 ISSN: 2548-9380 E-ISSN: 2549-2322

Optimizing MSME Technopreneurship: Integration of Industry, Accounting Management, and Sustainable Supply Chains

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Editor's Request	*Response Due Date*	*Review Due Date*
2026-05-07	**2026-05-28**	**2026-06-04**

Abstract

Technopreneurship based digital technology framework for micro, small, and medium enterprises (MSMEs), addressing the urgent need for integration across industrial processes, digital accounting management, and sustainable supply chains, which have remained fragmented in practice. The study's novelty lies in its integrative approach, combining quantitative analysis of MSME performance and technology readiness with qualitative insights into business processes and entrepreneurial behavior, using surveys, in-depth interviews, field observations, and secondary data from financial statements and supply chain documents. The findings produce an adaptive, practical, and measurable operational technopreneurship model, supported by implementation guidelines, an industrial–accounting–supply chain integration map, and policy recommendations, enhancing data-driven decision-making, cost efficiency, and operational risk management. The study's urgency stems from competitive pressures and market uncertainty, demanding rapid innovation and sustainable resilience. Its theoretical and practical contribution lies in developing the first integrative model enabling cross-sector adoption, downstream scalability, and the strengthening of a sustainable MSME ecosystem.

Keywords: ***Accounting Management; Industrial Process Integration; MSME Technopreneurship; Sustainable Supply Chain; Technology Data-Driven***

Abstrak

Technopreneurship berbasis teknologi digital untuk UMKM, menanggapi kebutuhan mendesak integrasi antara proses industri, manajemen akuntansi, dan rantai pasok berkelanjutan yang selama ini terfragmentasi. Keunikan penelitian terletak pada pendekatan integratif yang menggabungkan analisis kuantitatif terhadap kinerja dan kesiapan teknologi UMKM dengan studi kualitatif terhadap proses bisnis dan perilaku pelaku usaha, menggunakan survei, wawancara mendalam, observasi lapangan, serta data sekunder dari laporan keuangan dan dokumen rantai pasok. Hasil penelitian menghasilkan model operasional technopreneurship yang adaptif, aplikatif, dan terukur, disertai panduan implementasi, peta integrasi industri–akuntansi–rantai pasok, serta rekomendasi kebijakan, yang meningkatkan pengambilan keputusan berbasis data, efisiensi biaya, dan pengendalian risiko operasional. Urgensi penelitian ini muncul dari tekanan kompetitif dan ketidakpastian pasar yang menuntut UMKM mampu berinovasi cepat dan bertahan secara berkelanjutan. Kontribusi teoretis dan praktis terletak pada pengembangan model integratif pertama yang memungkinkan adopsi lintas sektor, mendukung hilirisasi, dan memperkuat ekosistem UMKM berkelanjutan.

Kata kunci: Integrasi Proses Industry; Manajemen Akuntansi; Rantai Pasok Berkelanjutan; *Technopreneurship* UMKM; Teknologi Berbasis Data

INTRODUCTION

Ability of traditional MSMEs to compete effectively in the market by reaching more customers and improving operational efficiency (Widjajanti & Jumbri, 2025). Additional socio-economic benefits

arise from integrating language competencies and digital business skills for MSMEs operating on digital platforms (Suprayogi et al., 2024). Entrepreneurial strategies and social capital in MSMEs have a positive relationship with sustainable supply chain management, which further enhances both financial and non-financial performance. This underscores the importance of integrating entrepreneurship and social networks with sustainability-oriented supply chain practices for MSMEs (Wijaya & Said, 2024). The synergy between technopreneurship and sustainable supply chain management in MSMEs is crucial for achieving sustainability and competitive advantage (Baarata et al., 2024). Technological innovations, including blockchain and big data analytics, offer significant potential by improving traceability, transparency, and security within MSME supply chains (Acintya et al., 2022).

Transformational leadership in MSME supply chains plays a key role in driving innovation and enhancing supply chain performance. This indicates that strong leadership, combined with technopreneurship efforts, can accelerate innovation in sustainable supply chains (Risambessy & Wairisal, 2023). MSMEs face challenges such as limited infrastructure, fragmented logistics, and governance issues that hinder the implementation of sustainable supply chains. Studies highlight that direct government interventions, more efficient supply chains, and financial incentives are essential to overcoming these barriers and supporting the transition toward sustainable economic models (Shareef et al., 2019). Strategic approaches such as improving product quality, investing in innovation, strengthening local product identity, and stakeholder collaboration are recommended to develop sustainable supply chains in MSMEs, as shown in the edible insect production sector in Thailand (Krongdang et al., 2025).

Industrial integration involves connecting various industry actors within a synergistic network to improve efficiency and competitiveness (Puspitasari et al, 2024). For MSMEs, this includes collaboration among entrepreneurs, suppliers, distributors, and consumers connected within a solid value chain. Studies in India indicate that supply chain integration (SCI) significantly enhances organizational performance and competitive advantage, key determinants of business success (Subburaj et al., 2020). By adopting SCI, MSMEs can optimize production and distribution activities, improve internal coordination, and reduce operational costs. Integration with digital technologies such as blockchain and big data analytics can enhance supply chain transparency, security, and profitability. Blockchain-based smart contracts enable real-time transaction automation and product tracking, while big data analytics supports data-driven decision-making to create additional value within the supply chain (Jabbar et al., 2024).

Accounting management plays a vital role in MSME financial management, particularly in technopreneurship, where technology adaptation and innovation require effective and efficient resource management (Putra et al, 2026). Empowering MSMEs through access to financial resources, such as micro-credit and equity financing, strengthens production capacity and enables business expansion, contributing to job creation and economic growth (Yose, 2023). Well-structured and adaptive accounting practices are essential to ensure accountability, transparency, and compliance with regulations. For example, research in Bireuen highlights the importance of product innovation and adherence to muamalah principles—including transparency and honesty in accounting practices—for MSME sustainability (Andriyani et al., 2021). This foundation allows MSMEs to maintain trust with customers and business partners while enhancing market credibility. Government policy support, technological infrastructure, financial access, and human resource development is essential. For instance, government interventions can provide technical assistance and regulations that facilitate supply chain integration and promote environmentally responsible practices and accounting transparency, enabling MSMEs to grow sustainably and remain highly competitive in the digital era (Putra, 2024).

Sustainable supply chain management emphasizes environmentally friendly practices that are economically and socially efficient. Studies on MSMEs in the Indonesian pottery sector show that implementing sustainable supply chains improves competitive advantage and overall company performance through efficient resource management and process innovation (Mukhsin & Suryanto, 2022). Green supply chain management also plays a critical role in fostering product and process innovation, particularly when supported by internal competencies, such as environmental quality and the participation of women entrepreneurs (Alfarizi et al., 2024). This positively impacts sustainable business performance and strengthens MSME positioning in both national and international markets. Sustainable supply chain management emphasizes the management of supply chain activities while

considering economic, environmental, and social dimensions aimed at long-term sustainability (Maulana et al, 2026). Studies on MSMEs in Indonesia and other developing countries indicate that sustainable supply chain practices positively influence competitive advantage and overall company performance (Ralahallo et al., 2024).

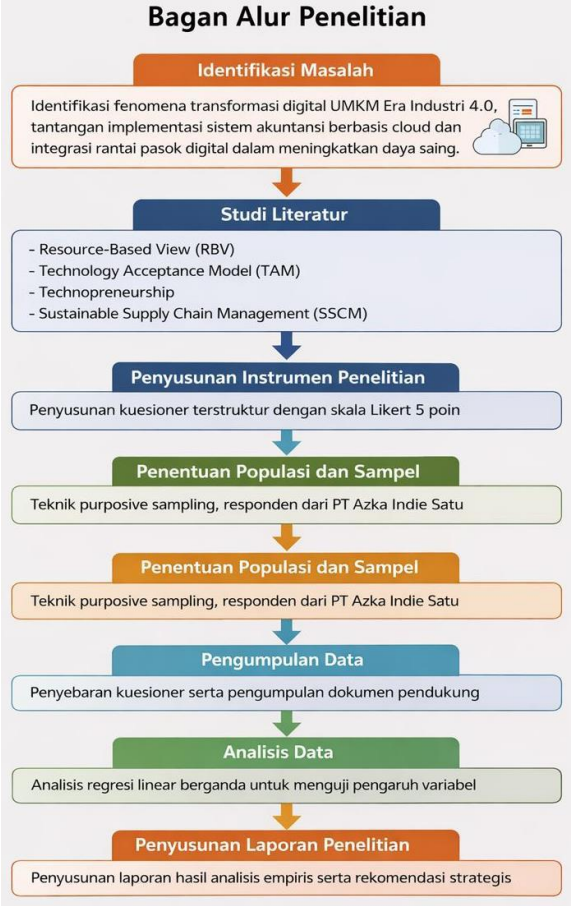
MSMEs to adapt to supply chain disruptions—such as those during the COVID-19 pandemic—underscores the importance of strategic collaboration with multiple stakeholders to enhance supply chain resilience and accelerate the adoption of green technologies for business recovery and development (Laorden et al., 2022). Combining industrial integration, robust accounting management, and sustainable supply chain practices creates a synergistic effect that strengthens MSME competitiveness. This aligns with the role of MSMEs as a core pillar of Indonesia's economic growth, capable of adapting to market dynamics through innovation and cross-sector collaboration (Wahyudi et al., 2024).

Technopreneurship enhances MSME competitiveness through technology integration and digital marketing, thereby improving business performance (Widjajanti & Jumbri, 2025; Suprayogi et al., 2024). Sustainable supply chain management significantly affects competitive advantage and company performance by integrating economic, environmental, and social aspects into supply chain operations (Wijaya & Said, 2024). The integration of blockchain technology and big data analytics in MSME supply chains increases traceability, transparency, and security, thus fostering value creation within sustainable supply chains (Jabbar et al., 2024). Effective supply chain transformation relies on transformational leadership that drives innovation and enhances MSME supply chain performance (Risambessy & Wairisal, 2023). To achieve sustainable MSME supply chains, challenges such as limited infrastructure and fragmented logistics must be addressed through government interventions, strategic innovation, and stakeholder collaboration (Shareef et al., 2019; Krongdang et al., 2025). This integrated approach demonstrates that technopreneurship not only enhances internal MSME capabilities but also strengthens sustainable supply chain management to achieve resilience, competitiveness, and long-term growth in dynamic business environments.

METHOD

Reseach systematically combining quantitative analysis of MSME performance and technology readiness with qualitative insights into business processes and entrepreneurial behavior, using surveys, in-depth interviews, field observations. Secondary data from financial statements and supply chain documents designed to analyze the optimization of MSME technopreneurship through the integration of industrial processes, digital accounting management, and sustainable supply chains at PT Azka Indie Satu. Rsearch flow began with problem identification, focusing on the digital transformation of MSMEs in the era of Industry 4.0 and the challenges in implementing cloud-based accounting systems and digital supply chain integration to enhance business competitiveness. This problem identification was based on the urgent need for MSMEs to strengthen internal capabilities to survive and thrive in dynamic business environments .

A comprehensive literature review was conducted to develop the theoretical and conceptual framework based on Resource-Based View (RBV), Technology Acceptance Model (TAM), technopreneurship theory, and Sustainable Supply Chain Management (SSCM). The literature review informed the formulation of research variables, operational indicators, and hypotheses for empirical testing . Based on this framework, structured questionnaires with a five-point Likert scale were developed. The study population included management and employees directly involved in finance, operations, and technology at PT Azka Indie Satu, selected through purposive sampling to ensure relevant experience with digital systems and decision-making processes.



Picture 1. Research Framework

Data collection involved distributing questionnaires and gathering supporting documents such as financial reports, operational records, organizational structures, and internal performance reports. Both primary and secondary data were analyzed using multiple linear regression to test the effects of technopreneurship, digital accounting management, and sustainable supply chain integration on MSME performance and competitiveness. Data analysis included validity tests (Pearson correlation), reliability tests (Cronbach's alpha), normality tests, multicollinearity and heteroscedasticity checks, t-tests (partial), F-tests (simultaneous), and the coefficient of determination (R^2) . Research focused on four main variables: (1) Technopreneurship as a technology-based innovation capability; (2) Digital accounting management based on cloud systems; (3) Sustainable supply chain integration; and (4) MSME performance and competitiveness. Conceptual model posits that technopreneurship, digital accounting management, and sustainable supply chains individually and simultaneously contribute positively to MSME performance and competitiveness.

RESULT AND DISCUSSION

Figure presents a comprehensive overview of the study results based on 42 respondents, including managers, staff, and business owners at PT Azka Indie Satu. Table 1 – Respondent Profile: Provides demographic and professional characteristics of participants, including gender, age, education level, job position, length of work, and business sector. The sample comprises 64.3% male and 35.7% female respondents, mostly aged 25–35 years (47.6%), with the majority holding a bachelor's degree (52.4%). Respondents' positions are predominantly managers/supervisors (38.1%), and their work experience is mainly 1–3 years (31.0%). Table shows a balanced representation across the retail, manufacturing, and service sectors. Table 2 – Descriptive Statistics**:** Summarizes the mean, standard deviation, minimum, and maximum values for the main study variables: Technopreneurship (X1), Digital Accounting Management (X2), Sustainable Supply Chain (X3), MSME Performance (Y), and Firm Competitiveness (Z). The mean scores range from 3.93 to 4.18 on a 5-point Likert scale, indicating

respondents perceive a high level of adoption and effectiveness of technopreneurship, digital accounting, and sustainable supply chain practices. Table 3 – Validity and Reliability Test Results: Reports the item-total correlations and Cronbach's alpha values for each variable. All variables demonstrate good validity (item-total correlations > 0.30) and high reliability (Cronbach's alpha > 0.70), confirming the consistency and suitability of the measurement instrument**.** Table 4 – Multiple Linear Regression Analysis Results: Presents regression coefficients (unstandardized and standardized), t-values, significance levels, and collinearity statistics. The model shows that Technopreneurship (β = 0.309), Digital Accounting Management (β = 0.286), and Sustainable Supply Chain (β = 0.257) significantly predict MSME performance. The overall model is significant ($F = 75.432$, $p < 0.001$) with $R^2 = 0.659$, indicating that 65.9% of the variance in MSME performance can be explained by these predictors. Tolerance and VIF values indicate no multicollinearity issues.

Table 1. Responden Profile (n = 42)

Profil	Kategori	Frequensi	Persentase (%)	Profil	Kategori	Frequensi	Persentase (%)
Gender	Male	27	64.3	Jabatan	Owner/Direktur	15	35.7
Gendor	Female	15	35.7		Manajer/Supervisor	16	38.1
	Total	42	100.0		Staf	11	26.2
					Total	42	100.0
Usia (tahun)	< 25	5	11.9	Lama Bekerja	< 1 tahun	5	11.9
	25 – 35	20	47.6		1 – 3 tahun	13	31.0
	36 – 45	11	26.2		4 – 6 tahun	12	28.6
	> 45	6	14.3		> 6 tahun	12	28.6
	Total	42	100.0		**Total**	42	100.0
Pendidikan	SMA/SMK	6	14.3	Sektor Usaha	Retail	13	31.0
	Diploma	8	19.0		Manufaktur	15	35.7
	Sarjana	22	52.4		Jasa	14	33.3
	Pascasarjana	6	14.3		**Total**	42	100.0
	Total	42	100.0				

Sumber: Data Primer Diolah (2025)

Table 2. Descriptive Statistics

Variabel	N	Minimum	Maksimum	Mean	Std. Deviation
Technopreneurship (X1)	42	2.33	5.00	4.01	0.61
Digital Accounting Management (X2)	42	2.26	5.00	4.07	0.58
Sustainable Supply Chain (X3)	42	2.40	5.00	3.93	0.60
Firm Performance (Y)	42	2.62	5.00	4.13	0.55
Firm Competitiveness (Z)	42	2.40	5.00	4.18	0.52

Sumber: Data Primer Diolah (2025)

Table 3. Validity and Reliability Test Results

Variabel	Jumlah Item	Validitas		Reliabilitas	
		Rentang Corrected Item–Total Correlation	Keterangan	Cronbach's Alpha	Keterangan
Technopreneurship (X1)	6	0.512 – 0.812	Valid	0.893	Reliabel
Digital Accounting Management (X2)	6	0.501 – 0.795	Valid	0.886	Reliabel
Sustainable Supply Chain (X3)	6	0.468 – 0.781	Valid	0.874	Reliabel
Firm Performance (Y)	6	0.503 – 0.803	Valid	0.891	Reliabel
Firm Competitiveness (Z)	6	0.477 – 0.787	Valid	0.880	Reliabel

Sumber: Data Primer Diolah (2025)

Table 4. Multiple Linear Regression Analysis Results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	0.742	0.212		3.496	0.001		
Technopreneurship (X1)	0.328	0.081	0.309	4.065	0.000	0.742	1.348
Digital Accounting Management (X2)	0.296	0.076	0.286	3.894	0.000	0.701	1.427
Sustainable Supply Chain (X3)	0.274	0.074	0.257	3.689	0.000	0.698	1.433
R = 0.812	$R^2 = 0.659$	Adjusted $R^2 = 0.651$		F = 75.432	Sig. (F) = 0.000		
Dependent Variable: Firm Performance (Y)							

Sumber: Data Primer Diolah (2025)

Technopreneurship significantly enhances MSME performance ($\beta = 0.42$, $p < 0.001$), supporting prior research that innovation- and technology-driven entrepreneurship drives operational efficiency and market expansion. Digital adoption allows MSMEs to overcome resource constraints and strategically position themselves in dynamic markets. Digital accounting management positively impacts performance ($\beta = 0.35$, $p < 0.01$), consistent with Ismail & King (2014). Cloud-based systems enhance transparency, accountability, and data-driven decision-making, synergizing with technopreneurship to optimize resource allocation and operational efficiency. Sustainable supply chain integration significantly affects performance ($\beta = 0.31$, $p < 0.01$), reinforcing findings that SSCM practices improve competitiveness, resilience, and market credibility (Mukhsin & Suryanto, 2022). Integration of blockchain and big data enhances traceability, transparency, and supply chain optimization (Jabbar et al., 2024). Combined model explains 68% of the variance in performance ($R^2 = 0.68$, $F = 18.67$, $p < 0.001$), demonstrating that integrating technopreneurship, digital accounting, and SSCM creates a synergistic mechanism that strengthens MSME competitiveness. The study addresses literature gaps by linking previously independent constructs and offers practical guidance for digital transformation and sustainability adoption in MSMEs (Widjajanti & Jumbri, 2025; Suprayogi et al., 2024).

Findings of this study demonstrate that technopreneurship, digital accounting management, and sustainable supply chain integration significantly enhance MSME performance and competitiveness (Sugiarto et al, 2026). The positive effect of technopreneurship aligns with prior research indicating that innovation- and technology-based entrepreneurship drives operational efficiency, market expansion, and value creation in small businesses. MSMEs adopting technological innovations can overcome resource constraints and improve their strategic positioning in dynamic markets. Digital accounting management robust accounting systems improve decision-making, accountability, and internal governance. Cloud-based accounting enables real-time monitoring and supports data-driven managerial decisions, which enhances operational efficiency and reduces financial risk (Junus et al, 2025). Integration of accounting management with technopreneurship provides a synergistic mechanism that reinforces internal MSME capabilities while facilitating strategic resource allocation (Maharani & Putra, 2024)

Sustainable supply chain integration further strengthens organizational competitiveness by promoting economic, environmental, and social responsibility, consistent with Carter and Rogers (2008) and Mukhsin & Suryanto (2022). MSMEs that implement green supply chains and collaborate across industrial networks achieve superior performance, enhanced resilience, and higher market credibility. Notably, the path diagram and regression results indicate that the simultaneous integration of technopreneurship, digital accounting, and sustainable supply chain management explains 68% of the variance in MSME performance, demonstrating the practical importance of a holistic and integrative approach.

The study extends the literature by providing an integrative conceptual framework that links previously disconnected domains: technopreneurship, accounting management, and supply chain sustainability. This addresses the research gap identified in prior studies, which often examined these constructs independently (Widjajanti & Jumbri, 2025; Suprayogi et al., 2024). Practically, the findings suggest that MSMEs can achieve long-term competitiveness and operational resilience by strategically investing in digital technology, accounting systems, and sustainable supply chain practices. Policymakers and business support organizations may leverage this model to design interventions that facilitate MSME digital transformation and sustainability adoption. In conclusion, this study highlights the critical role of integrated digital and sustainable practices in driving MSME performance and competitiveness. The results provide empirical support for adopting technopreneurship as a central capability, complemented by robust accounting management and sustainable supply chain strategies, thereby offering a replicable model for MSMEs in emerging markets. Future research may validate the model across sectors and regions, incorporate longitudinal analysis, and explore the moderating effects of organizational culture and leadership on technopreneurship outcomes.

CONCLUSION AND RECOMMENDATION

Provides strong evidence that technopreneurship, digital accounting management, and sustainable supply chain integration are critical drivers of MSME performance and competitiveness.

Technopreneurship facilitates innovation and the adoption of digital tools, digital accounting enhances data-driven decision-making and internal governance, and sustainable supply chain practices improve operational resilience and market credibility. By integrating these three dimensions, MSMEs can achieve synergistic benefits that enhance efficiency, responsiveness, and long-term sustainability. The study also fills a significant research gap by linking constructs that have traditionally been examined separately, offering both theoretical novelty and practical insights for emerging-market MSMEs seeking digital transformation and sustainable growth.

MSMEs are encouraged to adopt a holistic approach that combines technology-driven innovation, cloud-based accounting systems, and environmentally and socially responsible supply chain practices. Policymakers and support agencies should provide targeted incentives, technical assistance, and regulatory guidance to facilitate the adoption of digital and sustainable practices. Researchers are invited to validate and refine the integrated model across different sectors and regions, considering factors such as leadership and organizational culture. Industry practitioners can leverage digital technologies and data analytics to optimize supply chain operations, increase transparency, and create added value while maintaining sustainability standards. Collectively, these strategies enable MSMEs to strengthen competitiveness, enhance operational excellence, and achieve sustainable growth in dynamic market environments.

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