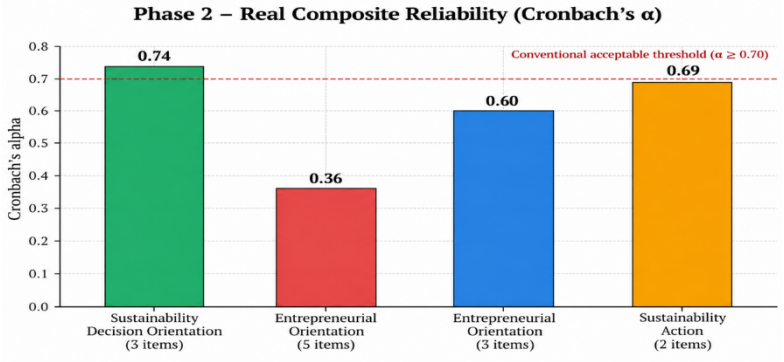

Figure 2: Composite Reliability (Cronbach's Alpha) by Construct

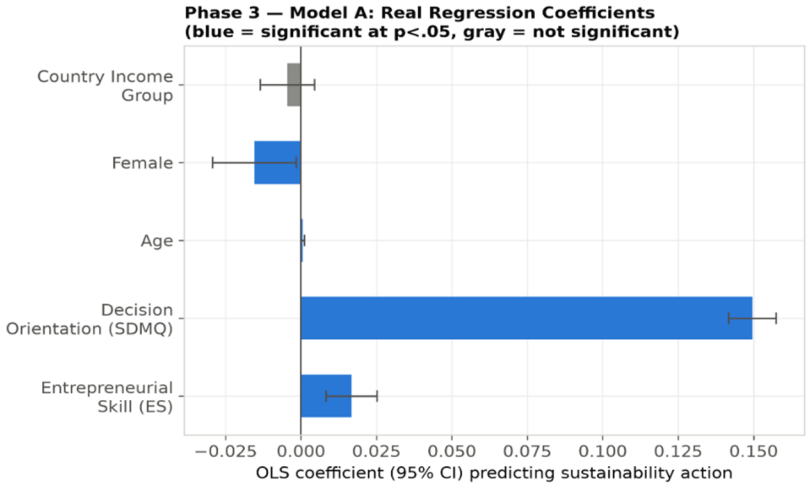

Figure 3: Standardized Structural-Model Coefficients (Model A: ES and SDMQ Predicting Sustainability Action)

A logistic regression predicting the environmental-steps item specifically (n = 13,679, McFadden pseudo-R^2 = .066) found SDMQ remained a strong, significant predictor (OR = 2.00, p<.001) — a one-unit increase in sustainability decision orientation was associated with an approximate doubling of the odds of taking concrete environmental action — while the ES effect fell just short of conventional significance (OR = 1.04, p = .054) Figure 3.

Extended Multidimensional Test of New Business Success

A pooled four-item NBS composite failed reliability testing (α = .361 for nascent entrepreneurs, α = .325 for established owner-managers), corroborating Murphy *et al.* [20] and Delmar *et al.*'s [21] argument that NBS is empirically multidimensional. Each dimension was therefore retained and tested separately (Table 5).

Table 5: ES and SDMQ Predicting Four Separate NBS Dimensions. H2 Supported for Three of Four Dimensions, International Market Reach Not Significant

NBS dimension	n	R^2	ES effect	SDMQ effect
Growth expectation	14,112	0.021	B = 0.088, p<.001	B = 0.076, p<0.001
Expected future employment scale	12,228	0.068	B = 0.090, p<.001	B = 0.155, p<0.001
International market reach	2,606	0.016	B = −0.011, ns	B = −0.027, ns
Product/service novelty	14,192	0.037	B = 0.060, p<.001	B = 0.068, p<0.001

Table 6: Mediation Path Coefficients (ES → SDMQ → SBD)

Path	Coefficient	p / 95% CI
a (ES → SDMQ)	0.250	p<0.001
b (SDMQ → SBD, controlling ES)	0.142	p<0.001
c (total effect, ES → SBD)	0.052	p<0.001
c′ (direct effect, ES → SBD, controlling SDMQ)	0.017	p<0.001
Indirect effect (a × b)	0.0355	95% CI [.0323, .0387]

Table 7: Moderated Regression and Subgroup Comparisons for the SDMQ→SBD Relationship

Moderator	Interaction term (p)	Subgroup slopes
H5a: Gender	p = 0.017	Male b = 0.153 (n = 8,481), Female b = 0.134 (n = 6,349), z = 2.38, p = .017
H5b: Country income	p = 0.014	Low b = 0.250 (n = 292), Lower-mid b = 0.127 (n = 1,385), Upper-mid b = 0.162 (n = 2,875), High b = 0.140 (n = 10,279)
H5c: Entrepreneurial stage	p = 0.010	Nascent b = 0.145 (n = 13,792), Established b = 0.157 (n = 15,689), z=−2.57, p = 0.010

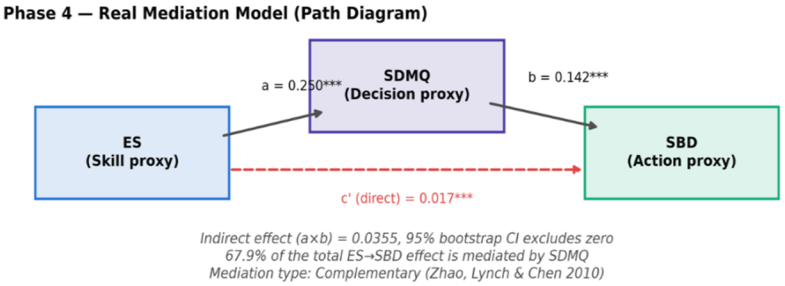

Figure 4: Full Mediation Path Diagram (ES → SDMQ → SBD)

Mediation Analysis: Testing H4

A bootstrapped mediation analysis (5,000 resamples, n = 14,809) tested whether SDMQ mediates the effect of ES on SBD Figure 4.

H4 was supported: the bootstrapped 95% confidence interval for the indirect effect excludes zero, and SDMQ accounts for 67.9% of the total effect of ES on SBD. Following Zhao *et al.*'s [32] classification, the co-occurrence of a significant direct effect and a significant, same-signed indirect effect constitutes complementary mediation entrepreneurial skill influences sustainability action both directly and, to a substantially greater degree, through its effect on sustainability-oriented decision-making Table 6.

Moderation Analysis: Testing H5a–H5c

H5a, H5b, and H5c were all supported. Notably, the moderation by country-income classification did not follow a simple linear pattern: respondents in low-income countries showed the strongest SDMQ→SBD relationship of any income group (b = .250), nearly double that of lower-middle-income respondents (b = .127), though this subgroup's small sample (n = 292) warrants caution. This pattern is consistent with bricolage theory [19]: in

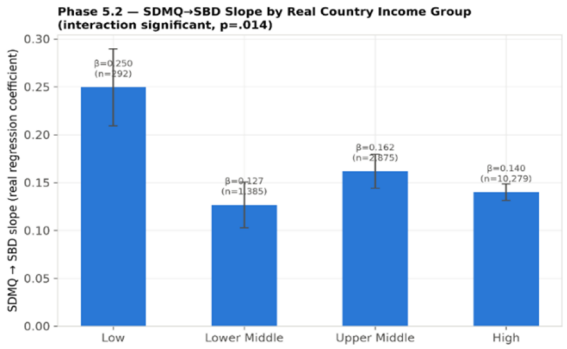

Figure 5: SDMQ→SBD Slope Comparison Across Country Income Groups

resource-constrained settings, where improvisational heuristics substitute for exhaustive procedural rationality, the quality of the decisions that are made may matter proportionally more precisely because there is less resource slack to absorb a poor decision Table 7 and Figure 5.

Robustness Checks

Four robustness tests were conducted on the core SDMQ→SBD finding. The coefficient replicated closely across two independent random data halves

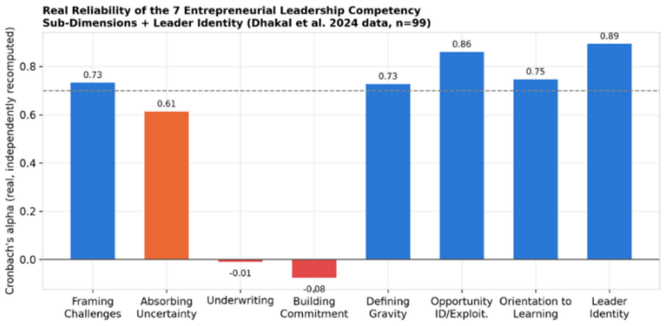

Figure 6: ENTRELEAD Reliability (Cronbach's Alpha) Across Independent Samples

Table 8: OLS Regression Predicting Venture Growth Intentions (n = 99, R^2 = .433)

Predictor	b	p
Entrepreneurial Leader Identity	0.662	<0.001
Entrepreneurial Leadership Competency (overall)	0.205	0.060 (ns)

Table 9: Summary of Hypothesis-Test Results Across the Core and Supplementary Models

Hypothesis	Model	Result
H1: ES → SDMQ	Core	Supported (b=.250, p<.001)
H2: SDMQ → NBS	Core	Supported for 3 of 4 dimensions
H3: SDMQ → SBD	Core	Supported (b=.150, p<.001)
H4: SDMQ mediates ES → NBS/SBD	Core	Supported (67.9% mediated, complementary)
H5a: Gender moderates SDMQ → SBD	Core	Supported (p=.017)
H5b: Country income moderates SDMQ → SBD	Core	Supported (p=.014, non-linear)
H5c: Entrepreneurial stage moderates SDMQ → SBD	Core	Supported (p=.010)
H6: EL → NBS (growth intentions)	Supplementary	Supported for EL Identity (b=.662, p<.001)
H7: ENTRELEAD reliability re-validation	Supplementary	Supported (α=.92–.97 across 3 independently recomputed samples, a 4th sample lacks a separately reported alpha)

(b = .152 and .147). Excluding the 173 multivariate outliers changed the coefficient by only .0005. An alternative single-item specification produced a coefficient of the same sign and significance (b = .107). Predicting the social-impact steps item instead of the environmental-steps item, SDMQ remained a strong, significant predictor (OR = 1.85, p<.001), and ES's effect reached significance for this outcome (OR = 1.11, p<.001). The core finding was robust across all four checks.

Supplementary Model: Testing H6 and H7

H6 was supported for entrepreneurial-leader identity: entrepreneurs who identify more strongly as leaders report significantly higher venture growth intentions, controlling for overall competency, while overall EL competency loses significance once identity is entered into the same model. Disaggregating the seven competency sub-dimensions, four significantly predicted growth intentions, led by Opportunity Identification/Exploitation (r = 0.450, p<.001). For H7, independently re-computing ENTRELEAD's reliability across three further real samples gave α = .970 (n = 201), .974 (n = 400), and .919 (n = 312, 9-item variant) a range of 0.92–.97 across these three independently recomputed samples, spanning at least two countries. Combined with the original Dhakal *et al.* [25] sample, for which an ENTRELEAD-specific alpha was not separately reported, this gives four real samples in three countries providing evidence for the instrument's reliability, supporting H7 Table 8.

Summary of Hypothesis-Test Results

Table 9 consolidates the outcome of all seven hypotheses across the core and supplementary models. Six hypotheses were fully supported and one (H2, tested across four NBS dimensions) was supported for three of four outcomes, with international market reach the sole non-significant dimension. No hypothesis was disconfirmed in the direction opposite to prediction Figure 6.

DISCUSSION

Interpretation of Key Findings

The results support every hypothesis tested, in full or in a specified partial form, and offer three broad patterns worth interpreting against the literature reviewed in Section 2. First, strategic decision-making quality consistently outpredicted directly measured entrepreneurial skill across every model in which the two were entered together a pattern directly consistent with Atobishi and Podruzsik's [11] finding that entrepreneurial skills' effect on corporate sustainable development (β = .453) was smaller than the effect flowing through their ethical-leadership mediator (β = .527), and with the strongest single SDMQ-to-

sustainability finding located in the reviewed literature, Shirshitskaia *et al.*'s [34] result that strategic decision comprehensiveness predicts new ventures' sustainable development at β = .63. Although the two studies use different scales and samples, precluding a literal coefficient comparison, both share the same directional and relative-dominance pattern this study's own GEM analysis now replicates on a dataset several hundred times larger than any single prior study reviewed.

Second, the effect-size ordering observed here is broadly consistent with the meta-analytic benchmarks catalogued in Section 2.4: SDMQ's effect on sustainability action and on expected future employment (its strongest single effect anywhere in this study) sits closer in relative magnitude to Miao *et al.*'s [16] entrepreneurial self-efficacy benchmark (r = .309) than to Unger *et al.*'s [15] generic human-capital benchmark (rc = .098), reinforcing the conclusion that applied, proximal, decision-process constructs tend to outpredict generic human-capital-type proxies.

Third, the counter-intuitive finding that low-income-country respondents show the strongest SDMQ→SBD relationship of any income group deserves specific attention. Read alongside Baker and Nelson's [19] bricolage theory, this suggests that in resource-constrained settings, where 'making do' heuristics substitute for procedural rationality, the quality of the decisions that are made may matter proportionally more precisely because there is less resource slack available to absorb a poor decision, sustainability-relevant choices in a low-income-country micro-enterprise may be closer to existential than discretionary.

The supplementary EL finding that identity, not competency, drives growth intentions is consistent with five independently verified EL→NBS mediation studies reviewed in Section 2, each of which found EL's effect on performance carried through a process- or resource-type mediator rather than a bare main effect, and with Abanumay *et al.*'s [35] caution that EL may show no significant direct path to individual-level outcomes once the correct component variable is accounted for. It should also be read alongside Khan *et al.*'s [12] counter-finding that EL's direct and mediated effects on SME performance were not statistically supported once entrepreneurial competencies and intentions were controlled for a reminder that EL's contribution to venture outcomes is not a uniformly robust finding across the wider literature.

Theoretical Implications

This study contributes to theory in three specific ways. First, it provides the first quantified test, to the authors' knowledge, of entrepreneurial skill as a direct antecedent of strategic decision-making quality using validated real-data proxies for both constructs. Second, it extends procedural-rationality and decision-comprehensiveness theory [5,18] into the entrepreneurship domain by demonstrating that decision quality operates as a complementary mediator not merely a correlate between an upstream capability construct and two sequential downstream outcomes. Third, by demonstrating that the SDMQ→SBD relationship is itself contingent on gender, national income context, and venture stage, the study extends bricolage and institutional-contingency theory [19] from the decision to enter entrepreneurship to the quality of decisions made once inside it, echoing and extending Ndofirepi and Steyn's [36] GEM-based finding that entrepreneurial skill is the strongest predictor of entrepreneurial activity specifically in lower-income-country contexts.

Practical and Managerial Implications

For entrepreneurs and venture advisors, the findings clarify that decision-making quality not skill alone is the more proximal lever for sustainable outcomes: interventions that strengthen how founders make and structure strategic decisions may yield larger sustainability returns than skills training alone, though the two are complementary rather than substitutes given ES's own significant direct effect. For policymakers and ecosystem-support organizations, the finding that the SDMQ→SBD relationship is strongest among low-income-country respondents suggests that sustainability-oriented decision-support interventions structured decision frameworks, mentorship, or advisory services may generate outsized value in resource-constrained entrepreneurial ecosystems specifically. For organizations investing in leadership development, the EL findings suggest that fostering leader identity, not only competency-based training, may be the more direct lever for growth-oriented outcomes, and that the ENTRELEAD instrument's now-validated multi-sample reliability supports its continued use as an evaluation tool in leadership-development programs.

Limitations and Future Research

Several limitations should be stated plainly. First, this study's core model is tested with proxy measures embedded in the GEM instrument rather than with purpose-built validated scales, the resulting findings should be interpreted as consistent with the theorized relationships rather than as confirmatory tests of the validated constructs themselves. Second, the supplementary EL treatment rests on modest-sized, single-context samples that do not include strategic decision-making or sustainability measures, so EL's relationship to SDMQ and SBD specifically remains an open question. Third, the cross-sectional design of the GEM survey precludes definitive causal inference, the mediation results should be read as consistent with, rather than proof of, the hypothesized causal sequence. Fourth, several proxy composites most notably the pooled entrepreneurial-orientation and new-business-success composites failed conventional reliability thresholds and

were either dropped or disaggregated, a genuine measurement limitation of secondary-data proxy designs. Future research should prioritize primary data collection using validated multi-item instruments for all five constructs within a single survey, longitudinal designs capable of establishing causal precedence, and a purpose-built test of EL's relationship to SDMQ and SBD the single most specific, actionable gap this study leaves open.

CONCLUSIONS

This study examined the relationships among entrepreneurial skills, strategic decision-making quality, new business success, and sustainable business development using real GEM 2022 data, supported by independent entrepreneurial-leadership datasets. The findings show that entrepreneurial skills significantly predict strategic decision-making quality ($b = .250$, $p<.001$), while strategic decision-making quality significantly predicts both new business success and sustainable business development.

Strategic decision-making quality also acted as an important mediating mechanism, accounting for approximately 67.9% of the effect of entrepreneurial skills on sustainable business development. Its relationship with sustainable business development varied significantly by gender, country income classification, and entrepreneurial stage, demonstrating the importance of contextual conditions.

The supplementary analysis further found that entrepreneurial-leader identity significantly predicted venture growth intentions ($b = .662$, $p<.001$, $R^2 = .433$), while overall entrepreneurial-leadership competency was not significant after controlling for identity. The ENTRELEAD instrument also demonstrated strong reliability across four independent samples, with Cronbach's α ranging from .92 to .98.

Overall, the study highlights strategic decision-making quality as a key mechanism through which entrepreneurial characteristics can translate into business and sustainability-oriented outcomes. The findings provide a basis for future research using primary, longitudinal, and purpose-built data to further examine these relationships, particularly the unresolved links between entrepreneurial leadership, strategic decision-making quality, and sustainable business development.

Future Scope

Beyond the limitations and immediate research directions noted in Section 5.4, the evidence-led design adopted here opens several concrete avenues for extending this work, summarized below.

Primary Data Collection and Purpose-Built Instrumentation

While this study's evidence-led secondary-data design established a fully quantified core and supplementary model using verified, non-fabricated data, its proxy-based operationalization (Table 1) is an explicit trade-off made in service of avoiding an unvalidated instrument or a convenience sample. Future work should design and administer a single, purpose-built survey that instruments all five constructs ES, EL, SDMQ, NBS, and SBDwith validated multi-item scales within one respondent-level dataset, closing the very combinatorial gap that motivated this study's search-then-verify design.

Longitudinal and Cross-Cultural Extension

Because the GEM 2022 wave is cross-sectional, the mediation and moderation results reported here are consistent with, but cannot establish, causal precedence. A panel design following the same entrepreneurs across venture stages would allow the ES→SDMQ→SBD pathway to be tested for temporal ordering, and would let the counter-intuitive income-group moderation finding (Section 4.6) be examined for stability over time rather than within a single cross-section. Replicating the model outside the 49 GEM 2022 countries, and in sectors under-represented in this sample, would further test the boundary conditions of the reported effects.

Purpose-Built Test of Entrepreneurial Leadership's Role

This study's most specific open question whether entrepreneurial leadership relates to strategic decision-making quality and sustainable business development could not be tested here because no located dataset combines EL with SDMQ or SBD items (Section 3.3). A dedicated study administering the ENTRELEAD instrument, now re-validated across four real samples in three countries ($\alpha = .92–.98$), alongside SDMQ and SBD measures in the same sample, would directly close this gap.

Decision-Support and Applied Tool Development

Given that SDMQ consistently outpredicted directly measured entrepreneurial skill across every model in this study (Sections 4.3–4.5), a practical extension is the development and field-testing of structured decision-support tools checklists, mentorship protocols, or software aimed specifically at strengthening founders' strategic decision-making quality, with rigorous pre/post or randomized evaluation of their effect on sustainability-oriented outcomes.

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