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The Role of Technological Innovation in Mediating The Influence of Intellectual Capital on MSMEs Business Performance

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Abstract:

This study aims to examine the role of technological innovation variables in mediating the influence of intellectual capital consisting of 3, namely Human Capital, Structural Capital, and Customer Capital on MSME performance. Using simple random sampling, the number of respondents was 106 consisting of MSME owners, employees, and student business owners from the total population. The data collection technique used an online survey with instruments from previous studies and self-development instruments. The data analysis technique used the PLS-SEM method. The results show that the three structural capital variables have a significant effect on technological innovation and customer capital affects MSME performance. However, the results of the analysis show that technological innovation is not a significant mediator variable between the variables included in Intellectual Capital on MSME performance. This shows that, for the MSME level, the use of technology improves MSME performance but not significantly. The existence of technological innovation, although it strengthens the relationship between Human Capital, Structural Capital, and Customer Capital on MSME performance, does not have a significant impact. Practically, this is possible because the cash flow is not yet high so it can still be handled manually. These results still need to be further developed regarding the role of technology in the MSME sector, especially at the micro level. Further research can test more deeply and can divide into each micro, small and medium cluster.

Keywords: *Human Capital, Intellectual Capital, MSME Performance, Structural Capital, Technological Innovation.*

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1. Introduction

Micro, Small, and Medium Enterprises (MSMEs) in Indonesia play a vital role in the country's economic development, particularly in driving economic growth, reducing unemployment, and contributing to regional development (Agus, 2020). MSMEs significantly contribute to Indonesia's economy by employing 7.9 million workers and accounting for 27% of the GDP (Alqershi et al., 2020; Beltramino et al., 2020). As a primary source of income for many people, MSME performance is crucial for fostering sustainable economic growth. Enhancing MSME performance is essential for their survival, competitiveness, and adaptability to market challenges, helping them avoid stagnation or bankruptcy (Anggraini et al., 2023).

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Performance refers to a business's ability to achieve its established targets. Key Performance Indicators (KPIs) are used to measure performance, providing both quantitative and qualitative metrics aligned with business goals and strategies (Rengganis et al., 2023). In the context of MSMEs, their performance is often evaluated based on criteria such as assets and revenue, as regulated by applicable laws (Syarifah et al., 2020). Improved MSME performance significantly impacts societal well-being, as many individuals rely on MSMEs for their livelihoods. Strong MSME performance is critical to surviving the increasingly competitive business environment.

Several factors influence MSME performance, one of which is human capital. Businesses that achieve high performance typically have reliable human resources with strong work motivation and high commitment to organizational goals. A business's success is often determined by the abilities and quality of its human capital (Atmadja et al., 2021). However, MSMEs often struggle to evaluate their performance effectively, which poses a challenge for business owners who are unsure how to measure their progress (Rohman, Asbari, 2024). The concept of the triple bottom line, encompassing financial, social, and environmental performance, is critical for understanding business sustainability and performance (Novila Sari et al., 2022).

According to the Resource-Based View (RBV) theory, organizations can gain a competitive advantage by effectively utilizing their internal resources, including human, structural, and customer capital, to influence performance (Hasmirati & Akuba, 2022). Human capital adds value to organizations through employee motivation, competence, and effective teamwork. Structural capital, or organizational capital, enables businesses to leverage their human resources to create value through systems, procedures, and routines that streamline operations (Prayogo & Syamsuri, 2023). Meanwhile, customer capital, built on strong relationships with business partners and customers, is also crucial for achieving business success (Septiani & Wuryani, 2020). Technological innovation supports MSME performance by improving productivity and creating a competitive edge (Farina & Opti, 2023).

This study focuses on the impact of Intellectual Capital (Human Capital, Structural Capital, and Customer Capital) on MSME performance, mediated by technological innovation. Using survey data with a 5-point Likert scale, this research aims to provide valuable insights into how technological innovation mediates the relationship between Intellectual Capital and MSME performance. The study will be conducted in the Klaten region, known for its rapid MSME growth. The findings are expected to offer guidance on enhancing MSME performance through the effective utilization of intellectual capital and innovation.

2. Theoretical Background

Resource-Based View (RBV) Theory

The Resource-Based View (RBV) theory emphasizes the importance of unique resources within an organization to create a competitive advantage. According to Ikhsan et al., (2024), resources that are valuable, rare, inimitable, and non-substitutable are key to achieving a competitive edge. In the context of MSMEs, resources such as Human Capital, Structural Capital, and Customer Capital can serve as a foundation for driving technological innovation and improving business performance. This aligns with studies by Muliyanti & Kaukab, (2020) and Halim, (2021), which highlight the critical role of intellectual resources in adding value and enhancing MSME performance amidst intense market competition.

Intellectual Capital

Intellectual Capital is a crucial element in supporting MSME competitiveness. It consists of three main components: Human Capital, Structural Capital, and Customer Capital. Human Capital encompasses the knowledge, skills, and abilities of individuals within an organization that directly influence productivity and innovation. Wahyuni et al., (2021) emphasize the significant role of Human Capital in shaping workforce quality and competitiveness. Structural Capital refers to organizational infrastructure, internal processes, and culture that support efficiency and innovation, as described by (Purnami et al., 2022). Meanwhile, Customer Capital pertains to the relationships between organizations and their customers and the value generated from these relationships. According to Thaib et al., (2022), strong customer relationships can enhance loyalty and strengthen MSME market positioning. A study by Judijanto et al., (2023) indicates that integrating these three components of intellectual capital is essential for building MSME competitiveness through technological innovation.

Technological Capital

Technological innovation is a key factor in enhancing MSME competitiveness in the modern era. Technological Capital includes an organization's ability to adopt information technology, conduct research and development, and leverage technology to improve operational efficiency. Rahmawati et al., (2022) assert that the use of technology by MSMEs can drive local economic growth by increasing efficiency and productivity. Information technology encompasses not only hardware and software but also the ability to transmit and utilize information effectively. This is consistent with findings by Solehudin, (2023), who states that technology adoption can optimize business performance. With the help of technology, MSMEs can manage information more quickly, improve customer service, and create products that meet market needs (Octavia & Sari, 2024).

Conceptual Framework

This study applies the Resource-Based View (RBV) theory to examine the relationship between intellectual capital comprising Human Capital, Structural Capital, and Customer Capital technological innovation, and MSME performance. The conceptual framework is designed to assess how each component of intellectual capital contributes to MSME performance through technological innovation (Firmansyah & Syah, 2021).

Human Capital is measured using indicators such as knowledge, skills, and the abilities of human resources, as discussed by Viviani et al., (2020) and Hasmirati & Akuba (2022). Structural Capital is measured using indicators of organizational infrastructure, systems, and internal processes, based on studies by Purbawangsa et al., (2020) and Rialmi et al., (2021). Customer Capital is evaluated through indicators of customer relationships and loyalty, as indicated by Nurdiyanto, (2020) and Samuel P.D. Anantadjaya et al., (2023). Technological Innovation is measured using indicators such as the adoption of information technology and research and development budgets, aligned with studies by Judijanto et al. (2023) and Satyawati, (2019). MSME performance is measured using the Balanced Scorecard concept, encompassing financial perspectives, customer perspectives, internal business processes, and learning and growth, as explained by Desy Rahmawati et al. (2022). This study supports the view that intellectual capital and technological innovation play a crucial role in enhancing MSME competitiveness and performance.

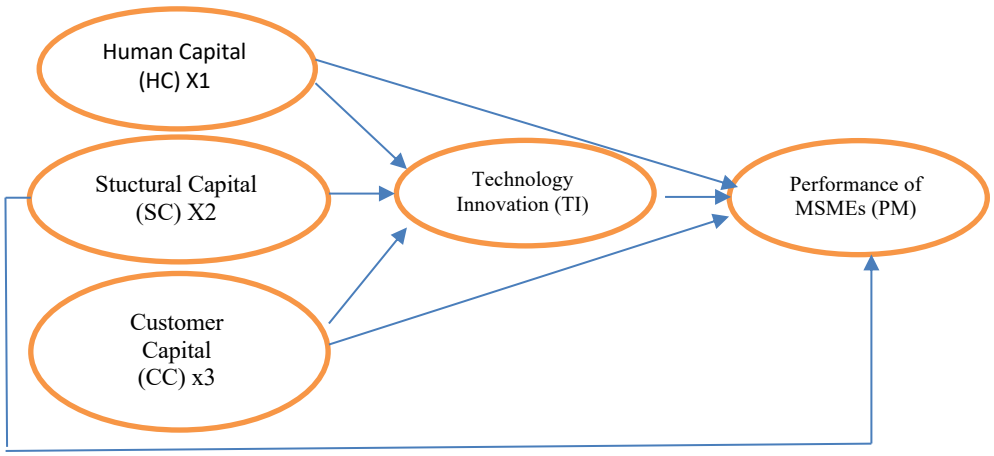

Figure 1. Conceptual framework of Intellectual Capital, Technological Innovation and MSME Performance

3. Methodology

This study employs a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze the relationships between independent variables (X1 = Human Capital, X2 = Structural Capital, X3 = Customer Capital), the mediating variable (Z = Technological Innovation), and the dependent variable (Y = MSME Performance). The research population consists of MSMEs located in the Klaten area, while the sample is selected using purposive sampling with specific criteria, such as MSMEs that have been operating for at least two years and have access to technology. Respondents eligible to complete the questionnaire include business owners, MSME employees, and university students who own MSMEs.

Data collection is carried out through a questionnaire adapted from previous literature, covering questions related to Human Capital, Structural Capital, Customer Capital, Technological Innovation, and MSME Performance. The measurement of variables is conducted using the following indicators: X1 (Human Capital) measures the knowledge, skills, and capabilities of human resources; X2 (Structural Capital) assesses the organization's infrastructure, processes, and culture; X3 (Customer Capital) evaluates relationships with customers and customer value; Z (Technological Innovation) measures the adoption of technology and innovation in business processes; and Y (MSME Performance) assesses revenue growth, productivity, and competitiveness.

Data analysis is performed using PLS-SEM software in two main stages: outer model testing to evaluate the validity and reliability of constructs, and inner model testing to examine hypotheses and relationships between latent variables. Measurement validity is assessed using Outer Loadings and Outer Weights indicators, while reliability is evaluated based on Construct Reliability and Validity. The structural model is then tested by evaluating Path Coefficients, Indirect Effects, and Total Effects to determine the relationships between latent variables. The quality of the model is assessed using several criteria, such as R-Square, f-Square, Model Fit, and Collinearity Statistics (VIF). Residual analysis is also conducted to identify potential bias in the model. Raw data is analyzed in various forms, including original data (Indicator Data (Original)), standardized data (Indicator Data (Standardized)), and correlation data between indicators (Indicator Data (Correlations)). These steps ensure that the resulting model has good

validity, reliability, and fit.

4. Empirical Findings/Result

Respondent Description

Data from a total of 106 respondents was collected from September 27 to November 10, 2024. The majority of respondents were 21 years old (8.4%), and most were female (62.6%). Based on the collected respondent data, calculations were performed using SmartPLS 3 software, with the model based on path analysis.

Path Analysis

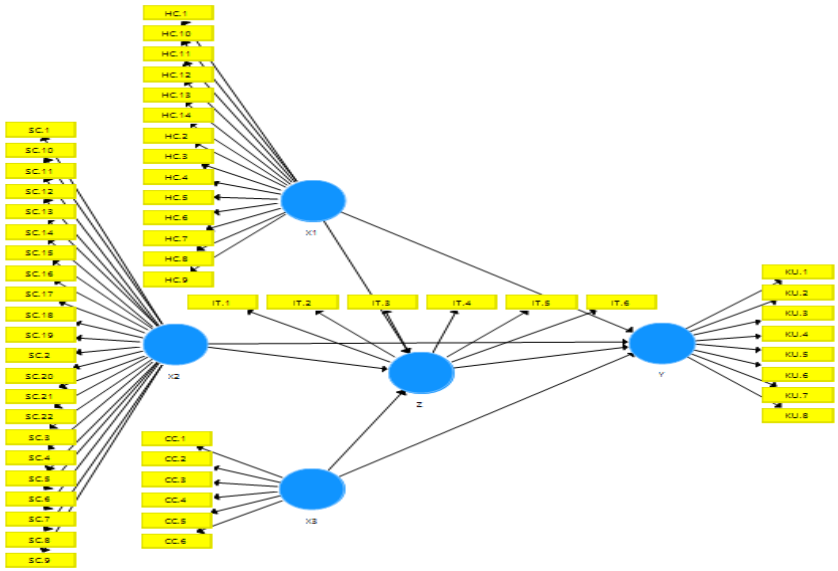

Figure 2. Path Analysis

Measurement Model Evaluation

The measurement model evaluation (outer model) was conducted to assess the validity and reliability of the reflective indicators that form the latent variables. Validity was assessed through convergent validity, discriminant validity, composite reliability, and Cronbach's alpha. Convergent validity was evaluated using the outer loading values of each indicator against the latent variable. Most indicators were found to be valid, with outer loading values between 0.60–0.70, and significant at an alpha level of 0.05 (t-statistic ≥ 1.96). However, some indicators with outer loading below this threshold were considered invalid and removed from the model.

Table 1. Discriminant Validity Test

Variable	(X1)	(X2)	(X3)	(Y)	(Z)
Human Capital (X1)	0.691				
Structural Capital (X2)	0.808	0.693			
Customer Capital (X3)	0.807	0.818	0.847		
MSME Performance (Y)	0.719	0.796	0.765	0.637	
Technological Innovation (Z)	0.686	0.764	0.663	0.688	0.767

Source: Processed Data, (2024)

The table above shows the correlation matrix between the latent variables in the study: Human Capital (X1), Structural Capital (X2), Customer Capital (X3), MSME Performance (Y), and Technological Innovation (Z). The analysis reveals that Human Capital (X1) has the highest correlation with Structural Capital (X2) at 0.808, followed by moderate positive relationships with other variables such as Customer Capital (X3), MSME Performance (Y), and Technological Innovation (Z). Structural Capital (X2) shows a strong relationship with Customer Capital (X3) (0.818), and significant correlations with MSME Performance (Y) (0.796) and Technological Innovation (Z) (0.764). Meanwhile, Customer Capital (X3) has the highest correlation with itself (0.847), and significant relationships with MSME Performance (Y) (0.765) and Technological Innovation (Z) (0.663).

Furthermore, MSME Performance (Y) has a relatively strong relationship with Structural Capital (X2) (0.796) and Customer Capital (X3) (0.765), as well as a significant relationship with Technological Innovation (Z) (0.688), indicating that technological innovation positively influences MSME performance. Technological Innovation (Z) shows the highest correlation with itself (0.767) and has significant relationships with other variables, especially Structural Capital (X2) (0.764) and MSME Performance (Y) (0.688). Overall, the results demonstrate positive relationships between variables, where Structural Capital (X2) and Customer Capital (X3) have a strong influence on MSME Performance (Y), while Technological Innovation (Z) plays an important mediating role in these relationships.

Table 2. Evaluation of Reliability and Construct Validity

Variabel	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Human Capital (X1)	0.909	0.928	0.924	0.477
Structural Capital (X2)	0.946	0.954	0.952	0.480
Customer Capital (X3)	0.921	0.925	0.938	0.718
Kinerja UMKM (Y)	0.800	0.840	0.839	0.406
Inovasi Teknologi (Z)	0.858	0.858	0.895	0.588

Source: Processed Data, (2024)

The table presents the evaluation of reliability and construct validity using four main metrics: Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE). In general, all variables exhibit good internal reliability, with Cronbach's Alpha values above 0.7, with Structural Capital (X2) having the highest value at 0.946, and MSME Performance (Y) having the lowest at 0.800. For the rho_A metric, all variables exceed the minimum threshold of 0.7, indicating measurement consistency across indicators for each construct. Composite Reliability also shows adequate results, with all variables exceeding 0.7, where Structural Capital (X2) has the highest value of 0.952, and MSME Performance (Y) the lowest at 0.839.

However, when looking at the Average Variance Extracted (AVE) values, only Customer Capital (X3) and Technological Innovation (Z) have values above 0.5, indicating good convergent validity. In contrast, variables such as Human Capital (X1), Structural Capital (X2), and MSME Performance (Y) have AVE values below 0.5, suggesting that the proportion of variance explained by the construct for its indicators needs improvement. Overall, while the model demonstrates good reliability, some constructs require enhancement in terms of convergent validity based on the AVE values.

Evaluation of the Structural Model (Inner Model)

The purpose of evaluating the structural model (Inner Model) is to assess how well the model fits the research data, which consists of various variables and their corresponding indicators. This evaluation is carried out using several approaches, one of which is R-Square (R^2). R-Square (R^2) is used to measure the extent to which the dependent variable is influenced by the independent variables and to indicate the strength or weakness of the model itself. According to Syah & Nadira, (2022), an R-Square value of 0.67 is considered a strong model, 0.33 is considered a moderate model, and 0.19 is considered a weak model. In addition to R-Square, other criteria such as f-Square, Model Fit, and Collinearity Statistics (VIF) are also used in evaluating the structural model.

Table 3. R-Square Test Results

Variable	R-Square	Adjusted R-Square
Y (UMKM Performance)	0.685	0.672
Z (Technological Innovation)	0.597	0.586

Source: Processed data, 2024

For UMKM Performance (Y), an R-Square value of 0.685 indicates that the model explains 68.5% of the variance in this variable. The adjusted R-Square of 0.672 suggests that the model still provides a good fit for the independent variables involved. For Technological Innovation (Z), an R-Square of 0.597 indicates that the model explains 59.7% of the variance in this variable. The adjusted R-Square of 0.586 shows that the model fits moderately well

Table 4. F-Square Test Results

Independent Variable	Dependent Variable	F-Square	Interpretation
X1 (Human Capital)	UMKM Performance	0.003	Very Small Effect
X1 (Human Capital)	Technological Innovation	0.023	Small Effect
X2 (Structural Capital)	UMKM Performance	0.100	Small Effect
X2 (Structural Capital)	Technological Innovation	0.231	Medium Effect
X3 (Customer Capital)	UMKM Performance	0.077	Small Effect
X3 (Customer Capital)	Technological Innovation	0.001	Very Small Effect
Technological Innovation	UMKM Performance	0.031	Small Effect

Source: Processed data, 2024

F-Square is used to measure the strength of the effect of independent variables on the dependent variables. The values indicate the strength of these effects, with 0.02 representing a small effect, 0.15 representing a medium effect, and 0.35 representing a large effect. Human Capital (X1) has a very small effect on UMKM Performance (Y) (0.003), but a small effect on Technological Innovation (Z) (0.023). Structural Capital (X2) shows a small effect on UMKM Performance (Y) (0.100) and a medium effect on Technological Innovation (Z) (0.231), indicating that organizational infrastructure and internal processes significantly support innovation. Customer Capital (X3) has a small effect on UMKM Performance (Y) (0.077) and a very small effect on Technological Innovation (Z) (0.001). Technological Innovation (Z) has a small effect on UMKM Performance (Y) (0.031), indicating that technological innovation does impact performance, though not dominantly.

Table 5. Model Fit Evaluation

Metric	Saturated Model	Estimated Model	Explanation
SRMR (Standardized Root Mean Square Residual)	0.096	0.096	Measures the difference between the observed and estimated covariance matrices. Smaller values indicate a better fit.
d_ULS (Squared Euclidean Distance)	14.629	14.629	Measures the squared Euclidean distance between the estimated and actual covariance matrices. Smaller values indicate a better model fit.

d_G (Geodesic Distance)	8.524	8.524	Measures the geodesic distance between the observed and estimated covariance matrices. Like d_ULS, smaller values indicate a better fit.
Chi-Square	3421.322	3421.322	A test statistic for evaluating the overall model fit. Smaller values generally indicate a better fit but are influenced by sample size.
NFI (Normed Fit Index)	0.474	0.474	Assesses the degree of model fit compared to a baseline model. Values closer to 1 indicate a good fit, while lower values suggest otherwise.

Source: Processed data, 2024

The SRMR (Standardized Root Mean Square Residual) value of 0.096 is slightly above the optimal threshold (≤ 0.08), indicating that the model is still acceptable, although not fully aligned with the data. The d_ULS (Unweighted Least Squares discrepancy) and d_G (Geodesic discrepancy) values suggest some model misfit, where lower values are preferred to indicate better fit. Additionally, the high Chi-Square value (3421.322) is common in SEM models, especially when the sample size is very large. However, the NFI (Normed Fit Index) value of 0.474 is far from the ideal value close to 1, indicating that the model's fit is still low. Overall, while the model is minimally acceptable, further improvements are needed to enhance the fit between the model and the data being analyzed.

Table 6. Collinearity Statistics (VIF) Test Results

Variable	Y (UMKM Performance)	Z (Technological Innovation)	Multicollinearity Interpretation
X1	3.624	3.542	No multicollinearity
X2	4.584	3.724	No multicollinearity
X3	3.720	3.717	No multicollinearity
Z	2.484	-	No multicollinearity

Source: Processed data, 2024

The VIF values less than 5 indicate no multicollinearity problems among the variables. All independent variables meet this criterion, meaning they can be used for further analysis without concerns of multicollinearity.

Table 7. Path Analysis Results

Variabel	Human Capital	Structural Capital	Customer Capital	Kinerja UMKM	Inovasi Teknologi
X1				0,062	0,182
X2				0,381	0,588
X3				0,300	0,035
Y					
Z				0,156	

Source: Processed data, 2024

X1 (Human Capital)

Human Capital has a very small effect on MSME Performance (Y) with a path coefficient value of 0.062, but it has a small effect on Technological Innovation (Z) with a value of 0.182. This indicates that Human Capital is more effective in driving technological innovation than in directly improving MSME performance.

X2 (Structural Capital)
Structural Capital shows a moderate effect on MSME Performance (Y) with a path coefficient of 0.381, and a large effect on Technological Innovation (Z) with a value of 0.588. This confirms that organizational structure and internal processes significantly support technological innovation, which ultimately impacts MSME performance.

X3 (Customer Capital)
Customer Capital has a small effect on MSME Performance (Y) with a path coefficient of 0.300, but its effect on Technological Innovation (Z) is very small (0.035). This suggests that relationships with customers have a greater impact on MSME performance than on technological innovation.

Z (Technological Innovation)
Technological Innovation has a small effect on MSME Performance (Y) with a path coefficient of 0.156. This indicates that technological innovation plays an important role, although it is not the sole determining factor of MSME performance.

Table 8. T-Statistic Results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
X1 -> Y	0,062	0,085	0,121	0,515	0,607
X1 -> Z	0,182	0,182	0,116	1,566	0,118
X2 -> Y	0,381	0,371	0,144	2,653	0,008
X2 -> Z	0,588	0,595	0,109	5,398	0,000
X3 -> Y	0,300	0,296	0,124	2,429	0,015
X3 -> Z	0,035	0,036	0,118	0,294	0,769
Z -> Y	0,156	0,152	0,107	1,456	0,146

Source: Processed data, 2024

Human Capital (X1) has an insignificant direct relationship with MSME performance (Y) with a p-value of 0.607. However, its effect on technological innovation (Z) is relatively stronger (p-value 0.118). Human Capital plays a role in influencing technological innovation but has less direct impact on MSME performance. This indicates the importance of developing technological capacity in line with human resources capabilities. This is supported by research Purbawangsa et al. (2020), which suggests that the direct relationship between human capital and company performance is often insignificant without mediating factors such as technological innovation. However, human capital plays a significant role in enhancing the speed and quality of technological innovation.

Structural Capital (X2) shows a significant effect both directly on MSME performance (p-value 0.008) and through technological innovation (p-value 0.000). Structural Capital is a dominant factor that significantly influences both technological innovation and MSME performance. This indicates that structured organizational systems, processes, and culture are the foundation for supporting MSME growth. Research by Beltramino et al. (2020) shows that Structural Capital helps MSMEs by organizing knowledge and processes to accelerate innovation, which in turn enhances their performance.

Customer Capital (X3) has a significant direct effect on MSME performance (p-value 0.015) but is not significant through technological innovation (p-value 0.769). Customer Capital has a greater direct influence on MSME performance than through the mediation of technological

innovation. Strong relationships with customers remain a key asset for MSME success. AlQershi et al. (2020) discuss how Customer Relationship Management (CRM), a key aspect of Customer Capital, has a significant impact on MSME performance. However, this study found that although CRM dimensions such as technology-based CRM and organizational CRM have a positive impact on performance, CRM knowledge management did not show a significant impact. This suggests that the direct effect on performance is more prominent than the effect through technological innovation.

Technological Innovation (Z) does not show a significant relationship with MSME performance (p-value 0.146). The role of technological innovation as a mediator is not significant in this study. This could be due to limited technological mastery or a lack of strategic technology implementation in MSME operations. The study results indicate that while digitalization and technological innovation are important for MSMEs, their direct impact on performance is not always significant. A study on digital transformation in MSMEs revealed the "digitalization paradox," where although MSMEs invest heavily in digital tools, they often do not see the expected performance improvements. This suggests that the adoption of technology alone does not always lead to better business outcomes without proper planning and strategic alignment.

Table 9. Total Indirect Effects

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
X1 -> Y	0.028	0.027	0.027	1.044	0.297
X1 -> Z					
X2 -> Y	0.092	0.092	0.067	1.369	0.172
X2 -> Z					
X3 -> Y	0.005	0.005	0.022	0.241	0.809
X3 -> Z					
Z -> Y					

Source: Processed data, 2024

5. Discussion

The findings of this study indicate that the indirect effects of Human Capital, Structural Capital, and Customer Capital on MSME performance are not statistically significant, highlighting critical gaps in the mechanisms through which intellectual capital influences business outcomes. Human Capital, which encompasses employee knowledge, skills, and competencies, appears to have limited indirect impact on MSME performance. This suggests that while a well-trained and knowledgeable workforce is important, its effect on performance may depend on the presence of other supporting factors, such as organizational structure, culture, or external conditions (Syarifah et al., 2020; Atmadja et al., 2021). Without effective mediating mechanisms, investments in Human Capital might not be fully realized in terms of tangible performance improvements. Similarly, the indirect effect of Structural Capital, which includes processes, systems, and organizational routines, also lacks significance. This finding is consistent with prior research indicating that Structural Capital needs to be strategically aligned with innovation and operational efficiency to enhance its impact (Beltramino et al., 2020; Purnami et al., 2022). While Structural Capital forms the backbone of organizational operations, its indirect influence suggests that it alone is insufficient to drive performance unless integrated with dynamic capabilities such as technological innovation.

In addition, the negligible indirect effect of Customer Capital on MSME performance reflects the limited role of customer relationships and networks when analyzed through indirect

pathways. This finding implies that while strong customer relationships are vital for business sustainability, their contribution to performance requires direct engagement strategies or robust frameworks for customer relationship management (Alqershi et al., 2020; Hasmirati & Akuba, 2022). The results align with the notion that customer-centric approaches need to be complemented with innovative practices and adaptive strategies to yield meaningful performance outcomes. Furthermore, the absence of data on the mediating role of technological innovation in the model highlights a significant gap in understanding how innovation might act as a bridge between intellectual capital components and MSME performance. Numerous studies have emphasized the critical role of technological innovation in enhancing organizational agility and competitive advantage, suggesting that its inclusion in future research could provide a more comprehensive explanation of these relationships (Anggraini et al., 2023; Solehudin, 2023; Judijanto et al., 2023).

The findings also underscore the importance of addressing potential contextual factors that might influence the effectiveness of intellectual capital. For instance, MSMEs often face challenges such as limited financial resources, access to markets, and technological capabilities, which may hinder the translation of intellectual capital into performance improvements (Farina & Opti, 2023; Prayogo & Syamsuri, 2023). In such contexts, direct interventions—such as enhancing digital literacy, promoting collaborative networks, and providing access to funding—may play a pivotal role in amplifying the impact of intellectual capital (Ikhsan et al., 2024; Viviani et al., 2020). Moreover, the insignificant indirect effects observed in this study suggest the need for future research to incorporate additional mediators or moderators, such as innovation strategies, leadership styles, or environmental factors, to better capture the dynamics of intellectual capital utilization in MSMEs (Samuel et al., 2023; Halim, 2021). This approach aligns with the Resource-Based View (RBV) theory, which posits that the strategic integration of resources and capabilities is essential for achieving superior performance (Agus, 2020; Purbawangsa et al., 2020).

Overall, these findings highlight the complexity of leveraging intellectual capital to improve MSME performance. While Human, Structural, and Customer Capital are undoubtedly valuable, their impact on performance requires a deeper understanding of the mechanisms and conditions under which they operate. Future studies should explore more nuanced models that integrate mediating factors like technological innovation, competitive strategies, and market orientation to provide actionable insights for MSMEs. By addressing these gaps, researchers and practitioners can develop more effective strategies to optimize intellectual capital and drive sustainable growth in the MSME sector.

6. Conclusion

The findings of this study reveal that none of the independent variables—Human Capital, Structural Capital, and Customer Capital—demonstrate statistically significant indirect effects on MSME performance within the current model. This indicates that the selected mediators or pathways fail to capture the mechanisms through which these components of intellectual capital influence performance. The results suggest a need to reconsider the conceptual framework and to explore additional mediators or moderators that might better explain the relationship between intellectual capital and MSME performance. Moreover, the absence of data regarding the indirect effects involving Technological Innovation further limits the interpretability of the model, particularly in understanding its potential role as a key mediator. Given the well-documented role of technological innovation in enhancing organizational agility and competitiveness, its omission presents a significant gap in this study.

Future studies should address the limitations of the current model by incorporating Technological Innovation as a mediator to provide a more comprehensive understanding of

how intellectual capital influences MSME performance. Additionally, researchers could examine other potential mediators, such as innovation strategies, organizational agility, leadership styles, or market orientation, to capture the complexity of these relationships more effectively. Studies should also explore contextual factors, such as access to resources, external market conditions, and digital transformation readiness, which may influence the effectiveness of intellectual capital utilization. Longitudinal research designs could provide deeper insights into the dynamic interplay between intellectual capital, mediators, and performance over time. By broadening the scope of analysis and adopting a more integrative approach, future research can help develop more robust models and actionable strategies to optimize MSME performance.

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