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Artificial Intelligence Adoption in Fishing SMEs: A Conceptual Framework Linking Perceived Relative Advantage, Compatibility, and Business Performance in Malaysia

Umar Fayas*
[a] *City University,Kuala Lumpur, Malaysia.*
umarfayas.uf@gmail.com
* *Umar Fayas*

ABSTRACT

This paper develops an integrative framework to explain how artificial intelligence (AI) adoption influences business performance in fishing small and medium-sized enterprises (SMEs) in Malaysia. Drawing on Diffusion of Innovation (DOI) theory, the study conceptually examines the roles of perceived relative advantage and compatibility as key innovation attributes shaping AI adoption decisions in a traditional, resource-constrained industry context. The framework positions AI adoption as a mediating mechanism through which innovation perceptions are translated into performance outcomes, including operational efficiency, market responsiveness, and competitive positioning. By situating AI adoption within the realities of fishing SMEs—characterised by limited technological readiness, strong reliance on established routines, and sensitivity to cost and risk—the paper extends AI adoption research beyond high-technology sectors. The study further discusses managerial and policy implications related to strategic AI investment, digital inclusion, and capacity-building initiatives, and outlines directions for future empirical research using structural equation modelling, mixed-method approaches, and longitudinal designs. Overall, the paper contributes to AI adoption and SME literature by offering a context-sensitive perspective on digital transformation in Malaysia's fishing industry.

KEYWORDS: Artificial intelligence adoption, Fishing SMEs, Relative advantage, Compatibility, Business performance, Diffusion of Innovation

I. INTRODUCTION

The accelerating pace of digital transformation has fundamentally reshaped how small and medium-sized enterprises (SMEs) operate, compete, and sustain performance across industries. Among emerging digital technologies, artificial intelligence (AI) has attracted growing attention for its potential to enhance decision-making, operational efficiency, and market responsiveness. While AI adoption has progressed rapidly in large corporations, its diffusion among traditional and resource-constrained SMEs remains uneven, particularly in developing economies. This study addresses this gap by conceptually examining AI adoption in fishing SMEs in Malaysia, focusing on how perceived relative advantage and compatibility shape adoption decisions and, ultimately, business performance.

Digital transformation has become a strategic imperative for SMEs seeking to improve productivity, resilience, and competitiveness in increasingly volatile markets. Recent research highlights AI as a transformative general-purpose technology capable of supporting forecasting, automation, optimization, and data-driven decision-making in SMEs (Raisch & Krakowski, 2021; Dwivedi et al.,

2023). However, unlike large firms, SMEs often face constraints related to financial resources, digital skills, and technological readiness, which influence how new technologies are perceived and adopted.

In Malaysia, fishing SMEs represent a critical component of the national blue economy, contributing to food security, employment, rural livelihoods, and export earnings. Despite their strategic importance, many fishing SMEs continue to rely on traditional practices and informal decision-making processes, rendering them vulnerable to market volatility, climate uncertainty, and supply chain disruptions (FAO, 2022; Aziz et al., 2023). Digital technologies and AI in particular offer opportunities to enhance operational efficiency through demand forecasting, resource allocation, catch optimization, price prediction, and access to digital marketplaces.

Recent studies suggest that AI-enabled tools can support SMEs by improving cost efficiency, reducing uncertainty, and enabling more informed strategic decisions (Verma et al., 2022; Khin & Ho, 2024). Nevertheless, the extent to which fishing SMEs recognize these benefits and perceive AI as compatible with their existing operational routines remains underexplored, especially within developing-economy contexts such as Malaysia.

Despite the growing policy emphasis on digitalization, AI adoption among traditional SMEs particularly in agriculture and fisheries remains low and highly uneven. Empirical evidence indicates that SMEs often struggle to move beyond basic digital tools toward advanced technologies such as AI due to perceived complexity, misalignment with existing practices, and uncertainty regarding tangible performance gains (Cenamor et al., 2021; Troise et al., 2022).

Moreover, existing research on AI adoption has predominantly focused on manufacturing, services, or high-technology sectors, leaving traditional industries such as fisheries relatively underrepresented in the literature. Even when SMEs are examined, studies frequently adopt fragmented approaches that isolate technological adoption from performance outcomes or focus narrowly on single determinants (Borges et al., 2021; Chatterjee et al., 2023). As a result, there is limited conceptual clarity regarding how key innovation attributes particularly perceived relative advantage and compatibility translate into improved business performance in resource-constrained and tradition-bound SME contexts.

Furthermore, there is a notable lack of integrative conceptual models tailored to fishing SMEs operating in developing economies. The absence of such frameworks constrains theoretical advancement and limits the ability of policymakers and practitioners to design targeted interventions that support meaningful AI adoption rather than symbolic or superficial digitalization.

In response to these gaps, this study pursues three interrelated objectives. First, it seeks to conceptually examine AI adoption in fishing SMEs by synthesizing insights from innovation adoption and SME performance literature. Second, it aims to explain the roles of perceived relative advantage and compatibility as critical determinants shaping AI adoption decisions in fishing SMEs. Third, the study develops an integrative conceptual framework that links AI adoption to business performance

outcomes, thereby clarifying the mechanisms through which innovation attributes contribute to value creation in the Malaysian fishing sector.

This study offers several important contributions. From a theoretical perspective, it extends innovation adoption literature by applying and contextualizing key innovation attributes within the underexplored domain of fishing SMEs and AI technologies. By integrating adoption determinants with performance outcomes, the study advances a more holistic understanding of technology-enabled value creation in SMEs (Zhou et al., 2021; Chatterjee et al., 2023).

From a practical standpoint, the framework provides actionable insights for SME owners and managers by highlighting how perceptions of relative advantage and compatibility influence AI adoption decisions. These insights can support more informed investment decisions and guide capacity-building initiatives tailored to the realities of fishing SMEs. For policymakers, the study offers a conceptual basis for designing targeted digital transformation programs that emphasize usability, contextual fit, and performance relevance rather than technology push alone.

Finally, the study contributes contextually by focusing on Malaysia's fishing industry, a strategically significant yet digitally underrepresented sector. By grounding the framework in the realities of developing-economy SMEs, the paper enhances the relevance and applicability of AI adoption theory beyond advanced and high-technology contexts.

II. LITERATURE REVIEW

A. Artificial Intelligence in SMEs

Artificial intelligence (AI) in SMEs can be defined broadly as the use of computational techniques (e.g., machine learning, predictive analytics, natural language processing, and computer vision) to automate, augment, or enhance decision-making and operational processes. In SME contexts, AI typically appears as "applied AI" embedded in affordable software platforms (e.g., forecasting tools, route planning, dynamic pricing modules, and inventory optimization systems) rather than bespoke in-house models, which are more common in large firms (Badghish & Soomro, 2024; Schwaeke et al., 2025). Contemporary reviews show that AI adoption in small firms is often driven by pragmatic performance needs improving speed and accuracy of decisions, reducing waste, and enabling data-driven coordination across the value chain—while constrained by limited data readiness, skills, and investment capacity (Culot et al., 2024; Ayinaddis et al., 2025).

AI use cases relevant to fishing SMEs map strongly onto common "pain points" in fisheries and seafood value chains where uncertainty and perishability are high. First, demand forecasting supports better landing-to-market coordination, reducing spoilage and improving market timing an application domain frequently emphasized in AI-enabled supply-chain research (Teixeira et al., 2025; Culot et al.,

2024). Second, resource optimisation can support fuel planning, trip scheduling, labor allocation, and ice/cold-storage utilization improving unit costs and reducing operational variability (Rowan & Galanakis, 2023). Third, logistics and cold-chain coordination are critical for seafood quality and pricing, and digital tools (including AI-enabled decision support) are increasingly discussed as pathways to reduce post-harvest losses and improve traceability and market access (Rowan & Galanakis, 2023; WorldFish, 2023). Finally, pricing and market intelligence (e.g., trend detection, buyer matching, dynamic pricing) can improve margins and enable SMEs to respond quickly to market shifts, especially when platforms and intermediaries are data-driven (Badghish & Soomro, 2024; Culot et al., 2024).

Business performance in SMEs is commonly conceptualized as a multidimensional outcome that includes financial performance (e.g., profitability, revenue growth, cost efficiency) and non-financial performance (e.g., customer satisfaction, service quality, operational reliability, innovation, and market access). Recent AI–SME studies increasingly treat performance as a blended construct, arguing that digital technologies may first improve process quality and decision accuracy before translating into financial outcomes (Badghish & Soomro, 2024; ul Haq, 2025). This is particularly relevant for fisheries-related SMEs where quality degradation, delivery timing, and compliance can influence downstream prices and repeat demand.

A useful conceptual distinction is between short-term efficiency and long-term competitiveness. In the short run, AI-enabled tools can improve operational efficiency (e.g., better matching supply to demand, reducing waste, optimizing routes or storage usage). In the longer run, competitiveness is shaped by the firm's ability to build capabilities data routines, learning, and adaptive decision-making that support innovation, resilience, and differentiation (Schwaeke et al., 2025; ul Haq, 2025). Thus, the AI adoption – performance relationship is more plausibly understood as capability-building over time rather than an instant "technology purchase → performance jump" effect, especially under resource constraints typical of SMEs (Ayinaddis et al., 2025; ul Haq, 2025).

Fishing SMEs in Malaysia operate within a sector that is economically meaningful and policy-relevant, with official national statistics and reports published by Malaysia's Department of Fisheries providing ongoing documentation of fisheries activity and performance. In practice, fishing SMEs often share structural features common to traditional or semi-traditional SMEs: small ownership structures, limited formalization, dependence on seasonal variability, and strong exposure to input-cost volatility and market price fluctuations (Rowan & Galanakis, 2023). These characteristics shape technology decisions in two ways: (1) they increase potential value from better forecasting and coordination, while (2) constraining investments in data infrastructure, talent, and experimentation.

Technological readiness and resource constraints are recurrent themes in SME digitalization research in Malaysia and beyond. Malaysia-focused discussions on SME digital adoption emphasize uneven digital maturity, capability gaps, and the need for targeted support mechanisms for smaller firms. In

fisheries and seafood chains specifically, digital transformation narratives highlight that benefits (e.g., better traceability, lower waste, improved planning) are achievable, but adoption barriers often include limited digital literacy, fragmented infrastructure, and constrained access to finance conditions that mirror wider global fisheries digitalization challenges (Rowan & Galanakis, 2023). For fishing SMEs, this implies that AI tools will be evaluated largely through perceived "fit" with daily operational realities and the visibility of benefits under uncertain conditions.

B. Theoretical Foundations

Diffusion of Innovation (DOI) theory argues that adoption decisions are shaped by how potential adopters perceive key innovation attributes. Among these, relative advantage and compatibility are consistently treated as central predictors of adoption because they represent (i) perceived net gains compared to current practices and (ii) perceived fit with existing values, needs, routines, and systems (Ayanwale et al., 2024; Overbye-Thompson et al., 2025). DOI is particularly suitable for your framework because fishing SMEs are likely to adopt AI incrementally and selectively, depending on whether AI appears clearly superior to manual heuristics and whether it integrates into existing workflows without disrupting core routines.

In recent DOI-based empirical work, relative advantage and compatibility remain robust predictors in adoption contexts where trust, usability perceptions, and constraints also matter (Ayanwale et al., 2024). This supports the conceptual claim that, for fishing SMEs, AI adoption is likely to be more strongly shaped by "value + fit" than by abstract awareness alone especially when uncertainty and experimentation costs are high.

The Resource-Based View (RBV) explains performance differences by emphasizing the role of valuable, rare, difficult-to-imitate, and well-organized resources and capabilities. In this lens, AI should not be seen only as a tool; rather, AI-enabled performance gains depend on complementary resources such as data quality, human skills, organizational learning, and process integration (ul Haq, 2025). This is particularly relevant for SMEs, where capability constraints can prevent technology from translating into measurable performance improvements even if adoption occurs.

Recent research integrating RBV with technology adoption models argues that AI becomes strategically meaningful when it is embedded into routines that improve decision quality, responsiveness, and operational coordination forming an emergent capability rather than a standalone asset (ul Haq, 2025). For fishing SMEs, RBV clarifies why adoption may produce heterogeneous outcomes: two SMEs may adopt similar AI tools, yet the one with stronger learning orientation, better data capture habits, and integration discipline may realize larger performance gains.

The Technology–Organization–Environment (TOE) framework explains adoption as a function of technological characteristics (e.g., readiness, compatibility), organizational conditions (e.g., resources,

skills, leadership support), and environmental pressures (e.g., competition, regulation, partner expectations). Recent SME AI adoption research uses TOE to highlight that adoption is not only an owner-manager perception issue, but also a readiness and ecosystem issue especially in resource-constrained settings (Badghish & Soomro, 2024; Schwaeke et al., 2025). TOE is a useful optional complement to DOI in your paper because DOI explains perceived innovation attributes (relative advantage, compatibility), while TOE explains why those perceptions may or may not translate into adoption under constraints.

For example, even if fishing SMEs perceive strong relative advantage, low data readiness or weak vendor support can hinder implementation; similarly, environmental pressures such as buyer requirements for quality assurance or traceability could accelerate adoption. Reviews focused on AI adoption in SMEs explicitly emphasize readiness, resources, and compliance/competitive pressures as recurring categories shaping adoption trajectories (Ayinaddis et al., 2025; Schwaeke et al., 2025).

C. Perceived Relative Advantage of AI

Relative advantage refers to the degree to which AI is perceived as better than existing methods in improving outcomes such as cost, speed, accuracy, or market responsiveness. In SME settings, relative advantage frequently appears as (a) cost reduction, (b) productivity gains, and (c) higher decision quality through better forecasting and optimization (Ayanwale et al., 2024; Teixeira et al., 2025). In fisheries-relevant value chains, relative advantage may also be expressed as reduced waste, better quality preservation through planning, and improved matching of supply to buyer demand—benefits highlighted in digital fisheries and seafood value chain discussions (Rowan & Galanakis, 2023; WorldFish, 2023).

Relative advantage may further include risk mitigation, especially in uncertain operational environments. AI-supported forecasting and planning can reduce exposure to price swings, demand shocks, and coordination failures an increasingly important benefit in perishable product supply chains where timing and quality materially affect value (Culot et al., 2024; Teixeira et al., 2025).

DOI suggests that when relative advantage is salient and credible, adoption likelihood rises. Recent adoption studies continue to support this logic by showing that perceived benefits and performance expectations are key drivers of intention to adopt AI technologies (Ayanwale et al., 2024; Badghish & Soomro, 2024). For fishing SMEs, the strategic implication is that adoption decisions will likely depend on whether owners can "see" immediate operational value e.g., reducing unsold inventory, improving daily dispatch decisions, or improving buyer satisfaction rather than distant strategic narratives. Therefore, relative advantage in this context should be theorized as both economic value (profit/cost) and operational value (quality, reliability, responsiveness).

D. Compatibility of AI with SME Operations

Compatibility is the perceived alignment of AI with existing work practices, values, skills, and technological infrastructure. DOI-based measurement work continues to treat compatibility as a central determinant because it captures the "fit cost" of adoption the disruption and learning burden required to integrate innovation into daily routines (Overbye-Thompson et al., 2025). For fishing SMEs, compatibility plausibly depends on whether AI tools (1) run on accessible devices, (2) use inputs the SME can realistically capture (data), and (3) produce outputs that are understandable and actionable in fast-moving operations (Rowan & Galanakis, 2023).

Compatibility also has a cultural and behavioral dimension: AI adoption is more likely when owner-managers perceive AI as supporting their expertise rather than replacing it, and when the technology aligns with established decision-making norms. This emphasis is consistent with SME AI adoption perspectives that highlight adoption as a socio-technical change rather than only a technical choice (Schwaeke et al., 2025; Ayinaddis et al., 2025).

Compatibility links directly to adoption readiness because "fit" reduces perceived complexity and lowers implementation risk. In TOE terms, compatibility intersects with organizational readiness factors such as available skills, financial readiness, and process maturity; reviews of AI adoption in SMEs repeatedly emphasize these readiness barriers as major constraints (Ayinaddis et al., 2025; Badghish & Soomro, 2024). In fishing SMEs, where operations can be informal and time-sensitive, compatibility should be conceptualized as the ease with which AI can be embedded into daily workflows (landing, grading, storage, selling, logistics) without requiring high fixed costs or advanced technical teams.

E. AI Adoption and Business Performance

In a performance-oriented conceptualization, AI adoption may directly improve SME performance through (a) operational efficiency, (b) market access, and (c) profitability. Systematic reviews in supply-chain and operations contexts point to AI's potential in process optimization and improved planning, which when appropriately implemented can translate into more reliable and efficient operations (Culot et al., 2024; Teixeira et al., 2025). In fisheries and seafood contexts, digital tools and analytics are frequently linked to improved coordination, quality outcomes, and reduced waste, which are performance-relevant in perishable value chains (Rowan & Galanakis, 2023; WorldFish, 2023).

However, the SME literature also cautions that performance outcomes depend on implementation quality and complementary capabilities; therefore, AI adoption's impact on performance is not automatic, especially under resource constraints (ul Haq, 2025; Ayinaddis et al., 2025).

For your model, AI adoption is best positioned as a mediator translating innovation perceptions into performance outcomes. Conceptually, relative advantage and compatibility shape whether AI is adopted and how deeply it is used; then adoption influences performance by improving decision

quality, coordination, and responsiveness. This logic is consistent with AI–performance studies that explicitly model adoption as a mediating mechanism between readiness/pressures and firm outcomes (ul Haq, 2025) and with SME AI adoption work emphasizing the role of adoption/implementation in achieving sustainable performance outcomes (Badghish & Soomro, 2024).

III. METHODOLOGY

F. Development of the Conceptual Framework

Perceived relative advantage refers to the degree to which an innovation is viewed as superior to existing practices in terms of efficiency, effectiveness, or economic value. Contemporary innovation research consistently shows that perceived relative advantage remains one of the most powerful predictors of advanced digital technology adoption, including AI, particularly in resource-constrained SMEs (Cenamor et al., 2021; Troise et al., 2022). In traditional sectors such as fishing, AI-enabled tools—such as predictive analytics for catch forecasting, fuel optimization, demand estimation, and pricing—can offer tangible operational and strategic benefits, thereby strengthening perceptions of relative advantage.

Compatibility, by contrast, reflects the extent to which an innovation aligns with existing values, routines, skills, and technological infrastructures. Recent studies emphasize that even when digital technologies promise substantial benefits, adoption is unlikely if the technology is perceived as misaligned with established workflows or organizational culture (Ghobakhloo et al., 2021; Imran et al., 2023). For fishing SMEs, where operations are often informal, experience-based, and labor-intensive, compatibility with current practices and owner–manager cognition becomes a critical determinant of AI adoption decisions.

Together, perceived relative advantage and compatibility capture both the value logic and fit logic of AI adoption. This dual emphasis reflects recent calls to move beyond single-factor explanations and adopt integrated frameworks that account for both perceived benefits and contextual alignment in SME digital transformation (Carter et al., 2022).

Rather than treating innovation attributes as having a direct effect on business performance, this study conceptualizes AI adoption as a mediating mechanism that translates perceived innovation attributes into tangible outcomes. Recent technology adoption literature argues that performance improvements arise not from perceptions alone, but from the effective assimilation and use of digital technologies within organizational processes (Rai et al., 2022; Hanelt et al., 2021).

AI adoption encompasses not only the decision to adopt AI tools, but also their integration into operational and decision-making routines. In SMEs, adoption mediates the relationship between innovation attributes and performance by enabling process optimization, data-driven decision-making, and enhanced responsiveness to market and environmental uncertainty (Gupta et al., 2022).

Thus, AI adoption represents a critical capability-building process through which perceived advantages and compatibility are converted into performance gains.

Business performance in SMEs is increasingly conceptualized as a multidimensional construct, incorporating financial outcomes (e.g., profitability, cost efficiency) and non-financial indicators (e.g., operational reliability, market reach, resilience). Recent SME and digitalization studies highlight that AI adoption can enhance performance by improving forecasting accuracy, reducing operational waste, and supporting strategic planning, particularly in volatile and environmentally sensitive sectors such as fisheries (Kraus et al., 2022; Ribeiro-Navarrete et al., 2021).

Positioning business performance as the ultimate outcome aligns the framework with both Diffusion of Innovation and Resource-Based View logics, wherein innovation attributes enable adoption, adoption builds capabilities, and capabilities generate performance advantages.

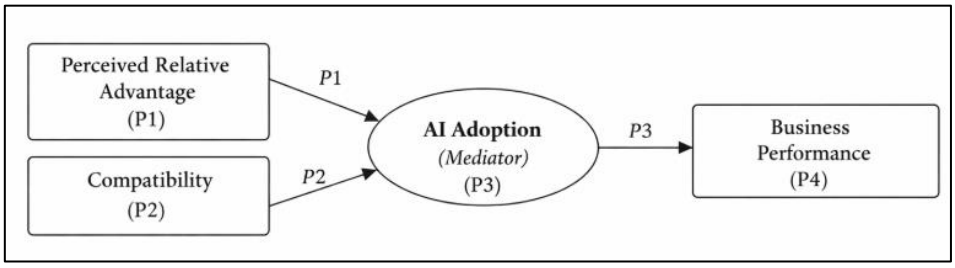

Figure 1. Conceptual Framework

IV. DISCUSSION AND CONCLUSION

G. Theoretical Implications

This paper advances DOI theorising by applying innovation attributes—especially relative advantage and compatibility—to AI, which differs from earlier "single-purpose" technologies because AI often requires data, skills, workflow redesign, and ongoing learning. Recent AI-in-SME studies show that perceived relative advantage is a consistent driver of AI adoption decisions, reinforcing DOI's core argument that innovations diffuse faster when users perceive clear benefits over current practices. Likewise, compatibility becomes theoretically central in traditional SMEs because fit with existing routines, values, and skill sets can determine whether AI is seen as "usable" rather than merely "useful," especially where operational practices are deeply embedded.

A second contribution is conceptual integration: rather than treating innovation attributes as ends in themselves, this framework links them to performance via AI adoption as a mediating capability. Recent work suggests AI adoption can translate into performance gains (including efficiency and competitiveness) when SMEs successfully implement AI in ways that support decision quality and process improvement consistent with a "capability pathway" view. This contributes to SME digital

transformation literature by clarifying how perceived benefits and fit are theorized to become measurable outcomes.

H. Managerial Implications

For fishing SME owner-managers, the framework implies that AI decisions should begin with a clear articulation of relative advantage and an honest assessment of compatibility (fit with workflows, data availability, digital skills, and vendor support). Empirical evidence from SME contexts indicates that when managers perceive AI as clearly superior to existing methods, adoption likelihood rises; however, integration challenges can offset benefits if AI is misaligned with day-to-day operations.

The model also suggests prioritising "low-friction" AI use cases those with high perceived advantage and strong operational fit—before scaling to complex applications. This staged logic aligns with recent SME-focused AI research emphasising resource constraints and the need to match AI ambition to readiness (data, skills, infrastructure, and process stability). Practically, this means investing first in foundational enablers (basic digital record-keeping, reliable connectivity, staff training, simple analytics tools) that increase compatibility and reduce implementation risk.

I. Policy Implications

At the policy level, the framework implies that increasing AI uptake in traditional SMEs requires not only incentives, but also ecosystem support that improves compatibility (skills, infrastructure, advisory services) and strengthens perceived relative advantage (clear business cases, pilot programs, and demonstrable results). Malaysia's national digital agenda emphasizes inclusive digital transformation beginning in 2021–2022 and scaling through 2023–2025, which conceptually aligns with removing structural barriers that prevent SMEs from capturing value from digital technologies.

The National 4IR Policy positions AI as a foundational technology and highlights coordinated initiatives that can be translated into SME-facing capacity building (training, sandbox pilots, shared facilities, and industry partnerships). For fishing SMEs, targeted programs should focus on "readiness bundles": (1) digital skills and literacy, (2) access to affordable tools/vendors, (3) data governance and cybersecurity basics, and (4) sector-relevant demonstration projects that make relative advantage observable and credible.

J. Limitations and Future Research Directions

As a conceptual paper, the framework does not estimate effect sizes, confirm causality, or test boundary conditions. It also focuses on two DOI attributes (relative advantage and compatibility) and may omit other plausible determinants, which future studies could add in extended models. Empirical testing is required to validate the mediating logic and to ensure robust measurement of AI adoption (intensity, breadth, and depth of use) and performance.

Survey-SEM is well-suited to test mediation and measurement quality, and organizational-methods research provides concrete recommendations for building and evaluating SEM models transparently. Mixed-method designs can uncover sector-specific compatibility issues (workflow fit, trust in vendors, data availability) and explain why perceived advantage may not translate into adoption. This aligns with recent calls for more holistic, grounded views of AI implementation in SMEs.

K. Conclusion

This study synthesises recent AI-in-SME scholarship with DOI logic to propose a framework explaining how perceived relative advantage and compatibility shape AI adoption, which then enables business performance gains in Malaysia's fishing SMEs. The key conceptual insight is that AI value creation in traditional SMEs is unlikely to be driven by "technology availability" alone; instead, performance benefits depend on whether owner-managers perceive AI as meaningfully better than existing practices and practically workable within local routines and resource constraints. Consistent with recent evidence, AI adoption can contribute to SME performance, but implementation success is strongly conditioned by readiness and fit.

In contribution terms, the paper (i) clarifies DOI's continuing relevance for modern AI adoption, (ii) strengthens the adoption-to-performance pathway by theorising adoption as a mediating capability, and (iii) provides a policy-relevant lens for inclusive digital transformation. Looking ahead, the digital transformation of fishing SMEs in Malaysia will be most sustainable when national initiatives translate into practical readiness support skills, infrastructure, pilots, and trusted ecosystems so that relative advantage is visible and compatibility barriers are systematically reduced

REFERENCES

Almaiah, M. A., Al-Khasawneh, A., Althunibat, A., Khawatreh, S., & Al-Amayreh, I. (2022). Measuring institutions' adoption of artificial intelligence applications. Electronics, 11(20), 3291.

Ayanwale, M. A., Adeleke, A., & Ayanwale, A. B. (2024). Investigating factors of students' behavioral intentions to use AI tools: An expanded diffusion of innovation perspective. *Journal of King Saud University – Computer and Information Sciences, 36*(3), 101911.

Ayinaddis, S. G., *et al.* (2025). Artificial intelligence adoption dynamics and knowledge in SMEs: A TOE-based synthesis. *Journal of Innovation & Knowledge*.

Aziz, N. A., Rahman, A. A., & Yusoff, M. Y. (2023). Digital readiness and sustainability of fisheries SMEs in Malaysia. *Asian Journal of Agriculture and Development, 20*(2), 45–60.

Badghish, S., & Soomro, A. A. (2024). Artificial intelligence adoption by SMEs to achieve sustainable business performance: Application of the technology–organization–environment framework. Sustainability, 16(5), 1864.

Bank for International Settlements. (2021). Malaysia Digital Economy Blueprint (MyDIGITAL). Economic Planning Unit, Prime Minister's Department.

Borges, A. F., Laurindo, F. J. B., Spínola, M. M., Gonçalves, R. F., & Mattos, C. A. (2021). The strategic use of digital technologies in SMEs. *Journal of Small Business Management, 59*(3), 389–415.

Cenamor, J., Sjödin, D. R., & Parida, V. (2021). Adopting a platform approach in servitization: Leveraging digitalization for value creation. *Industrial Marketing Management, 93*, 32–44.

Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2023). Artificial intelligence adoption in SMEs: A systematic review and future research agenda. *Journal of Business Research, 156*, 113486.

Culot, G., Nassimbeni, G., Orzes, G., & Sartor, M. (2024). Artificial intelligence in supply chain management: A systematic literature review of empirical research. *Technovation, 129*, 102809.

Carter, S., Shankar, A., & Nguyen, M. (2022). Digital transformation in SMEs: A systematic review and future research agenda. *Journal of Business Research, 146*, 203–217.

Cenamor, J., Parida, V., & Wincent, J. (2021). How entrepreneurial SMEs compete through digital platforms: The roles of digital ambidexterity and value creation. *Journal of Business Research, 135*, 441–453.

Dwivedi, Y. K., Hughes, L., Ismagilova, E., et al. (2023). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research. *International Journal of Information Management, 71*, 102642.

FAO. (2022). *The state of world fisheries and aquaculture*. Food and Agriculture Organization of the United Nations.

Ghobakhloo, M., Iranmanesh, M., Tseng, M.-L., Grybauskas, A., & Amran, A. (2021). Drivers and barriers of Industry 4.0 adoption: A systematic review. *Technological Forecasting and Social Change, 162*, 120406.

Gupta, S., Karimi, J., & Somers, T. M. (2022). The effects of digital transformation on firm performance: Evidence from AI-enabled processes. *Information Systems Research, 33*(2), 567–590.

Hair, J. H., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). A primer on partial least squares structural equation modeling (PLS-SEM) (3rd ed.). SAGE.

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. Journal of Management Studies, 58(5), 1159–1197.

Imran, M., Shahzad, K., Butt, A., & Kantola, J. (2023). Organizational factors for Industry 4.0 adoption in SMEs: A developing country perspective. Technological Forecasting and Social Change, 186, 122148.

Khin, S., & Ho, T. C. F. (2024). Digital transformation, innovation capability, and SME performance. *Technological Forecasting and Social Change, 196*, 122859.

Kock, F., Berbekova, A., & Assaf, A. G. (2021). Understanding and managing the threat of common method bias: Detection, prevention and control. Tourism Management, 86, 104330.

Kraus, S., Schiavone, F., Pluzhnikova, A., & Invernizzi, A. C. (2022). Digital transformation in SMEs: A systematic literature review. Journal of Business Research, 146, 554–567.

Muhammad, S. S., et al. (2025). Digital transformation or digital divide? SMEs' use of AI and its implications. Technological Forecasting and Social Change.

Podsakoff, P. M., Podsakoff, N. P., Williams, L. J., Huang, C., & Yang, J. (2024). Common method bias: It's bad, it's complex, it's widespread, and it's not easy to fix. Annual Review of Organizational Psychology and Organizational Behavior, 11, 17–61.

Rai, A., Constantinides, P., & Sarker, S. (2022). Next-generation digital platforms: Toward human–AI hybrid systems. MIS Quarterly, 46(1), 287–319.

Raisch, S., & Krakowski, S. (2021). Artificial intelligence and management: The automation–augmentation paradox. *Academy of Management Review, 46*(1), 192–210.

Ribeiro-Navarrete, S., Saura, J. R., Palacios-Marqués, D., & Iturricha-Fernández, A. (2021). Digital transformation in business: Towards a systematic literature review. Sustainability, 13(6), 3102.

Rowan, N. J., & Galanakis, C. M. (2023). The role of digital technologies in supporting and improving fisheries and aquaculture value chains. Aquaculture Reports, 27, 101394.

Schwaeke, J., Hansen, E. G., & Wiedmann, K.-P. (2025). The new normal: The status quo of AI adoption in SMEs. *The Journal of Business & Industrial Marketing*.

Soomro, R. B., et al. (2025). A SEM–ANN analysis to examine the impact of artificial intelligence adoption on SMEs' sustainable performance. PLOS ONE.

Teixeira, A. R., et al. (2025). A systematic literature review on artificial intelligence applications in supply chain management: Trends and future research agenda. Information, 16(5), 399.

ul Haq, F. (2025). Exploring AI adoption and SME performance in resource-constrained environments: An RBV–TOE perspective.

Troise, C., Corvello, V., Ghobadian, A., & O'Regan, N. (2022). How can SMEs successfully navigate digital transformation? *Journal of Business Research, 146*, 330–344.

Troise, C., Corvello, V., Ghobakhloo, M., & Oghazi, P. (2022). How SMEs successfully implement Industry 4.0: The role of organizational culture and technological readiness. Journal of Manufacturing Technology Management, 33(5), 797–821.

Unit Perancang Ekonomi, Jabatan Perdana Menteri. (2021). National Fourth Industrial Revolution (4IR) Policy. Government of Malaysia.

WorldFish. (2023). Fish cold supply chain management. WorldFish.

Verma, S., Sharma, R., Deb, S., & Maitra, D. (2022). Artificial intelligence adoption in SMEs: Empirical evidence from emerging economies. *International Journal of Information Management, 65*, 102513.

Zhou, Y., Jiang, Y., & Zhang, X. (2021). Digital technology adoption and SME performance: A capability-based perspective. *Information & Management, 58*(7), 103505.

Zyphur, M. J., Bonner, C. V., & Tay, L. (2023). Structural equation modeling in organizational research: The state of our science and some proposals for its future. *Annual Review of Organizational Psychology and Organizational Behavior, 10*, 495–517.