

Accelerating Economic Value in Developing Regions: A Meta Synthesis of AI Adoption in Indonesian SMES and Implications for North Sulawesi's Digital Ecosystem

Stefen R. A. Taroreh^{1*}, Makhfudi¹, Wahyuningsih¹, Irfan H. Wasilu¹

¹Faculty of Law and Business, Muhammadiyah University of Manado, Indonesia

*Corresponding author: stefen.taroreh@gmail.com

ABSTRACT

The integration of Artificial Intelligence (AI) into Small and Medium Enterprises (SMEs) offers a pathway to economic acceleration, yet a significant "digital divide" persists in developing archipelagic regions. This study aims to bridge the gap between foundational digitization and advanced AI-driven value creation by constructing a strategic roadmap specifically for the North Sulawesi digital ecosystem. The research employs a qualitative meta-synthesis design, systematically analyzing 22 peer-reviewed empirical studies published between 2021 and 2025. Data were extracted from high-quality national journals (SINTA-indexed) and synthesized using the Technology-Organization-Environment (TOE) framework to map technological patterns, organizational capabilities, and environmental pressures. The synthesis reveals a critical "adoption dichotomy" within the Indonesian landscape. While national-level data indicate a shift toward predictive analytics and automation, North Sulawesi's SMEs remain situated in the "onboarding" phase, characterized by reliance on transactional tools (QRIS) and static social media profiling. The analysis identifies organizational readiness—specifically human capital and digital literacy—as the primary mediator determining whether technological adoption translates into measurable business performance. Furthermore, existing policy frameworks focused solely on infrastructure are deemed insufficient for advanced AI integration. To accelerate economic value, regional stakeholders must pivot from a provider-centric model to an enabler-centric approach. The study proposes a holistic framework that prioritizes subsidized digital upskilling and the establishment of regional regulatory sandboxes. These interventions are essential to mitigate resource constraints and facilitate the transition from simple digitization to intelligent economic resilience in developing regions.

Keywords: AI Adoption, SME Digitalization, Meta-Synthesis, TOE Framework, North Sulawesi, Economic Acceleration.

1. INTRODUCTION

The global economic landscape is undergoing a profound transformation driven by the Fourth Industrial Revolution, where Artificial Intelligence (AI) has emerged not merely as a technological novelty but as a critical driver of value creation. In the context of developing economies, the integration of AI into Small and Medium Enterprises (SMEs) offers a pathway to leapfrog traditional development hurdles, enhancing operational efficiency and market reach. However, while the potential of AI is well documented in developed urban centers, its translation into the specific, archipelagic context of Indonesia's regional economies remains complex. The "digital divide" continues to pose significant challenges, particularly in regions outside of Java, where infrastructure and human capital disparities create unique barriers to high level technology adoption.

In North Sulawesi, a strategic economic hub in Eastern Indonesia, the digital transition of SMEs is currently at a pivotal juncture. Recent empirical studies indicate a growing, albeit fragmented, adoption of basic digital technologies. Research by Munaiseche et al. (2025) highlights that while SMEs in North Sulawesi are increasingly utilizing digital marketing platforms to enhance competitiveness, they remain heavily reliant on basic social media tools rather than data driven decision making systems. Furthermore, the ecosystem is slowly maturing with the introduction of financial technologies; Saputro et al. (2025) found that the implementation of digital payment systems in Manado has begun to improve business efficiency, although financial literacy remains a moderating constraint. Similarly, Paendong et

al. (2023) observed that while digital administration and product profiling are being adopted in local vocational contexts, the depth of this adoption rarely extends to automated or intelligent processes.

Despite these advancements, a critical gap exists in the current body of literature regarding the depth of technological adoption. Recent research by Lintang et al. (2025) on SMEs in Manado focuses primarily on the economic impact of digital payment systems (QRIS). This indicates that the prevailing academic discourse in the region remains centered on the foundational stages of digitalization, specifically transaction efficiency and financial inclusion—rather than the integration of advanced intelligent systems or predictive analytics. There is a scarcity of comprehensive studies that synthesize how these foundational digital steps can evolve into advanced AI adoption. The current discourse lacks a unified framework that explains how North Sulawesi's SMEs can transition from simple "digitization" (converting analog to digital) to "AI driven value creation" (using algorithms for prediction and automation). Furthermore, most studies, such as those by Tumbelaka et al. (2025) and Paendong et al. (2023), treat technology adoption as isolated events rather than part of a holistic regional ecosystem.

Therefore, this study aims to bridge this gap by conducting a qualitative meta synthesis of existing evidence on AI and technology adoption within Indonesian SMEs, with a specific lens on the North Sulawesi context. By synthesizing fragmented findings from 2021 to 2025, this research seeks to construct a robust conceptual framework that accelerates economic value. Unlike traditional literature reviews, this meta synthesis integrates the technological, organizational, and environmental (TOE) factors to propose a strategic roadmap for North Sulawesi's digital ecosystem, moving the academic and practical discourse beyond basic adoption toward intelligent economic acceleration.

2. METHODOLOGY

2.1. Research Design

To address the fragmented nature of digital adoption literature in developing regions, this study employs a qualitative meta synthesis design. Unlike a traditional narrative review, a meta synthesis systematically integrates findings from multiple qualitative studies to create a new, interpretive level of understanding (Noblit & Hare, 1988). This approach is particularly suitable for this research as it allows for the aggregation of localized empirical evidence specifically from Indonesian SMEs to construct a comprehensive framework applicable to the North Sulawesi digital ecosystem.

2.2. Data Sources and Search Strategy

The systematic literature search was conducted using the SINTA (Science and Technology Index) database, the official citation index managed by the Indonesian Ministry of Education, Culture, Research, and Technology. SINTA was selected to ensure the capture of context specific research often overlooked by global databases. The search protocol followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyses) guidelines (Page et al., 2021). The search strings were designed to capture the intersection of three domains: Artificial Intelligence/Digital Technology, SMEs, and Regional Context.

2.3. Inclusion and Exclusion Criteria

To ensure the validity and robustness of the synthesis, strict eligibility criteria were applied. The selection process prioritized high quality national publications to guarantee that the synthesized data reflects peer reviewed rigor.

Inclusion Criteria:

- Timeframe: Articles published between 2021 and 2025 to capture the post pandemic digital acceleration.
- Journal Quality: Articles must be published in journals indexed in SINTA 1 (S1), SINTA 2 (S2), SINTA 3 (S3), or SINTA 4 (S4). This ensures a minimum standard of peer review and editorial process.
- Context: Studies focusing on SMEs in Indonesia, with a specific prioritization of research conducted in North Sulawesi (Manado, Bitung, Minahasa).
- Content: Articles discussing digital adoption, from basic digitization to advanced AI applications (e.g., chatbots, automated accounting, digital marketing algorithms).

Exclusion Criteria:

- Articles indexed in SINTA 5 or SINTA 6, or non accredited journals.
- Conference proceedings (unless indexed SINTA 2 or higher), theses, and opinion pieces.

- Studies solely focused on large corporations or technical algorithm development without managerial/economic implications.

2.4. Data Extraction and Quality Appraisal

Quality appraisal was inherent in the selection of SINTA 1-4 journals; however, each article was further scrutinized for methodological clarity. Data were extracted using a standardized coding form capturing: (1) Author/Year, (2) Location, (3) Technology Type, (4) Drivers/Barriers, and (5) Economic Outcomes.

2.5. Data Synthesis

The synthesis process utilized the reciprocal translation analysis method, where concepts from one study are translated into the terms of another to reveal overarching themes (Noblit & Hare, 1988). These themes were then mapped onto the Technology Organization Environment (TOE) Framework. This theoretical lens facilitated the categorization of findings into technological readiness (AI tools), organizational capabilities (SME human capital), and environmental pressures (regional infrastructure in North Sulawesi), forming the basis for the proposed strategic model.

3. RESULTS AND DISCUSSION

This meta-synthesis of twenty-two primary studies (2021-2025) illuminates the multifaceted landscape of digital and AI adoption within Indonesian SMEs. By organizing the findings through the Technology-Organization-Environment (TOE) framework, we identify distinct patterns that explain the current state of the digital ecosystem, particularly the contrast between national trends and the specific realities in North Sulawesi.

Table 1. Primary Studies Included in the Meta Synthesis (2021-2025)

No	Author(s) (Year)	Journal & Indexing	Location / Context	Methodology	Core Theme (TOE)	Key Findings / Contribution
1	Munaiseche et al. (2025)	MEC-J (SINTA 3)	North Sulawesi (SME General)	Quant. Survey	Tech	Use of social media algorithms for market expansion; limited deep analytics usage.
2	Lintang et al. (2025)	Jurnal Berkala Ilmiah Efisiensi (S4)	North Sulawesi	Quantitative	Tech	The adoption of QRIS significantly accelerates economic value for SMEs by enhancing transaction efficiency and sales volume.
3	Saputro et al. (2025)	J. Pengabdian IPTEK (S4)	Manado (Urban)	Action Research	Tech	Implementation of QRIS/Digital payments improves transaction speed but requires financial literacy.
4	Santosa and Surgawati (2024)	Jurnal Sosial Humaniora (S2)	Indonesia	Quantitative	Org	AI adoption significantly enhances MSME productivity, reduces operational costs, and provides competitive advantage through improved marketing capabilities and digital transformation.
5	Paendong et al. (2023)	J. Pengabdian Vokasi (S4)	Manado (Vocational)	Mixed Method	Tech	Digital administration (websites) used mostly for profiling, not for operational automation.
6	Tumbelaka et al. (2025)	J. EMBA (S4)	Minahasa, North Sulawesi	Qualitative	Tech	Digital adoption in the local tourism sector is currently centered on basic social media platforms for promotion.

7	Umayasari & Amantha (2025)	JAGPI (S4)	Indonesia (National)	SLR	Env	Regional government policy is the primary driver for initial digital onboarding.
8	Prasasti et al. (2025)	Sentralisasi (S4)	Indonesia (Jambi City)	Quantitative	Tech	AI-based marketing and chatbot services significantly increase customer satisfaction, which positively mediates and drives consumer economic behavior (purchase/retention) in the MSME sector.
9	Lina and Suwarni (2022)	J. Aplikasi Bisnis dan Manajemen (S2)	Indonesia (National)	Qualitative	Org	Top management support and IT knowledge are critical organizational drivers for social commerce adoption; adoption positively impacts SME performance.
10	Zainurrafiqi and Gazali (2024)	Jurnal Aplikasi Manajemen (S2)	Pamekasan Regency, Indonesia	Quantitative	Tech	Supply chain digitalization significantly drives MSME competitiveness, which in turn improves business performance; however, digitalization must be paired with supply chain resilience strategies to be fully effective.
11	Relifra et al. (2025)	JMBI UNSRAT (S4)	Indonesia (National)	Quantitative	Tech	Perceived Ease of Use significantly enhances Perceived Usefulness, and both are critical drivers of attitude towards AI
12	Yamin et al. (2025)	International Journal of Sustainable Development and Planning (S1)	South Sumatra, Indonesia	Quantitative	Org	Socio-economic factors are the critical organizational/individual drivers for adoption; adoption significantly improves farmer productivity and income.
13	Tumbelaka (2023)	J. Hospitality (S4)	Manado (Culinary)	Descriptive	Tech	High dependence on food delivery apps (Gofood/Grab) algorithms for sales volume.
14	Bawono et al. (2022)	J. Manajerial (S3)	Indonesia (National)	Quantitative	Org	Organizational readiness translates into better performance specifically when it leads to the successful adoption of new technologies.
15	Mansyur (2025)	JEGAR (S4)	Indonesia (National)	Mixed Method	Env	Access to digital credit (Fintech) accelerates SME growth in unbanked regions.
16	Tamyiz et al. (2025)	Khazanah Sosial (S2)	Indonesia (National)	Quantitative	Org	ICT/E-commerce adoption on business performance is significantly realized only when accompanied by strong human capital readiness within the organization.
17	Aligarh et al. (2023)	Cogent Business & Management (S1)	Indonesia (National)	Quantitative	Tech	Cloud computing adoption has a positive and significant impact on MSME business performance (financial & operational).

18	Wulandari et al. (2024)	Asia Pacific Management and Business Application (S2)	Indonesia (National)	Quantitative	Org	Digitalization capabilities alone do not directly improve business performance; they must be mediated by digitalization performance. Stronger digital literacy is proven critical to bridge this gap and achieve measurable business outcomes.
19	Sunarjo et al. (2025)	ITSDI (S2)	Indonesia (National)	Case Study	Env	Digital onboarding enhances stakeholder engagement, improves supply chain transparency, and optimizes resource utilization.
20	Hasya and Sabri (2025)	Jurnal Bisnis Strategi (S2)	Indonesia (National)	Quantitative	Tech	AI-based decision making and chatbot integration significantly enhance business performance; Market intelligence is critical for leveraging these technologies effectively.
21	Dianta et al. (2025)	Jurnal Informatika Ekonomi Bisnis (SINTA 4)	Salatiga City, Indonesia	Quantitative	Tech	Digital marketing adoption has a significant direct effect on SME sustainable growth; firm performance acts as a critical mediator, meaning adoption must translate into operational performance first to ensure long-term sustainability.
22	Syahidun et al. (2025)	APTISI Transactions on Management (ATM) (S4)	Indonesia (National)	Quantitative	Env	Policymakers must shift focus from providing infrastructure (Tech) to actively subsidizing digital upskilling and creating regional regulatory sandboxes (Env) to mitigate the "resource-constrained" nature of local SMEs.

3.1. Technological Adoption Patterns

The technological context reveals a striking "dual-speed" adoption landscape. While national-level data points toward the emergence of sophisticated AI integration, regional SMEs in North Sulawesi are predominantly situated in the foundational stages of digitization.

The "Adoption Dichotomy" in North Sulawesi In North Sulawesi, technology adoption is currently defined by transactional efficiency rather than strategic intelligence. Lintang et al. (2025) found that the adoption of QRIS (Quick Response Code Indonesian Standard) has been a pivotal driver in accelerating economic value, significantly enhancing transaction speed and sales volume for local SMEs. This finding is corroborated in Manado's urban sector, where Saputro et al. (2025) observed that digital payments improve transaction velocity, though their effectiveness remains tethered to the user's financial literacy.

However, the depth of this adoption remains shallow. In the vocational sector of Manado, Paendong et al. (2023) reported that digital administration tools, such as websites, are utilized almost exclusively for static profiling rather than for operational automation. Similarly, the tourism sector in Minahasa relies heavily on basic social media platforms for promotion. Munaiseche et al. (2025) reinforce this observation, noting that while North Sulawesi SMEs successfully leverage social media algorithms for market expansion, the utilization of deep analytics to inform decision-making is virtually nonexistent. Furthermore, Tumbelaka (2023) highlights a high dependency on external algorithms from food delivery

platforms (e.g., GoFood/Grab) to drive sales volume in the culinary sector, indicating a "platform reliance" rather than internal technological capability.

The Shift Toward Intelligent Integration In contrast to the regional focus on basic transactions, broader Indonesian studies indicate a shift toward higher-value technologies. Aligarh et al. (2023) demonstrated that cloud computing adoption has begun to yield positive, significant impacts on both financial and operational performance for MSMEs. Moving beyond infrastructure, Hasya and Sabri (2025) found that the integration of AI-based decision-making and chatbots significantly enhances business performance, largely by leveraging market intelligence. This is supported by Prasasti et al. (2025), who noted that AI-based marketing and chatbot services directly increase customer satisfaction, subsequently driving consumer retention.

The divergence between national capabilities and regional implementation suggests that North Sulawesi is currently in a "Digital Onboarding" phase. While the "Perceived Ease of Use" of tools like QRIS drives their adoption, the region has yet to transition to the "Digital Transformation" phase characterized by the deep analytics and automation seen in national studies.

3.2. Organizational Readiness

The literature unequivocally identifies organizational attributes—specifically human capital and management support—as the critical mediators that determine whether technology adoption translates into tangible business performance.

The Human Capital Mediator A recurring theme across the synthesized studies is that technology is a tool, but human capital is the driver. Tamyiz et al. (2025) argue that the impact of ICT and e-commerce on business performance is only realized when accompanied by strong human capital readiness. This is further refined by Wulandari et al. (2024), who found that digitalization capabilities alone do not improve performance; they must be mediated by "digitalization performance," a metric heavily dependent on strong digital literacy.

Strategic Alignment and Support Beyond skills, the strategic intent of the organization matters. Bawono et al. (2022) emphasize that organizational readiness translates into performance specifically when it leads to the successful adoption of new technologies, rather than just their acquisition. This requires active leadership; Lina and Suwarni (2022) identified top management support and IT knowledge as critical drivers for social commerce adoption. When these organizational factors align, Santosa and Surgawati (2024) found that AI adoption significantly enhances productivity and reduces operational costs, providing a true competitive advantage.

These findings imply a "Skill-Technology Gap." The mere availability of tools (as identified in the Technological Context) is insufficient. The dependency on financial literacy for QRIS success and the critical role of socio-economic factors in agricultural adoption suggest that intervention strategies must prioritize "organizational upgrading"—specifically upskilling—over simple hardware distribution.

3.3. Environmental Drivers

The environmental context highlights the pivotal role of external forces, particularly government policy and the financial ecosystem, in facilitating the initial leap into the digital economy.

Policy as the Catalyst Government intervention appears to be the primary "ignition" for digital adoption. Umayasari & Amantha (2025) explicitly cite regional government policy as the primary driver for initial digital onboarding. However, the demands on policy are evolving. Syahidun et al. (2025) present a critical finding for future strategy: policymakers must shift focus from merely providing infrastructure (Tech) to actively subsidizing digital upskilling and creating "regional regulatory sandboxes". This shift is necessary to mitigate the resource-constrained nature of local SMEs and allow for safe experimentation.

Financial and Ecosystem Enablers The financial environment also plays a crucial role in democratization. Mansyur (2025) found that access to digital credit (Fintech) accelerates SME growth specifically in unbanked regions, effectively lowering the barrier to entry for capital-starved businesses. Furthermore, the broader digital ecosystem enhances stakeholder engagement and improves supply chain transparency, creating a network effect that benefits all participants.

The environmental analysis suggests that the government's role must evolve from "provider" to "enabler." While initial policies successfully drove the onboarding seen in North Sulawesi, sustainable growth requires a more nuanced approach. The recommendation for "regulatory sandboxes" is particularly

relevant for developing regions, as it suggests creating a protected space for innovation that can help local SMEs transition from basic profiling to the advanced AI usage observed at the national level.

4. CONCLUSION

The findings of this study reveal that accelerating economic value in developing regions goes beyond simple technological diffusion, it is contingent upon bridging the sharp "adoption dichotomy" that currently separates the basic transactional usage in North Sulawesi from the intelligent integration emerging at the national level. The synthesis confirms that while external drivers such as government policy and fintech are effective at facilitating initial digital onboarding, sustainable economic acceleration is strictly mediated by organizational readiness. Specifically, human capital and digital literacy act as the essential bridge required to transform technological potential into measurable operational performance. Consequently, to truly optimize North Sulawesi's digital ecosystem, policy must evolve from a monolithic focus on infrastructure toward a holistic "enabling" framework. This necessitates a strategic pivot toward actively subsidizing digital upskilling and establishing regional regulatory sandboxes, thereby mitigating local resource constraints and fostering the resilience needed for high-value AI adoption.

REFERENCES

- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Umayasari, U., & Amantha, G. K. (2025). Partisipasi Warga Melalui Media Digital dan Implikasinya terhadap Akuntabilitas serta Perumusan Kebijakan Pemerintah Daerah di Lampung. *Journal of Administration, Governance, and Political Issues*, 2(1), 109-124. <https://doi.org/10.47134/jagpi.v2i1.4426>
- Mansyur, K. K. (2025). The impact of fintech on financial inclusion and regional economic growth. *Journal of Economic Growth and Development Review*, 17-26. <https://doi.org/10.62012/jegar.v2i1.15>
- Sunarjo, R. A., Pujiati, T., Apriliasari, D., & Hardini, M. (2025). Digital Onboarding in Agricultural Platforms and its Impact on Agricultural Productivity. *IAIC Transactions on Sustainable Digital Innovation (ITSDI)*, 6(2), 205-214. <https://doi.org/10.34306/itsdi.v6i2.688>
- Bawono, H. T., Winarno, W., & Karyono, K. (2022). Effect of technology, organization, and external environment on business performance mediated by the adoption of technology 4.0 in SMEs. *Jurnal Manajerial*, 9(02), 228. <https://doi.org/10.30587/jurnalmanajerial.v9i02.3854>
- Tamyiz, U. M. H., Munir, M., Furqon, C., & Dirgantari, P. D. (2025). Investigate The Relationship Between ICT Adoption and SME Performance with Digital Literacy Serving as A Mediator Variable Using TOE Framework. *Khazanah Sosial*, 7(3), 616-638. <https://doi.org/10.15575/ks.v7i3.49432>
- Lina, L. F., & Suwarni, E. (2022). Social Commerce adoption to Enhance SMEs performance: Technology, Organization and Environment (TOE) Perspectives. *Jurnal Aplikasi Bisnis Dan Manajemen*, 8(3), 689. <https://doi.org/10.17358/jabm.8.3.689>
- Yamin, M., Saputra, A., Nariswari, T. N., Andelia, S. R., Tafarini, M. F., Sulastri, M. A., & Damayanthi, D. (2025). Exploring Socio-Economic factors influencing the adoption of climate smart agriculture. *International Journal of Sustainable Development and Planning*, 20(5), 2045-2054. <https://doi.org/10.18280/ijstdp.200521>
- Munaiseche, M., Mandey, N. H. J., Rooroh, B., Ponggawa, V., & Lumunon, E. (2025b). Optimizing digital marketing strategy for small and medium enterprises in North Sulawesi. *MEC-J (Management and Economics Journal)*, 9(1), 111-126. <https://doi.org/10.18860/mec-j.v9i1.31893>
- Aligarh, F., Sutopo, B., & Widarjo, W. (2023). The antecedents of cloud computing adoption and its consequences for MSMEs' performance: A model based on the Technology-Organization-Environment (TOE) framework. *Cogent Business & Management*, 10(2). <https://doi.org/10.1080/23311975.2023.2220190>
- Paendong, M. K. E., Kumaat, A. P., Rambing, P. R., & Kolondam, A. (2023). Penerapan Sistem Administrasi Digital dan Pemasaran Digital dengan Website Profiling Produk UMKM di Galeri

- Investasi Politeknik Negeri Manado. *Jurnal Pengabdian Vokasi*, 3(2), 355-358. <https://doi.org/10.14710/jpv.2023.20309>
- Prasasti, L., Fahdillah, Y., & Pangestu, M. G. (2025). The impact of AI-Based marketing, chatbots, and social media on customer satisfaction and the economic behavior of MSMEs consumers in Jambi City. *Sentralisasi*, 15(1), 35-72. <https://doi.org/10.33506/sl.v15i1.4952>
- Wulandari, A., Marcelino, D., Suryawardani, B., & Adithya, D. (2024). Digital Capability and Literacy for MSME Transformation: Perspectives of Digital and Business Performance. *Asia Pacific Management and Business Application*, 13(2), 109-128. <https://doi.org/10.21776/ub.apmba.2024.013.02.2>
- Zainurrafiqi, Z., & Gazali, G. (2024). Supply Chain Digitalization, Green Supply Chain, Supply Chain Resilience Toward Competitiveness And Msmes Performance. *Jurnal Aplikasi Manajemen*, 22(1). <https://doi.org/10.21776/ub.jam.2024.022.01.14>
- Dianta, I. A., Sinaga, H. R., Wicaksono, J., & Zusrony, E. (2025). The Impact of digital marketing adoption on sustainable growth Mediated by Firm Performance: An Empirical Study of SMES. *Jurnal Informatika Ekonomi Bisnis*, 811-815. <https://doi.org/10.37034/infec.v7i4.1287>
- Saputro, P. H., Sitompul, B. J. D., & Tumurang, O. M. T. (2025). Pengembangan sistem digital payment pada UMKM di Manado sebagai upaya peningkatan efisiensi bisnis. *ABDIMAS IPTEK*, 5(1), 104-110. <https://doi.org/10.53513/abdi.v5i1.10612>
- Hasya, A., & Sabri, A. Q. M. (2025). The impact of AI based decision making, market intelligence, and Chatbot integration on business performance in Indonesian start-ups. *JURNAL BISNIS STRATEGI*, 34(1), 1-10. <https://doi.org/10.14710/jbs.34.1.1-10>
- Syahidun, Susetyono, E., Adiwijaya, A., Madani, M., & Kareem, Y. M. (2025). AI Adoption Barriers in SMEs Analyzing through the Technology Organization Environment TOE Framework. *ijc.ilearning.co*. <https://doi.org/10.33050/h6qyfk21>
- Lintang, S. K., Walewangko, E. N., & Rorong, I. P. F. (2025, January 24). Dampak Penggunaan QRIS Pada Pelaku UMKM Sebagai Upaya Percepatan Pertumbuhan Ekonomi di Kota Manado. <https://ejournal.unsrat.ac.id/v3/index.php/jbie/article/view/60782>
- Tumbelaka, G., Palandeng, I. D., & Lintong, D. C. A. (2025). Strategi Pemasaran Menggunakan Teknologi Digital Pada Objek Wisata Bukit Kasih Kanonang Di Kecamatan Kawangkoan Barat. ejournal.unsrat.ac.id. <https://doi.org/10.35794/emba.v13i04.64918>
- Tumbelaka, S. (2023). The impact of food delivery algorithms on culinary SMEs in Manado. *Jurnal Hospitality dan Pariwisata*, 9(1), 101-115.
- Relifra, Mardiah, A., Fikriando, E., Ramadhi, & Syafriani, O. (2025, March 15). Technological Innovation: Adoption Of Artificial Intelligence In Micro, Small, And Medium Enterprises (MSMES). <https://ejournal.unsrat.ac.id/v3/index.php/jmbi/article/view/59713>
- Santosa, A. D., & Surgawati, I. (2024). Artificial Intelligence (AI) Adoption as Marketing Tools among Micro, Small, and Medium Enterprises (MSMEs) in Indonesia. *Jurnal Sosial Humaniora*, 17(1), 91. <https://doi.org/10.12962/j24433527.v17i1.20520>