

The Impact of Intellectual Capital, Digital Literacy and Digital Transformation on MSME Performance: The Mediating Role of Edupreneurship Innovation in Malang City

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Abstract: Micro and Small Enterprises (MSEs) play a strategic role in the Indonesian economy; however, they continue to face challenges in improving performance and competitiveness in the digital economy era. These challenges are closely related to limitations in intellectual capital management, low levels of digital literacy, and the suboptimal implementation of digital transformation, which weaken business innovation, particularly among Food and Beverage (F&B) sector MSEs in Malang City. From the perspective of educational and educational management, these conditions indicate the need for systematic entrepreneurship education, digital literacy learning, and well-managed training programs to strengthen the competencies and adaptive capacities of MSE actors. This study aims to analyze the influence of intellectual capital, digital literacy, and digital transformation on MSE performance, with Innovation edupreneurship as a mediating variable, based on Dynamic Capability Theory and supported by educational management approaches emphasizing learning processes, knowledge development, and entrepreneurial capacity building. This quantitative research employed an explanatory design with a cross-sectional survey of 373 MSE owners selected from a population of 11,929 F&B MSEs in Malang City. Data were collected through a five-point Likert scale questionnaire and analyzed using Structural Equation Modeling–Partial Least Squares (SEM–PLS) with SmartPLS 4.0. The findings show that intellectual capital significantly improves MSE performance, while digital literacy and digital transformation do not directly affect performance. However, all three variables significantly influence innovation. Innovation edupreneurship also positively affects performance and mediates the relationships between intellectual capital, digital literacy, digital transformation, and MSE performance. These findings highlight the strategic role of educational management through entrepreneurship education, digital literacy programs, and continuous training in strengthening Innovation edupreneurship capacity and improving the sustainable performance of MSEs.

Keywords: *Intellectual Capital, Digital Literacy, Digital Transformation, edupreneurship, MSE Performance*

A. Introduction

Micro and Small Enterprises (MSEs) represent a fundamental pillar of Indonesia's economy, absorbing more than 96% of the national workforce during 2015–2022

(Lestari, 2025). Despite their resilience, MSEs continue to face structural constraints in developing higher-order capabilities related to knowledge integration, digital adaptation, and Innovation edupreneurship (Ayton et al., 2024). While digitalization is widely promoted as a pathway to competitiveness, empirical evidence suggests that many MSEs struggle not merely with technology adoption, but with transforming digital resources into sustainable performance outcomes (Hernández et al., 2024; Raj et al., 2024; State, 2024). This condition indicates that the core issue lies not in technological availability, but in firms' ability to orchestrate and reconfigure strategic resources. Previous studies have extensively examined the mediating role of Innovation edupreneurship between intellectual capital and firm performance. However, much of this research adopts a linear input output logic and treats intellectual capital, digital literacy, and digital transformation as isolated predictors of performance, without explaining the underlying capability-building mechanisms that connect them. Consequently, the theoretical explanation of how digital competencies and knowledge assets are converted into competitive advantage remains underdeveloped, particularly at the micro-enterprise level.

To address this limitation, this study reconceptualizes intellectual capital, digital literacy, and digital transformation as interrelated components of dynamic capabilities while integrating perspectives from educational management and entrepreneurship education. From an educational standpoint, the development of intellectual capital and digital competencies among entrepreneurs is closely associated with structured learning processes, capacity-building initiatives, and entrepreneurship education programs that aim to enhance managerial and technological capabilities of MSE actors. Drawing analytically on Dynamic Capability Theory, this research operationalizes the sensing–seizing–reconfiguring framework to clarify the transformation process within the context of entrepreneurial learning and capability development (Berman, 2012). Digital literacy is conceptualized as a sensing capability that enables firms to recognize technological opportunities and environmental shifts, which can be strengthened through digital literacy education and training programs. Intellectual capital represents the seizing capability, allowing firms to mobilize human, structural, and relational knowledge resources developed through entrepreneurship education, knowledge-sharing activities, and educational management practices that support continuous learning and competence development among entrepreneurs.

Digital transformation reflects reconfiguring capability, whereby firms realign processes, structures, and business models (Mele et al., 2023; Feevale et al., 2025). Within this framework, Innovation edupreneurship is not merely treated as a mediating variable but as the observable manifestation of successful capability orchestration that ultimately enhances firm performance. Although the empirical context focuses on F&B MSEs in Malang City, the primary contribution of this study is conceptual rather than geographical. By integrating intellectual capital and digital transformation within a dynamic capability lens at the micro-enterprise level, this research offers a more analytically grounded explanation of how digital-era resources are converted into performance-enhancing innovation, thereby strengthening theoretical development in small business and digital transformation literature.

B. Methods

This study employs a quantitative approach with an explanatory research design to examine the relationships among intellectual capital, digital literacy, digital transformation, innovation, and MSE performance based on the established theoretical framework (Sekaran, U., & Bougie, 2021). Although the research model is theoretically developed to explain directional relationships among variables, this study uses a cross-sectional survey design in which data were collected at a single point in time. Therefore, the results are interpreted as associative and predictive relationships rather than definitive causal conclusions, as cross-sectional data limit strong causal inference (Creswell, J. W., & Creswell, 2018).

The population of this study consists of all Micro and Small Enterprises (MSEs) in the Food and Beverage (F&B) sector in Malang, totaling 11,929 units based on official data from the Malang City Office of Cooperatives, Industry, and Trade (Diskopindag). The sample size was determined using a sample size calculator with a 95% confidence level and a 5% margin of error, resulting in a minimum requirement of 373 respondents. The study applies purposive sampling, selecting respondents based on specific criteria: they must be owners or managers of MSEs, have operated their businesses for at least two years, and have adopted digital technology in their business activities (e.g., digital marketing, online transactions, or digital bookkeeping). This technique ensures that respondents possess relevant experience related to digital transformation and Innovation edupreneurship processes, which are central to the research objectives.

Primary data were collected through structured online questionnaires using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Because all variables were measured using self-reported instruments, several procedural and statistical remedies were applied to reduce the risk of common method bias (CMB). Procedurally, respondents were assured of anonymity and confidentiality, predictor and criterion variables were separated into different sections of the questionnaire, and item wording was designed to be clear and neutral. Statistically, common method bias was assessed using Harman's single-factor test and full collinearity testing, with variance inflation factor (VIF) values below the recommended threshold of 3.3 indicating that CMB was not a serious concern. Secondary data were obtained from Statistics Indonesia (BPS) and Diskopindag to support contextual understanding, and brief structured interviews were conducted with selected respondents to provide triangulation and enrich interpretation.

Data analysis was conducted in two stages. First, descriptive analysis was used to describe respondent characteristics and the distribution of research variables. Second, inferential analysis was performed using Structural Equation Modeling–Partial Least Squares (SEM–PLS) with SmartPLS version 4.0. The analysis included evaluation of the measurement model (validity and reliability testing) and the structural model (path coefficients, coefficient of determination/ R^2 , effect size/ f^2 , and predictive relevance/ Q^2). Mediation effects were examined using bootstrapping procedures. To enhance the robustness of the findings, multigroup analysis (MGA) was conducted based on firm size (micro versus small enterprises) and length of business operation, and additional robustness checks were performed by comparing alternative model specifications and examining collinearity statistics.

Given the relatively high grand mean (≥ 4.5) observed in several constructs, the study acknowledges the potential presence of social desirability bias. To address this issue, neutral wording and several reverse-coded items were incorporated into the questionnaire, and the distribution of responses, including standard deviation values, was carefully examined to ensure adequate variability. Consequently, the findings are interpreted cautiously, avoiding overgeneralization of highly favorable responses while maintaining consistency with the theoretical framework.

The research model structure is illustrated using solid lines to represent direct effects and dashed lines to indicate indirect effects through innovation.

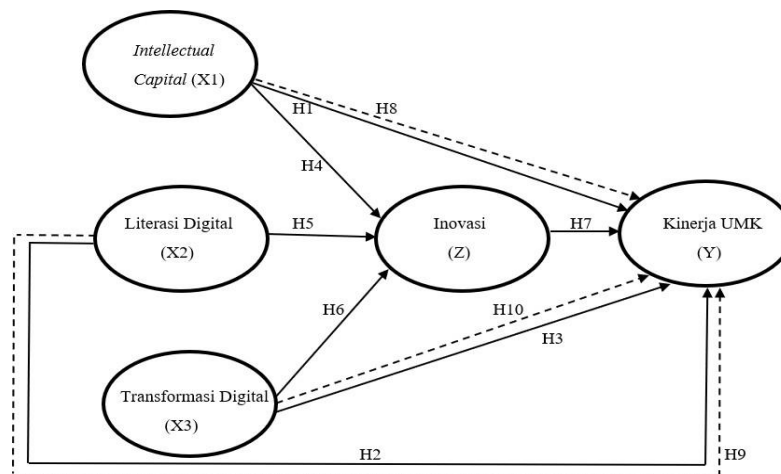


Figure.1 Conceptual Framework
 Source: Processed by the researcher, 2026

C. Results and Discussion

Results

SEM-PLS Analysis Outer Model

In evaluating the outer model, convergent validity is used to assess the consistency of indicators in representing the same construct. An indicator is considered valid when it has a loading factor value ≥ 0.70 or an Average Variance Extracted (AVE) ≥ 0.50 , indicating that the latent variable explains most of the indicator variance. The results of convergent validity testing based on loading factor values are presented in the following table.

Table 1. Loading Factor Results

Variabel	Indicator	Loading Factor	SE	Description
<i>Intellectual Capital</i>	IC1	0.872	0,7	Valid
	IC2	0.842	0,7	Valid
	IC3	0.811	0,7	Valid
Digital Literacy	LD1	0.822	0,7	Valid
	LD2	0.782	0,7	Valid
	LD3	0.844	0,7	Valid
	LD4	0.826	0,7	Valid
Digital	TD1	0.820	0,7	Valid

Transformation	TD2	0.813	0,7	Valid
	TD3	0.793	0,7	Valid
	TD4	0.825	0,7	Valid
	IN1	0.821	0,7	Valid
Innovation edupreneurship	IN2	0.806	0,7	Valid
	IN3	0.818	0,7	Valid
	IN4	0.774	0,7	Valid
	MSME Performance	KU1	0.834	0,7
KU2		0.856	0,7	Valid
KU3		0.865	0,7	Valid

Based on Table 1, all indicators of intellectual capital, digital literacy, digital transformation, innovation, and MSE performance have loading factor values above 0.70, thus meeting the convergent validity criteria. These results indicate that the indicators strongly and consistently represent their respective latent constructs. Therefore, the measurement model (outer model) is considered adequate, enabling accurate analysis of relationships among variables.

The Average Variance Extracted (AVE) values for each construct are presented below.

Table 2. Average Variance Extracted (AVE)

Variabel	AVE	Description
Inovasi	0.709	VALID
Intellectual Capital	0.671	VALID
Digital Literacy	0.661	VALID
Digital Transformation	0.648	VALID
MSME Performance	0.726	VALID

The AVE evaluation results in Table 2 show that all research variables have AVE values greater than 0.50. Intellectual Capital recorded an AVE of 0.709; Digital Literacy 0.671; Digital Transformation 0.661; Innovation edupreneurship 0.648; and MSE Performance 0.726. These findings indicate that each latent construct adequately explains indicator variance, fulfilling convergent validity requirements. Hence, the measurement model is suitable for further structural model testing.

Table 3. Cross Loading Values

Indikator	Inovasi_Z	Intellectual Capital_X1	Kinerja UMK_Y	Digital Literacy_X2	Transformasi Digital_X3
IC1	0.682	0.872	0.689	0.752	0.698
IC2	0.655	0.842	0.622	0.653	0.615
IC3	0.613	0.811	0.646	0.628	0.585
IN1	0.821	0.606	0.625	0.668	0.666
IN2	0.806	0.639	0.664	0.667	0.662
IN3	0.818	0.672	0.632	0.640	0.670
IN4	0.774	0.567	0.574	0.582	0.600
KU1	0.631	0.638	0.834	0.638	0.623
KU2	0.674	0.706	0.856	0.668	0.624
KU3	0.678	0.634	0.865	0.610	0.612
LD1	0.654	0.693	0.658	0.822	0.643
LD2	0.620	0.619	0.590	0.782	0.637

LD3	0.672	0.657	0.621	0.844	0.689
LD4	0.659	0.672	0.587	0.826	0.654
TD1	0.662	0.615	0.598	0.661	0.820
TD2	0.651	0.594	0.548	0.672	0.813
TD3	0.581	0.578	0.565	0.607	0.793
TD4	0.723	0.655	0.648	0.663	0.825

The cross-loading results indicate that each indicator has the highest loading value on its respective construct compared to others. Indicators IC1–IC3 load highest on Intellectual Capital; IN1–IN4 on Innovation; KU1–KU3 on MSE Performance; LD1–LD4 on Digital Literacy; and TD1–TD4 on Digital Transformation. This demonstrates that each indicator adequately discriminates among constructs, fulfilling discriminant validity criteria and confirming that the measurement model is suitable for structural model testing.

Table 4. Composite Reliability and Cronbach’s Alpha

Variabel	Cronbach's alpha	Composite reliability	Keterangan
Inovasi	0.819	0.880	Valid
Intellectual Capital	0.794	0.880	Valid
Digital Literacy	0.836	0.891	Valid
Digital Transformation	0.829	0.886	Valid
MSME Performance	0.811	0.888	Valid

Composite reliability testing in Table 4 evaluates the internal consistency of indicators in reflecting latent constructs. All variables have Composite Reliability and Cronbach’s Alpha values above 0.70, indicating good measurement reliability. Innovation, Intellectual Capital, Digital Literacy, Digital Transformation, and MSE Performance demonstrate strong internal consistency, confirming that all constructs are reliable and suitable for further structural analysis.

Inner Model

The structural model (inner model) is used to analyze causal relationships among latent variables and test the formulated hypotheses. The R-square results are shown below.

Table 5. R-Square Results

Variabel	R-square
Inovasi_Z	0.734
MSME Performance_Y	0.690

The R^2 test measures the explanatory power of exogenous variables on endogenous constructs. Higher R^2 values indicate stronger explanatory power. Table 5 shows that Innovation edupreneurship has an R^2 value of 0.734, meaning Intellectual Capital, Digital Literacy, and Digital Transformation collectively explain 73.4% of Innovation edupreneurship variance. MSE Performance shows an R^2 of 0.690, indicating that Intellectual Capital, Digital Literacy, Digital Transformation, and Innovation edupreneurship explain approximately 69% of performance variance. These values confirm strong explanatory power of the structural model.

Table 6. f-Square Results

Variabel	Inovasi	Intellectual Capital	Kinerja UMK	Digital Literacy	Transformasi Digital
Inovasi_Z			0.089		
Intellectual Capital_X1	0.076		0.107		
MSME Performance_Y					
Digital LiteracyX2	0.072		0.016		
Digital TransformationX3	0.197		0.009		

The f^2 test indicates that Intellectual Capital and Digital Literacy have small effects on Innovation edupreneurship ($f^2 = 0.076$ and 0.072), suggesting supportive roles. In contrast, Digital Transformation has a moderate effect on Innovation edupreneurship ($f^2 = 0.197$), indicating that Innovation edupreneurship in MSEs is primarily driven by business process digitalization and technology integration. Regarding MSE Performance, Innovation edupreneurship and Intellectual Capital show small effects ($f^2 = 0.089$ and 0.107), while Digital Literacy and Digital Transformation also exhibit small effects ($f^2 = 0.016$ and 0.009). These results reinforce innovation's mediating role, particularly in channeling digital transformation impacts into performance improvements through value creation.

Table 7. Q-Square Results

Variabel	Q ² predict
Inovasi	0.728
MSME Performance	0.650

The Q^2 test assesses predictive relevance, where Q^2 values above zero indicate good predictive capability. Innovation edupreneurship records a Q^2 value of 0.728 and MSE Performance 0.650, confirming strong predictive ability of the model. This indicates that integrating intellectual capital, digital literacy, and digital transformation through Innovation edupreneurship effectively predicts MSE Innovation edupreneurship and performance outcomes in the digital era.

Bootstrapping Results

Table 8. Bootstrapping Results

Hiipotesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Keterangan
Edupreneurship Innovation_Z -> MSE Performance_Y	0.322	0.327	0.080	4.020	0.000	Accepted
Intellectual Capital_X1 -> Innovation_Z	0.252	0.252	0.061	4.113	0.000	Accepted
Intellectual Capital_X1 -> MSE Performance_Y	0.335	0.335	0.065	5.187	0.000	Accepted
Digital Literacy_X2 -> Innovation_Z	0.271	0.268	0.074	3.664	0.000	Accepted
Digital Literacy_X2 -> MSE	0.143	0.149	0.093	1.536	0.125	Rejected

Hiipotesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Keterangan
Performance_Y						
Digital Transformation_X3 -> Innovation_Z	0.401	0.405	0.065	6.194	0.000	Accepted
Digital Transformation_X3 -> MSE Performance_Y	0.101	0.091	0.094	1.064	0.287	Rejected
Intellectual Capital_X1 -> Innovation_Z -> MSE Performance_Y	0.081	0.083	0.030	2.682	0.007	Accepted
Digital Literacy_X2 -> Innovation_Z -> MSE Performance_Y	0.087	0.088	0.033	2.676	0.007	Accepted
Digital Transformation_X3 -> Innovation_Z -> MSE Performance_Y	0.129	0.132	0.039	3.306	0.001	Accepted

The structural model testing reveals that Innovation edupreneurship plays a crucial role in improving MSE performance, as business actors capable of generating product, process, and strategic innovations achieve better performance outcomes. Intellectual capital and digital literacy positively influence both Innovation edupreneurship and performance, indicating that knowledge, skills, and digital technology utilization serve as strategic resources for business improvement.

In contrast, digital transformation significantly affects Innovation edupreneurship but does not directly influence performance, suggesting that technology adoption must be accompanied by value-creating Innovation edupreneurship processes. Indirect effect analysis further confirms innovation's significant mediating role between intellectual capital, digital literacy, digital transformation, and MSE performance. These findings demonstrate that performance improvement in the digital era depends not only on resources and technology ownership but also on the ability to integrate them through Innovation edupreneurship to achieve sustainable performance.

Discussion

The findings of this study indicate that performance improvement among Micro and Small Enterprises (MSEs) is primarily driven by intellectual capital and innovation, while digital literacy and digital transformation do not directly enhance performance. Instead, both digital-related capabilities exert their influence indirectly through innovation. This pattern suggests that in the current competitive environment, technology adoption alone is insufficient to generate superior outcomes. What differentiates higher-performing firms is their ability to transform knowledge and digital resources into innovative business practices (Aljuboori et al., 2022).

Intellectual capital emerges as a meaningful predictor of both Innovation edupreneurship and performance (Subramaniam et al., 2005; Rehman, 2026; Dzenopoljac et al., 2022). This confirms that human competence, internal systems, and external networks remain strategic assets for MSEs. In small business settings, where formal structures are often limited, the quality of managerial judgment, employee adaptability, and relational trust

plays a central role in sustaining competitiveness (Anthony, 2025; Smes et al., 2002; Churiyah, M., Sholikhan, et al., 2021). However, the effect size (f^2) indicates that the magnitude of this influence is moderate rather than dominant. This nuance is important. While intellectual capital significantly contributes to performance variation, it does not operate as a single decisive factor. Its value depends on how effectively knowledge resources are mobilized and integrated into daily business practices. In this sense, intellectual capital provides potential advantage, but Innovation entrepreneurship determines whether that potential is realized.

In contrast, digital literacy does not directly influence performance. Although respondents report high levels of digital familiarity, this widespread competence appears to have reduced its differentiating power. When most firms are already capable of using social media, e-commerce platforms, and digital payments, digital literacy becomes a basic operational requirement rather than a strategic advantage. From the perspective of educational management and entrepreneurship education, this condition indicates that basic digital competence alone is insufficient to improve business performance without structured learning processes, managerial training, and entrepreneurial capacity development that encourage the effective use of digital knowledge.

The small and insignificant direct effect, combined with limited response variance, indicates that digital literacy functions as an ordinary capability. This does not mean it is unimportant; rather, it suggests that its contribution is conditional and dependent on how digital competencies are developed through entrepreneurship education programs, digital literacy training, and continuous learning systems managed through educational management practices. The significant relationship between digital literacy and Innovation entrepreneurship demonstrates that digital knowledge becomes economically meaningful only when applied creatively. Firms that use digital tools merely for routine transactions gain limited benefit, whereas those that leverage digital insights for product development, customer engagement strategies, and market experimentation tend to achieve higher levels of innovation. In this context, entrepreneurship education and well-managed training programs play a crucial role in transforming basic digital literacy into innovative capabilities that support sustainable business performance (Leszkiewicz & Kumar, 2020; Zaki, 2026; Aithal, 2023).

The similar explanation applies to digital transformation. The absence of a direct effect on performance suggests that technology integration in MSEs may still be superficial or operationally oriented. Many businesses have adopted digital payment systems, marketplaces, and online promotion channels, yet these tools may be used primarily to maintain market presence rather than to redesign business models. The relatively small effect size reinforces this interpretation: digital transformation contributes incrementally, not dramatically, to performance differences. Therefore, it would be misleading to frame its impact as large. Instead, the findings support the view that digital transformation acts as enabling infrastructure. Without strategic alignment and innovative application, digital adoption remains a support function rather than a competitive weapon.

Innovation, by contrast, shows a consistent and substantive relationship with performance. This confirms its role as the key mechanism that converts intangible and digital resources into measurable economic value. Innovative firms are better able to adjust product offerings, refine processes, improve customer interaction, and respond to environmental uncertainty (Peters & Buijs, 2022; Restuputri, 2026). Importantly,

Innovation edupreneurship in the MSE context is not limited to radical product development; it includes incremental improvements in packaging, service delivery, marketing communication, and operational efficiency. These cumulative adjustments create tangible performance gains. The findings therefore position Innovation edupreneurship not merely as an outcome of capabilities, but as the central dynamic process linking resources to results.

The mediation analysis further clarifies the structural relationships among variables (Richter et al., 2022; Li et al., 2023; Utami et al., 2023). Innovation edupreneurship partially mediates the relationship between intellectual capital and performance, indicating that knowledge resources influence outcomes both directly and indirectly. This suggests that some benefits of intellectual capital such as improved decision-making or operational discipline can enhance performance even without explicit innovation. However, a significant portion of its effect flows through innovative activities, reinforcing the argument that knowledge must be transformed into action.

More notably, Innovation edupreneurship fully mediates the effects of digital literacy and digital transformation on performance. This means digital capabilities do not independently generate economic returns; they produce value only when translated into innovative outputs. The mediation coefficients, although statistically significant, are relatively modest in magnitude. This implies that the impact of digital capabilities on performance is gradual and cumulative rather than immediate. Such findings contribute to the ongoing debate on the “digitalization paradox,” where technology investments do not automatically translate into superior firm outcomes.

Overall, the study refines Dynamic Capability Theory in the MSE context by distinguishing between enabling capabilities (digital literacy and digital transformation) and converting capabilities (innovation). Digital skills and technologies expand opportunity space, but Innovation edupreneurship determines whether opportunities are exploited. Intellectual capital strengthens this process by providing the cognitive and relational foundation necessary for adaptation.

Practical Implications

The practical implications of these findings are more specific than generic recommendations to “adopt more technology.” First, MSE owners should prioritize structured knowledge management and skill upgrading, particularly in areas related to market analysis, customer feedback utilization, and process documentation. Strengthening intellectual capital enhances the firm’s ability to generate and implement innovative ideas.

Second, digital support programs should shift focus from basic literacy training toward innovation-oriented digital application. Rather than teaching only how to operate marketplaces or social media, training initiatives should emphasize digital experimentation, data-driven decision-making, and integration of online feedback into product development. This approach ensures that digital literacy contributes directly to Innovation edupreneurship intensity.

Third, policymakers in Malang should design integrated support schemes that combine digital adoption assistance with mentoring in product Innovation edupreneurship and business model development. Providing digital infrastructure without Innovation edupreneurship guidance risks creating homogeneous technology usage with limited performance differentiation.

In summary, this study demonstrates that performance improvement in MSEs depends less on the mere presence of digital technology and more on the firm's ability to convert knowledge and digital resources into sustained innovation. By clarifying these mechanisms, the research offers both theoretical refinement and targeted strategic direction for MSE development.

D. Conclusions

Based on the research findings, it can be concluded that intellectual capital has a positive and significant effect on the performance of Micro and Small Enterprises (MSEs) in Malang City, while digital literacy and digital transformation do not show a significant direct effect on performance. However, intellectual capital, digital literacy, and digital transformation are proven to have a positive and significant effect on innovation, and Innovation edupreneurship itself has a positive and significant effect on MSE performance. These findings confirm that Innovation edupreneurship acts as the main mediating variable linking intellectual resources and digital capabilities to improved business performance. From the perspective of educational management and entrepreneurship education, these results highlight the importance of systematic learning processes, knowledge development, and capacity-building programs designed to strengthen the competencies of entrepreneurs. Intellectual capital and digital capabilities can be more effectively utilized when supported by well-managed entrepreneurship education, digital literacy training, and continuous professional development programs for MSE actors. Therefore, improvements in MSE performance are not determined solely by the possession of knowledge and technology, but more importantly by the ability of business actors to transform these resources into valuable and sustainable innovations. In this context, educational management plays a strategic role in designing and implementing entrepreneurship education programs that encourage creative thinking, Innovation edupreneurship skills, and adaptive learning, enabling MSE actors to respond effectively to the challenges of the digital economy.

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