



RISK-TAKING, TRANSFORMATIONAL LEADERSHIP, AND ORGANIZATIONAL CULTURE IN RELATION TO MADRASAH INNOVATION IN DOLOK MASIHUL

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Abstrak

Penelitian ini membahas hubungan antara pengambilan risiko, kepemimpinan transformasional kepala madrasah, budaya organisasi, dan inovasi madrasah pada lima Madrasah Aliyah di Kecamatan Dolok Masihul. Penelitian menggunakan pendekatan kuantitatif asosiatif dengan sampel 101 guru yang dipilih secara proporsional dari lima Madrasah Aliyah. Data dikumpulkan melalui kuesioner dan dianalisis menggunakan Partial Least Squares Structural Equation Modeling (PLS-SEM) dengan SmartPLS 4.0. Model menghasilkan SRMR sebesar 0,052; nilai R-square budaya organisasi sebesar 0,054 dan inovasi madrasah sebesar 0,472. Pengambilan risiko, kepemimpinan transformasional, dan budaya organisasi menunjukkan hubungan positif dan signifikan dengan inovasi madrasah. Pengambilan risiko juga menunjukkan hubungan positif dan signifikan dengan budaya organisasi, sedangkan hubungan kepemimpinan transformasional dengan budaya organisasi tidak signifikan. Budaya organisasi memiliki koefisien jalur terbesar di antara prediktor inovasi yang diuji. Temuan ini menunjukkan bahwa variasi inovasi madrasah dalam sampel berkaitan dengan faktor kepemimpinan, pengambilan risiko, dan terutama norma serta praktik budaya organisasi. Karena data dikumpulkan secara cross-sectional dari guru yang berada dalam lima madrasah, hasil ditafsirkan sebagai hubungan statistik pada konteks penelitian ini, bukan sebagai bukti kausalitas.

Kata Kunci: Pengambilan Risiko; Kepemimpinan Transformasional; Budaya Organisasi; Inovasi Madrasah; PLS-SEM

Abstract

This study examines the relationships among risk-taking, principals' transformational leadership, organizational culture, and madrasah innovation in five Madrasah Aliyah in Dolok Masihul. A quantitative associative design was employed with 101 teachers proportionally sampled from the five schools. Questionnaire data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.0. The model produced an SRMR of 0.052; the R-square values were 0.054 for organizational culture and 0.472 for madrasah innovation. Risk-taking, transformational leadership, and organizational

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culture each showed a positive and significant association with innovation. Risk-taking also showed a positive and significant association with organizational culture, whereas the association between transformational leadership and organizational culture was not statistically significant. Organizational culture had the largest estimated path coefficient among the predictors of innovation tested. These findings indicate that variation in madrasah innovation in the study sample is associated with leadership, risk-taking, and particularly organizational-cultural conditions. Because the data were cross-sectional and collected from teachers nested within five madrasahs, the findings are interpreted as statistical associations within the study context rather than as evidence of causal effects.

Keywords: Risk-Taking; Transformational Leadership; Organizational Culture; Madrasah Innovation; PLS-SEM

INTRODUCTION

Innovation has become a strategic requirement for madrasahs facing rapid technological, curricular, and social change. In educational organizations, innovation includes not only technology adoption but also renewal in curriculum, learning methods, institutional management, evaluation, and educational services (Chesbrough, 2020; Girsang et al., 2022). The research setting illustrates this urgency. Madrasah Aliyah in Dolok Masihul are expected to implement more flexible learning, strengthen students' character and competence, and respond to digital transformation while preserving Islamic identity. Initial field observations reported that several schools had introduced new learning media and methods, but these practices remained limited and uneven. Teachers' willingness to experiment still depended heavily on principal approval, and innovation was frequently constrained by administrative workloads, unequal infrastructure, limited access to continuous training, and uncertainty surrounding new programs. These conditions indicate that madrasah innovation is an organizational outcome shaped by leadership decisions, collective norms, and the institution's ability to learn from change.

Prior studies consistently identify leadership and organizational conditions as important antecedents of educational innovation, yet the evidence is not uniform across institutional contexts. Reviews of innovation culture in education emphasize that sustainable change requires supportive leadership, professional collaboration, and organizational learning rather than isolated programs (Fuad et al., 2020). Transformational school leadership can inspire staff, align collective goals, and create a shared orientation toward improvement (Wilson Heenan et al., 2023), while organizational culture determines whether new ideas are accepted, tested, evaluated, and institutionalized. However, evidence from Islamic educational institutions remains comparatively limited, particularly in suburban and rural settings where resources and access to technology are uneven. Existing work also tends to embed risk-taking within



entrepreneurial leadership or organizational culture instead of examining it as an independent construct. Consequently, the interaction among risk-taking, transformational leadership, organizational culture, and innovation requires direct empirical testing in the daily governance of madrasahs.

Risk-taking is especially relevant because educational innovation necessarily involves uncertainty. Introducing a new curriculum, digital platform, collaborative teaching model, or administrative system requires leaders to allocate resources before all outcomes are known. Responsible risk-taking is not recklessness; it is a reasoned willingness to evaluate opportunities, anticipate obstacles, and learn from unsuccessful trials. Studies in other organizational settings show that risk orientation and transformational leadership can support innovative performance when they are accompanied by commitment and organizational capability (Abu Afifa & Nguyen, 2023; Iqbal et al., 2021). In madrasahs, the principal's willingness to authorize experimentation may also signal that change is legitimate and that failure can be treated as organizational learning. At the same time, visionary leadership alone may be insufficient when routines, communication patterns, and shared values remain rigid. This makes organizational culture a crucial mechanism through which individual leadership behavior becomes collective innovative practice.

This study examines a structural model in which risk-taking and principals' transformational leadership are treated as exogenous constructs, organizational culture as an intermediate endogenous construct, and madrasah innovation as the principal endogenous outcome. Five direct relationships are tested: risk-taking with innovation, transformational leadership with innovation, organizational culture with innovation, risk-taking with organizational culture, and transformational leadership with organizational culture. The study contributes by integrating these constructs in a single PLS-SEM model and by examining risk-taking as an independent educational-management construct in five Madrasah Aliyah in Dolok Masihul. The study therefore provides context-specific evidence on how these constructs are statistically related in a setting characterized by strong religious identity and constrained resources. Given the cross-sectional teacher-survey design and the nesting of respondents within five madrasahs, the findings are interpreted as associations rather than causal effects.

LITERATURE REVIEW

Madrasah innovation refers to the creation, development, evaluation, and implementation of new ideas that improve teaching, institutional management, educational programs, or the use of resources. Innovation is not limited to novelty; it must generate meaningful value and respond to identifiable problems (Chesbrough,



2020). Within educational institutions, the process typically begins with identifying needs and opportunities, producing ideas, securing organizational support, implementing change, and evaluating outcomes for further refinement (Burhan & Putri, 2022). Islamic education adds a distinctive requirement: innovation should strengthen quality and relevance without separating academic improvement from moral and religious formation. Recent studies of Islamic educational innovation underline the need for adaptive management, creative pedagogy, and context-sensitive technology use (Nurazis, 2025). Accordingly, the present study conceptualizes madrasah innovation through problem and opportunity identification, innovative idea generation, organizational support, implementation, evaluation, and decision-making. These dimensions frame innovation as a continuous institutional capability rather than a temporary project.

Risk-taking describes the willingness of leaders and organizations to face uncertainty through calculated decisions in pursuit of strategically valuable opportunities. In this study, the construct comprises risk awareness, measured decision-making, courage to innovate, openness to uncertainty, and resilience in learning from failure. Organizational research indicates that risk orientation can improve innovation when decision makers combine experimentation with information, evaluation, and resource discipline (Ruba et al., 2021). Risk-taking is particularly important for madrasahs because many innovations must begin under conditions of limited finance, incomplete infrastructure, and uncertain stakeholder acceptance. Principals who avoid all risk may preserve short-term stability but restrict organizational learning, whereas principals who manage risk carefully can authorize pilot programs, digital learning trials, curriculum integration, and teacher-led experimentation. Educational risk management therefore requires both courage and accountability (Suriyadi & Azmi, 2022). The first hypothesis proposes that measured risk-taking is positively associated with madrasah innovation.

Transformational leadership is a change-oriented leadership approach that raises followers' motivation, aligns them with a shared vision, stimulates new ways of thinking, and provides individualized consideration (Bass & Riggio, 2006). Applied to madrasahs, transformational principals articulate an educational vision, model ethical conduct, empower teachers, attend to individual professional needs, and communicate change in ways that reduce uncertainty. Research in Islamic schools suggests that transformative leadership can support curriculum innovation by connecting institutional identity with strategic renewal (Abidin et al., 2025). Other studies show that principal leadership contributes to educational quality when inspiration is followed by staff development, distributed responsibility, and consistent support for implementation (Gunawan &



Cahyani, 2024). Transformational leadership is therefore expected to be positively associated with innovation by encouraging teachers to contribute ideas and persist through change. The second hypothesis proposes a positive association between transformational leadership and madrasah innovation.

Organizational culture comprises shared values, norms, assumptions, and habitual work patterns that guide member behavior. An innovation-supportive culture values collaboration, adaptability, consistency, openness to new ideas, and a sustained orientation toward quality. Studies across organizational settings show that culture influences whether innovation is treated as legitimate work or as an additional burden (AlSaied & Alkhoraif, 2024). In university and educational contexts, cultures that support learning and cross-unit cooperation facilitate the conversion of ideas into institutional practice (Arias & Morales, 2023). Culture also gives continuity to innovation beyond the tenure or personality of a particular leader. When teachers share norms of professional learning, disciplined implementation, mutual support, and reflective evaluation, new methods are more likely to survive initial difficulties. Conversely, hierarchical rigidity can prevent ideas from junior staff from entering institutional decision-making. The third hypothesis therefore proposes that organizational culture is positively associated with madrasah innovation.

The relationship between leadership and culture is theoretically important but empirically complex. Transformational leaders can influence culture through vision, symbolic action, communication, and repeated reinforcement, yet culture is also shaped by long-standing routines and collective participation. Studies report that organizational culture may mediate or condition the effects of leadership on innovation and performance (Peña & Caruajulca, 2024; Wiroonrath et al., 2024). Digital transformation research similarly shows that leadership support becomes more effective when the organization provides cultural support for experimentation and collaboration (Sibassaha & Pea-Assounga, 2025). Risk-taking may also influence culture because leaders' responses to uncertainty communicate what conduct is acceptable. When carefully designed experiments are encouraged and setbacks are discussed constructively, the organization develops norms of learning and adaptability. The fourth and fifth hypotheses test whether risk-taking and transformational leadership are positively associated with organizational culture.

The integrated model positions organizational culture as both an endogenous construct related to managerial behavior and a direct statistical predictor of innovation. This structure recognizes that innovation can emerge through multiple paths. Risk-taking may open opportunities for experimentation; transformational leadership may provide meaning and motivation; and organizational culture may stabilize innovative behavior



as a shared practice. Evidence from innovation studies supports this complementary perspective. Transformational leadership has been linked to innovative performance through organizational capabilities (Nasir et al., 2022), while culture has been shown to strengthen open innovation and organizational learning (Alateeg & Alhammad, 2024; Gad David et al., 2023). At the same time, the strength and significance of each path can vary by institutional setting. Testing all five paths simultaneously with PLS-SEM allows the study to estimate the five specified direct associations and compare their estimated path coefficients, and assess how much variance in organizational culture and madrasah innovation is explained by the proposed model.

RESEARCH METHODS

The study used a quantitative cross-sectional associative design and was conducted in five Madrasah Aliyah in Dolok Masihul District, Serdang Bedagai Regency, North Sumatra, during the 2025/2026 academic year. The population consisted of 135 teachers. A sample of 101 teachers was determined using the Yamane formula with a five-percent margin of error and allocated proportionally across the schools. The final distribution included 40 teachers from MAN Serdang Bedagai, 14 from MA Nur Indah Mutiara Asshufi, 12 from MAS Al-Ittihadiah Bandar Pamah, 16 from MAS Islamiyah, and 19 from MAS Miftahul Ulum. Data were collected using a four-point Likert questionnaire. Before the main survey, the instrument was tested with 34 teachers outside the study sample and reviewed by three expert validators. Invalid items were excluded, leaving 10 risk-taking indicators, 11 transformational-leadership indicators, 12 organizational-culture indicators, and 13 madrasah-innovation indicators. Because respondents were sampled within five madrasahs, the observations are institutionally nested; the study therefore does not treat the 101 responses as 101 independent organizations and does not generalize the findings beyond the participating schools.

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.0. The measurement model was evaluated through outer loading, Average Variance Extracted, Cronbach's alpha, and composite reliability. Indicators were retained when their loading exceeded 0.70; constructs were considered convergently valid when AVE exceeded 0.50 and reliable when Cronbach's alpha and composite reliability exceeded 0.70 (Ghozali, 2021; Hair et al., 2021, 2022). The structural model was evaluated using SRMR, NFI, R-square, path coefficients, T-statistics, and P-values. Hypotheses were considered statistically supported when T-statistics exceeded 1.96 and P-values were below 0.05. The model specified risk-taking and transformational leadership as exogenous constructs; organizational culture as an intermediate endogenous construct; and madrasah innovation as the principal endogenous construct.



Bootstrapping was used to test the five proposed direct relationships. Because the retained SmartPLS output reported in this manuscript does not include additional diagnostics such as HTMT, VIF, f^2 , Q^2 /PLSpredict, or bootstrap confidence intervals, these statistics are not added or reconstructed here in order to avoid introducing results that were not produced by the original analysis.

Table 1. Population and Sample Distribution

No.	Madrasah	Population	Sample
1	MAN Serdang Bedagai	53	40
2	MA Nur Indah Mutiara Asshufi	18	14
3	MAS Al-Ittihadiyah Bandar Pamah	17	12
4	MAS Islamiyah	21	16
5	MAS Miftahul Ulum	26	19
	Total	135	101

Source: Research data (2026).

RESULTS AND DISCUSSION

1. Results

The descriptive results show that all four constructs were rated in the “sufficient” category on the study’s four-point scale. Transformational leadership obtained the highest mean (2.44), followed by organizational culture (2.39), while risk-taking and madrasah innovation both obtained a mean of 2.37. These values indicate that change-oriented leadership, collective culture, and innovation were present but had not yet reached an optimal or evenly distributed level. At the indicator level, resilience and learning from failure was the strongest risk-taking dimension (2.51); inspiring and communicating a shared vision was the strongest leadership dimension (2.49); consistency in implementing rules was the strongest cultural dimension (2.53); and identifying problems and opportunities was the strongest innovation dimension (2.41). The weakest areas were risk calculation, communicative change management, adaptability to change, and implementation of innovation.

The results and discussion in an article or thesis can vary depending on the scope of the problem and the methodology used in the study. In qualitative research the discussion presents systematically the relevant theories and data collected. Then, based on a clear methodology, the data is critically analyzed in order to obtain answers to the core research problems. The format of the results of the research and discussion is not separated, given the limited number of pages available to the author.

Table 2. Descriptive Statistics of the Research Constructs

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Construct	Indicators	Mean	SD	Category
Risk-Taking (X1)	10	2.37	0.93	Sufficient
Transformational Leadership (X2)	11	2.44	0.95	Sufficient
Organizational Culture (X3)	12	2.39	0.95	Sufficient
Madrasah Innovation (Y)	13	2.37	0.94	Sufficient

Source: Research data (2026).

Instrument testing preceded the main structural analysis. The pilot test used 34 teachers outside the study sample and a Pearson product-moment criterion of 0.339. The screening process retained 10 valid items for risk-taking, 11 for transformational leadership, 12 for organizational culture, and 13 for madrasah innovation. The subsequent PLS measurement model showed that all retained indicators had outer loadings above 0.70. Convergent validity was also satisfactory: AVE values ranged from 0.776 to 0.796. Cronbach's alpha values ranged from 0.971 to 0.976, while composite reliability (rho_c) ranged from 0.974 to 0.979. These results support the internal consistency and convergent validity of the retained measurement model. They do not, by themselves, establish discriminant validity or eliminate possible common-method effects.

Table 3. Measurement Model Assessment

Construct	Cronbach's α	rho_a	rho_c	AVE
Risk-Taking (X1)	0.972	0.978	0.975	0.796
Transformational Leadership (X2)	0.971	0.975	0.974	0.776
Organizational Culture (X3)	0.975	0.976	0.978	0.786
Madrasah Innovation (Y)	0.976	0.977	0.979	0.779

Source: Primary data processed with SmartPLS 4.0 (2026).

Model-fit evaluation produced an SRMR of 0.052 for both the saturated and estimated models. Because this value is below 0.08, the discrepancy between the observed and model-implied correlation matrices was considered acceptable. The NFI value was 0.797 and is reported as supplementary model-fit information rather than as a standalone basis for model adequacy. In PLS-SEM, fit indices were treated as complementary information; the interpretation of the structural results therefore also considers the reported explanatory power and path estimates.

The R-square value for organizational culture was 0.054. Thus, risk-taking and transformational leadership jointly explained 5.4% of the variance in organizational culture, while 94.6% was attributable to factors outside the model. This explanatory power is weak and indicates that culture is influenced by broader mechanisms such as long-standing routines, staff participation, communication, institutional history, policy



consistency, and other unmeasured conditions. By contrast, the R-square value for madrasah innovation was 0.472. Risk-taking, transformational leadership, and organizational culture therefore explained 47.2% of the variance in innovation, a moderate contribution, while 52.8% remained associated with variables not included in the study.

Table 4. Structural Model Fit and Explanatory Power

Indicator / Endogenous Construct	Value	Interpretation
SRMR	0.052	Acceptable (< 0.08)
NFI	0.797	Supplementary fit information
R ² Organizational Culture	0.054	Weak explanatory power
R ² Madrasah Innovation	0.472	Moderate explanatory power

Source: Primary data processed with SmartPLS 4.0 (2026).

The first hypothesis was statistically supported. Risk-taking had a positive path coefficient of 0.266, a T-statistic of 3.525, and a P-value below 0.001. Thus, within the estimated model, higher scores on measured risk-taking were associated with higher scores on madrasah innovation. The result should not be interpreted as evidence that risk-taking causes innovation; rather, it indicates a positive statistical association in the observed sample.

The second hypothesis was statistically supported. Transformational leadership had a positive path coefficient of 0.258, a T-statistic of 3.582, and a P-value below 0.001 in relation to madrasah innovation. Within the estimated model, higher scores on transformational leadership were associated with higher scores on innovation. This result is consistent with the proposed mechanism in which shared vision, staff motivation, personal support, ethical modeling, teacher empowerment, and communicative change management are related to innovative practice; however, the cross-sectional design does not establish temporal or causal direction.

The third hypothesis was statistically supported. Organizational culture had a coefficient of 0.468, a T-statistic of 7.005, and a P-value below 0.001 in relation to madrasah innovation. It had the largest estimated path coefficient among the three direct paths to innovation in the tested model. This result indicates a strong statistical association between collaborative, consistent, change-oriented, and quality-focused cultural conditions and the reported ability to identify opportunities, generate ideas, implement programs, and evaluate innovation. The coefficient should not be interpreted as proof that organizational culture is causally more influential than the other predictors.



The fourth hypothesis was statistically supported at the five-percent significance level. Risk-taking had a positive coefficient of 0.184, a T-statistic of 1.969, and a P-value of 0.049 in relation to organizational culture. Because the P-value is close to the 0.05 threshold and the estimated coefficient is modest, this association should be interpreted cautiously. The result is consistent with the possibility that measured experimentation and constructive responses to failure are related to cultural norms of adaptability, learning, and openness, but the cross-sectional design does not establish that risk-taking changes organizational culture.

The fifth hypothesis was not statistically supported. Transformational leadership had a coefficient of 0.110, a T-statistic of 1.126, and a P-value of 0.260 in relation to organizational culture. The positive coefficient indicates the hypothesized direction, but the relationship was not statistically significant in the tested model. Thus, the present data do not provide sufficient evidence of a statistical association between transformational leadership and organizational culture in these five madrasahs. The weak R-square for culture further indicates that much of the variation in organizational culture lies outside the predictors included in the model.

Table 5. Hypothesis Testing Results

Path	β	T	P	Decision
Risk-Taking → Innovation	0.266	3.525	<0.001	Supported
Transformational Leadership → Innovation	0.258	3.582	<0.001	Supported
Organizational Culture → Innovation	0.468	7.005	<0.001	Supported
Risk-Taking → Organizational Culture	0.184	1.969	0.049	Supported
Transformational Leadership → Organizational Culture	0.110	1.126	0.260	Not supported

Source: Primary data processed with SmartPLS 4.0 (2026).

The positive association between risk-taking and innovation indicates that educational renewal in the study context is accompanied by a controlled willingness to move beyond established routines. The strongest risk-taking indicator was resilience and learning from failure, which suggests that respondents particularly recognized the value of learning from unsuccessful trials. This interpretation is consistent with the literature emphasizing experimentation, information use, and resource discipline as conditions under which risk orientation can support innovation. Because the data are cross-sectional, the finding should be understood as an observed association rather than evidence that risk-taking produces innovation.

The positive association between transformational leadership and innovation is consistent with the view that principals' communication of a shared vision, staff



motivation, personal support, ethical modeling, teacher empowerment, and communicative change management are related to innovative practices. The descriptive results show that inspiring and communicating a shared vision was the strongest leadership dimension. This provides a plausible contextual interpretation of the statistical relationship, while the study design does not establish that transformational leadership itself causes innovation.

Organizational culture had the largest estimated path coefficient among the predictors of madrasah innovation in the tested model. This result is consistent with the interpretation that innovation is a collective organizational process: new ideas are more readily sustained when shared norms support their acceptance, refinement, implementation, and evaluation. However, the coefficient magnitude alone should not be treated as a formal ranking of predictor importance, because the analysis reported here does not include comparative effect-size tests or confidence intervals for the differences between coefficients.

The statistically significant association between risk-taking and organizational culture was positive but modest ($\beta = 0.184$; $p = 0.049$). This finding is compatible with the idea that repeated managerial choices under uncertainty can be related to collective expectations about experimentation and learning. Because the significance level is close to the conventional 0.05 threshold, the result warrants cautious interpretation and should be tested again in larger and more diverse samples.

The non-significant association between transformational leadership and organizational culture is an important contextual finding. It indicates that, in this sample, leadership scores were not statistically related to culture scores after accounting for the other specified relationship in the model. A leader may therefore be associated with innovative action without the available cross-sectional evidence demonstrating a corresponding change in deeper organizational norms and routines. The weak R-square for culture reinforces the need to consider additional institutional conditions beyond leadership style.

Overall, the model provides a context-specific account of statistical associations with innovation in Islamic secondary education. Risk-taking and transformational leadership were positively associated with innovation, while organizational culture had the largest estimated path coefficient among the three direct predictors. The model explained 47.2% of the variance in innovation, but only 5.4% of the variance in organizational culture. These results indicate that substantial variation in culture remains unexplained and that the model should not be interpreted as a complete causal account of madrasah innovation. The practical implications are therefore best framed as areas for organizational attention rather than as guaranteed effects of particular interventions.

2. Discussion

Risk-taking and Madrasah Innovation

The positive association between risk-taking and madrasah innovation ($\beta = 0.266$, $t = 3.525$, $p < 0.001$) indicates that innovation in the participating madrasahs is



accompanied by a greater willingness to make decisions under uncertainty. This finding is particularly meaningful in a context where innovation may require schools to allocate limited resources to new teaching methods, digital tools, curriculum adjustments, or institutional programs before their outcomes are fully known. The result therefore supports the conceptualization of risk-taking in this study as calculated rather than reckless risk-taking. The strongest descriptive indicator of risk-taking was resilience and learning from failure (mean = 2.51), whereas risk calculation was the weakest (mean = 2.25). This pattern suggests an important distinction: respondents appeared to recognize the value of persistence after setbacks more strongly than the systematic assessment of risk before a decision is made.

This finding is consistent with the argument that innovation requires organizations to tolerate a degree of uncertainty while maintaining information use, evaluation, and resource discipline (Ruba et al., 2021). It is also compatible with evidence that risk-taking orientation can be related to managerial decision processes when it is combined with transformational leadership and adequate information (Abu Afifa & Nguyen, 2023). In the madrasah context, however, the finding should not be interpreted as support for greater risk exposure in general. Rather, it points to the organizational value of responsible experimentation: piloting a new instructional strategy, testing a digital platform on a limited scale, or introducing a new program with clear monitoring arrangements can create opportunities for learning without treating failure as an acceptable outcome in itself.

The finding also helps explain the initial field condition described in the study, in which innovation was present but uneven and teachers' willingness to experiment depended partly on principal approval. When leaders are willing to authorize carefully bounded experimentation, teachers may perceive change as legitimate and become more willing to identify problems and opportunities. This interpretation is especially relevant because identifying problems and opportunities was the strongest innovation indicator (mean = 2.41). Nevertheless, the cross-sectional design does not establish that risk-taking produces innovation. The observed association may also reflect reciprocal or omitted processes: more innovative madrasahs may develop greater confidence in taking calculated risks, or both characteristics may be supported by an unmeasured institutional factor such as managerial capacity, professional learning, or external support.

Transformational Leadership and Madrasah Innovation

Transformational leadership was positively associated with madrasah innovation ($\beta = 0.258$, $t = 3.582$, $p < 0.001$). The result is consistent with the theoretical proposition that innovation depends not only on ideas but also on leadership that gives those ideas



direction, legitimacy, and motivation. The strongest leadership indicator was inspiring and communicating a shared vision (mean = 2.49), while communicative change management was comparatively weaker (mean = 2.39). This combination is informative: the participating principals appear to communicate a direction for change, but translating that direction into sustained, two-way change communication may remain a challenge.

The finding accords with research indicating that transformational leadership can support curriculum and organizational innovation in Islamic educational settings (Abidin et al., 2025) and with studies linking transformational school leadership to educational quality and change-oriented practice (Gunawan & Cahyani, 2024). It is also consistent with broader innovation research suggesting that transformational leadership can mobilize knowledge, motivation, and innovative performance (Nasir et al., 2022; Harsono et al., 2025). In the present context, the leadership mechanism is plausibly expressed through shared vision, teacher empowerment, individual consideration, ethical modeling, and encouragement to reconsider established practices.

At the same time, the moderate size of the path coefficient and the descriptive results suggest that inspirational leadership alone is insufficient. The study's initial observations indicated that principals showed transformational tendencies but had not always provided broad space for teacher experimentation. This distinction matters for theory and practice. A vision becomes organizationally consequential when it is translated into opportunities for participation, professional development, feedback, resource allocation, and iterative implementation. Thus, the present result is better understood as evidence of an association between transformational leadership and innovation rather than evidence that a leadership style by itself guarantees innovative outcomes.

Organizational Culture and Madrasah Innovation

Organizational culture showed a positive association with madrasah innovation ($\beta = 0.468$, $t = 7.005$, $p < 0.001$), and its estimated path coefficient was the largest among the three direct predictors in the tested model. This result highlights the collective nature of educational innovation. Innovation is not sustained merely because a principal supports change or an individual teacher generates an idea; it requires shared norms that make experimentation, collaboration, implementation, and evaluation part of legitimate organizational work. The descriptive findings reinforce this interpretation. Consistency in implementing rules was the strongest culture indicator (mean = 2.53), followed by collaboration among madrasah members (mean = 2.49), whereas adaptability to change was comparatively weaker (mean = 2.29).



The coexistence of strong rule consistency and weaker adaptability is theoretically important. It suggests that organizational order can provide a foundation for innovation, but order alone does not constitute an innovation-supportive culture. A madrasah needs sufficiently stable routines to coordinate work while also allowing those routines to be questioned and improved. This interpretation is compatible with research emphasizing organizational learning, collaboration, and innovative culture as conditions for sustained innovation (Arias & Morales, 2023; AlSaied & Alkhoraif, 2024). It also supports the view that leadership support becomes more effective when embedded in organizational arrangements that facilitate experimentation and collaboration (Wiroonrath et al., 2024).

The relatively large coefficient should nevertheless be interpreted carefully. It is appropriate to state that organizational culture had the largest estimated coefficient in this model, but not to conclude that it is statistically proven to be more influential than the other predictors because the analysis did not report formal coefficient-difference tests or confidence intervals for comparing paths. In addition, the R-square for madrasah innovation was 0.472, meaning that the three predictors together accounted for 47.2% of the observed variance. The remaining 52.8% indicates that innovation is also related to factors outside the model. Accordingly, organizational culture should be viewed as an important organizational condition rather than as a complete explanation of innovation.

Risk-taking and Organizational Culture

Risk-taking also showed a positive but modest association with organizational culture ($\beta = 0.184$, $t = 1.969$, $p = 0.049$). The finding is statistically supported at the conventional 5% level, but its proximity to the significance threshold and its modest coefficient warrant a cautious interpretation. One plausible explanation is that repeated managerial responses to uncertainty communicate what kinds of behavior are acceptable in the organization. When responsible experimentation is permitted and setbacks are discussed as opportunities for learning, members may gradually develop stronger norms of adaptability, openness, and collective learning. This interpretation is compatible with literature linking risk orientation, organizational learning, and innovation-supportive culture (Iqbal et al., 2021; Alateeg & Alhammadi, 2024).

However, the weak explanatory power for organizational culture is equally important. The R-square of 0.054 indicates that risk-taking and transformational leadership together explained only 5.4% of the variance in culture. Therefore, the observed association between risk-taking and culture should not be treated as evidence that managerial risk-taking is a major determinant of culture in these madrasahs. Long-standing routines, institutional history, participation patterns, communication quality, governance arrangements, religious values, and other unmeasured conditions may



account for much of the remaining variation. The result consequently points to risk-taking as one possible cultural signal rather than a sufficient mechanism for cultural change.

Transformational Leadership and Organizational Culture

In contrast to the relationships above, transformational leadership was not statistically associated with organizational culture ($\beta = 0.110$, $t = 1.126$, $p = 0.260$). This non-significant result is an important finding rather than merely a rejected hypothesis. It indicates that, within the tested model and sample, transformational leadership scores were not sufficiently related to differences in organizational culture. The result may appear inconsistent with the expectation that transformational leaders shape shared values and norms, but it can be understood by distinguishing short- to medium-term leadership influence from the deeper institutional processes through which culture is formed and maintained.

Organizational culture in madrasahs may reflect accumulated routines, institutional history, religious values, seniority patterns, governance structures, and relationships among teachers and administrators. A principal may communicate an inspiring vision without that vision becoming embedded in everyday practices. The descriptive results illustrate this possibility: inspiring and communicating a shared vision was the strongest leadership indicator, while consistency in implementing rules was the strongest culture indicator. The two constructs may therefore operate through different behavioral pathways. Vision and motivation can encourage innovative action relatively quickly, whereas changes in shared norms require repeated reinforcement through procedures, participation, role modeling, professional learning, and institutional incentives.

This interpretation is consistent with research suggesting that culture can function as a mechanism through which leadership becomes organizationally consequential, rather than necessarily being an immediate outcome of leadership (Peña & Caruajulca, 2024; Alshuhumi & Al-Hidabi, 2025). It also helps explain why transformational leadership was significantly associated with innovation while not being significantly associated with culture in the present model. Leadership may influence visible innovative activities through direction, motivation, and support, whereas deeper cultural change may require longer exposure and broader collective participation. Because the present study is cross-sectional, however, this mechanism remains a theoretically plausible interpretation rather than an empirically tested mediation process.



Integrated Interpretation and Theoretical Contribution

Taken together, the findings suggest that madrasah innovation is best understood as an organizational phenomenon involving both leadership action and collective conditions. Risk-taking is associated with the willingness to move beyond established routines; transformational leadership is associated with mobilizing people around change; and organizational culture is strongly associated with whether innovative behavior can be supported and sustained. The non-significant leadership-to-culture path adds an important qualification to this model: leadership and culture should not be assumed to be interchangeable dimensions of organizational change. A principal can be perceived as transformational while the deeper norms and routines of the institution remain relatively stable.

The model also contributes context-specific evidence from five Madrasah Aliyah in Dolok Masihul, where innovation is pursued under conditions of uneven infrastructure, administrative demands, and constrained access to professional development. In such settings, innovation cannot be reduced to technology adoption. It involves identifying problems, generating ideas, obtaining organizational support, implementing changes, and evaluating results while maintaining the Islamic identity of the institution. The findings therefore extend the discussion of educational innovation by showing how risk-taking, transformational leadership, and organizational culture can coexist as distinct organizational conditions rather than as interchangeable concepts.

The practical implication is not that madrasahs should simply increase risk-taking or adopt a particular leadership style. Instead, the findings point toward an organizational configuration in which calculated experimentation is accompanied by clear procedures, collaborative decision-making, consistent communication, and reflective evaluation. Such an approach is particularly relevant because the weakest descriptive indicators included risk calculation, communicative change management, adaptability to change, and innovation implementation. These areas identify where organizational processes may need further development, while the cross-sectional design means that their improvement should be evaluated empirically rather than assumed to produce a predetermined effect.

Limitations Relevant to Interpretation

Several limitations should shape the interpretation of the Discussion. First, the cross-sectional design captures associations at one point in time and cannot establish causal direction. Second, the respondents were teachers nested within only five madrasahs, so the observations should not be treated as independent evidence from 101 separate organizations. Third, the model explained 47.2% of the variance in innovation



but only 5.4% of the variance in organizational culture, indicating substantial unexplained institutional heterogeneity. Fourth, the retained analysis did not report HTMT, VIF, f^2 , Q^2 /PLSpredict, or bootstrap confidence intervals; therefore, claims about discriminant validity, relative effect sizes, predictive relevance, or comparative coefficient differences should not be made beyond the reported evidence. Finally, the measures were obtained through a common teacher questionnaire, so common-method effects cannot be excluded.

CONCLUSION

The study found positive statistical associations of risk-taking, transformational leadership, and organizational culture with madrasah innovation in the five participating Madrasah Aliyah in Dolok Masihul. The three predictors jointly accounted for 47.2% of the variance in innovation. Organizational culture had the largest estimated path coefficient (0.468), followed by risk-taking (0.266) and transformational leadership (0.258). These results indicate that, within the tested model, collective values, work routines, collaboration, openness to change, and commitment to educational quality are strongly related to reported innovation. The findings should be interpreted as associations rather than causal effects because the study used a cross-sectional teacher survey and respondents were nested within five madrasahs.

Risk-taking also showed a positive but modest association with organizational culture, whereas transformational leadership was not statistically associated with culture in the tested model. The difference between the two relationships suggests that motivating or enabling participation in innovation and changing deeper organizational routines may involve different organizational processes. The study's strength lies in integrating risk-taking, transformational leadership, organizational culture, and innovation within one PLS-SEM model in a rural-suburban madrasah context. Its limitations include the low explained variance for organizational culture (5.4%), the cross-sectional design, the concentration of respondents within only five madrasahs, and the absence of several potentially relevant institutional or external determinants.

The findings may inform discussion of organizational development, but they should not be read as evidence that any single intervention will necessarily increase innovation. Principals may consider creating structured opportunities for teachers to propose and test ideas, establishing collaborative learning communities, communicating change consistently, and evaluating pilot programs without punitive responses to responsible failure. Teachers and education staff may be involved in institutional decision-making, while supervisors and government agencies may provide sustained mentoring, digital-capacity development, and innovation-oriented quality assurance. Future studies should



include more madrasahs, consider multilevel designs that account for teachers nested within schools, and examine additional factors such as school climate, digital competence, organizational commitment, change management, academic supervision, and communication quality.

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