

A CONCEPTUAL FRAMEWORK FOR ARTIFICIAL INTELLIGENCE (AI) READINESS AND ADOPTION AMONG SMALL AND MEDIUM ENTERPRISES (SMESs) ENTREPRENEURS IN WEST SUMATRA, INDONESIA

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Article history

Received date : 19-6-2026
Revised date : 20-6-2026
Accepted date : 25-7-2026
Published date : 1-8-2026

To cite this document:

Septrizola, W., & Ab Wahid, H. (2026). A conceptual framework for Artificial Intelligence (AI) readiness and adoption among Small and Medium Enterprises (SMEs) entrepreneurs in West Sumatra, Indonesia. *International Journal of Accounting, Finance and Business (IJAFB)*, 11 (67), 1 - 12.

Abstract: *Small and Medium Enterprises (SMEs) constitute the backbone of Indonesia's economy, including in West Sumatra, where the business landscape encompasses a diverse range of traditional enterprise clusters. However, the ability of SMEs entrepreneurs to adopt advanced digital technologies such as Artificial Intelligence (AI) remains at a very early stage. Their understanding of and readiness to adopt AI are minimal and are accompanied by considerable technological concerns, which are believed to hinder the adoption of this technology among SMEs entrepreneurs. Accordingly, this conceptual paper discusses AI readiness and adoption among SMEs entrepreneurs in West Sumatra by examining technology readiness and acceptance, entrepreneurial orientation, and digital literacy.*

Keywords: *Readiness, Acceptance, Artificial Intelligence, Entrepreneurs, Small and Medium-sized Enterprises (SMEs).*

Introduction

The Small and Medium Enterprises (SMEs) sector is the backbone that drives Indonesia's national economic growth. Data shows that SMEs account for more than 99% of all business units in Indonesia and contribute a significant 116 million (97%) jobs (ukmindonesia.id). This suggests that the country's entire economic orientation and prosperity depend heavily on the stability, sustainability, and expansion of the SMEs sector. Despite the enormous economic potential of SMEs, the industry continuously faces a number of serious structural issues, especially with regard to less systematic management, capital or financial limits, and low production productivity (Hardyansah & Putra, 2023).

In the wake of the COVID-19 pandemic crisis, digital technology has become increasingly significant for enterprises to adopt as an alternative method of online marketing. SMEs entrepreneurs in Indonesia in general, and in West Sumatra in particular, are no exception. However, in reality, not all SMEs entrepreneurs are ready to undergo a comprehensive digital transformation. Among the main challenges reported are their difficulties in understanding, accessing and applying rapidly evolving digital technologies. This has resulted in only around 26 million SMEs entrepreneurs, out of a total of over 64 million SMEs units in the region, successfully adopting basic digital technology (ukmindonesia.id). The vast majority of other SMEs have yet to utilise digital technology in their marketing, sales, or daily financial record-keeping. A complete reliance on traditional marketing methods still persists (Kurniasari et al. 2023).

Despite the diversity of sectors pursued by SMEs entrepreneurs in those seven major cities, it is undeniable that they face serious marketing challenges. The infrastructure gap, with high-speed internet access, remains concentrated in major city centres such as Padang and Bukittinggi, while other districts experience very limited coverage. Inequality may be exacerbated by the rural poor's lack of dependable, fast internet. Prioritizing underdeveloped areas on the government's agenda is crucial to achieving equitable digital transformation (Husna & Budiman, 2023). Also, minimal digital literacy and cybersecurity might expose these entrepreneurs to the risk of cybercrime.

Although fundamental issues such as capital, legal registration, and network infrastructure are critically important, there is an urgent need for SMEs entrepreneurs to specifically adopt AI technology to solve their problems, rather than merely relying on e-commerce or conventional social media. Firstly, in terms of capital constraints, SMEs are often rejected by conventional banks due to the lack of formal financial transaction records and systematic audits. It is believed that AI Technology, through advanced analytical algorithms and alternative credit scoring models, can help analyse non-traditional transaction data (such as daily cash flow on social media, frequency of raw material purchases, and customer sentiment) to prove their creditworthiness to Peer-to-Peer platforms. (P2P) Lending or micro-credit institutions. Secondly, to address the issue of legal formalisation (where 99.50% of SMEs lack a valid licence), intelligent AI agents or legal advice bots could be built to guide entrepreneurs directly in the local language (whether Minangkabau or Indonesian) to register their businesses (such as obtaining a Unique Business Identification Number - NIB) without the need for high legal costs. Thirdly, in the food (43,588 units) and clothing (16,599 units) industries, which are highly dependent on seasonal trends and perishable raw materials, AI is able to perform

accurate demand forecasting based on local tourism trends, weather changes, and historical sales data, thereby reducing stock waste and optimising their supply chains.

Therefore, this conceptual paper aims to discuss the readiness and adoption of artificial Intelligence among West Sumatra entrepreneurs and propose a conceptual framework that links both variables. Previous literature often examines digitalisation in general without discussing how entrepreneurial psychological traits, cognitive literacy, entrepreneurial orientation, and external institutional support interact to overcome barriers to AI adoption.

Artificial intelligence (AI) also has the potential to help SMEs entrepreneurs overcome bureaucratic constraints, particularly those involving regulatory and legal aspects. Examples include the halal certification application process for SMEs entrepreneurs, the procurement of distribution permits for product compositions approved by BPOM (the Food and Drug Supervisory Body), the ownership of IPR (Intellectual Property Rights), as well as business licences or NIB (Business Identification Number). This artificial intelligence (AI) application will help SMEs in West Sumatra to analyse and understand the legal instruments in force in Indonesia, thereby facilitating their compliance with the legality of their business operations. In this regard, artificial intelligence (AI) serves as a catalyst for SMEs entrepreneurs in West Sumatra in examining and understanding the regulations that are often considered complex in Indonesia.

The Readiness of SMEs Technology in West Sumatra

The entrepreneurial culture of SMEs in West Sumatra, as part of the Minangkabau ethnic group, is unique and has been passed down from generation to generation through traditional methods. However, these SMEs are now challenged to embrace digital transformation. This presents a shift and an opportunity for SMEs in West Sumatra to transform their Minangkabau SMEs entrepreneurial culture from a social perspective (Games, 2024) to digital transformation (Armadia et al., 2026), enabling them to compete with their rivals.

One digital transformation tool that can be used by SMEs entrepreneurs in West Sumatra is the TRI (Technology Readiness Index). The TRI can be used as a tool to measure the attitude of SMEs entrepreneurs in West Sumatra towards adopting technological innovations that are highly beneficial for their business development. The TRI can measure the readiness of SMEs entrepreneurs in West Sumatra to adopt new technologies in their businesses, or the resistance they may show. This may cause the business activities conducted by SMEs entrepreneurs in West Sumatra to lag far behind those of other entrepreneurs who are open to adopting new technologies (Putri et al., 2022).

The role of technology in customer–firm interactions and the number of technology-based products and services have grown rapidly. Although this development has benefited customers, there is also evidence of increased customer frustration when dealing with technology-based systems. Drawing on insights from existing literature and extensive qualitative research on customer reactions to technology, this article first proposes the construct of societal technological readiness and discusses its conceptualisation. It then outlines the research programme undertaken to operationalise the construct, develop and refine a multi-item scale to measure it, and assess the scale's psychometric properties.

This article concludes with a discussion of the potential practical applications at scale and the agenda for further research aimed at deepening our understanding of the role of technology in marketing and customer service. To measure entrepreneurs' capacity to adopt technologies such as AI, the Technology Readiness Index (TRI) model is used.

The level of entrepreneurs' technological readiness in West Sumatra must be further enhanced so that they are willing to conduct digital-based businesses and shift away from traditional enterprises. Although SMEs are a significant contributor to the economy of West Sumatra, SMEs entrepreneurs in the region still face challenges in adopting integrated technology. This results in these entrepreneurs lacking the ability to compete in the digital transformation era (Parasuraman in Lestari et al., 2025).

Therefore, the research gaps this conceptual paper seeks to address is by proposing a conceptual framework that links entrepreneurs' individual technological readiness with their capacity to accept and adopt AI, with the unique cultural characteristics of the Minangkabau entrepreneurial community in West Sumatra. Previous literature on digitalisation has not comprehensively addressed how entrepreneurial psychological traits, cognitive literacy, entrepreneurial orientation, and external institutional support interact to overcome barriers to AI adoption. Through the construction of a critical conceptual framework, this conceptual paper is hoped to provide comprehensive guidance for overcoming technological barriers, thereby enabling an inclusive AI transformation among SMEs entrepreneurs in West Sumatra.

Literature Review

Minangkabau Entrepreneurial Culture and Digital Transformation

The entrepreneurial culture of SMEs in West Sumatra is uniquely dominated by the Minangkabau ethnic group. The Minangkabau people involved in long distance merchant trading long ago and they migrated from one state to another, far away from their homeland, for a living, trade and education (Games, 2024). Minangkabau entrepreneurs' identities have been influenced by their migratory experience; they are self-reliant, resilient, flexible, and have excellent social and negotiating abilities. Traditional, useful techniques are used to transmit this trading culture from one generation to the next. However, in the contemporary digital era, Minangkabau SMEs entrepreneurs have a difficult time striking a balance between the necessity for quick digital transformation and the ideals of traditional trade culture (Games, 2024).

SMEs in West Sumatra are experiencing a cognitive and social shift as a result of digital transformation. Traditional entrepreneurs take great satisfaction in their ability to haggle, but the transition from direct physical (face-to-face) interaction to non-face-to-face digital transactions is frequently seen as stiff. However, the integration of cutting-edge technology is crucial for SMEs in West Sumatra to effectively compete with competitors at the national and international levels. The Resource-Based View (RBV), which highlights the significance of a firm's dynamic capabilities and distinctive resources in attaining a sustained competitive advantage, can be used to analyze this shift (Barney, 1991), as well as the Diffusion of Innovations theory by Rogers (2003), which explains how an invention gradually becomes part of a society's social structure.

Entrepreneurs' Technology Readiness Index

To measure the propensity of SMES entrepreneurs to adopt advanced technologies such as AI, the Technology Readiness Index (TRI) model developed by Parasuraman (2000) and updated to TRI 2.0 by Parasuraman and Colby (2015) is used as the primary theoretical instrument. Unlike other technology adoption models that focus on specific system perceptions (such as TAM or UTAUT), the TRI measures an individual's general mental disposition as a kind of “technology personality” that determines their readiness to engage with technology-based innovations. The TRI construct is built from the dynamic interaction between four key dimensions, which are divided into two categories:

Drivers of Technological Readiness (Contributors):

- 1) Optimism, which is the entrepreneur's positive outlook on technology's ability to enhance efficiency, control and flexibility in both life and business; and
- 2) Innovativeness, which is the entrepreneur's self-confidence in their capacity to be an early adopter pioneering the use of new technologies.

Technology Availability Inhibitors:

- (1) Discomfort, the feeling that technology is complicated, difficult to understand, rigid, and inflexible to adapt to traditional business needs; and
- (2) Insecurity, which is a deep concern about digital security aspects, fear of online fraud, leaks of confidential data, and distrust in automation systems.

Based on a secondary empirical study by Chandra et al. (2024) on SMEs entrepreneurs in West Sumatra, it was found that the overall level of technological readiness among the entrepreneurs was at a moderate (moderate-low) level, with an average TRI score of 3.06. The most critical finding from the study is the classification of the West Sumatran SMEs technology user profiles into five adopter categories based on the model of Parasuraman and Colby (2001 & 2015). The distribution data for these entrepreneur categories is detailed in Table 1 below:

Table 1: Profile of Technology Readiness of SMEs Entrepreneurs in West Sumatra

Adopter Category	Description of SMES Entrepreneur Mental Characteristics	Percentage (%)
Explorers	Very optimistic, innovative, and brave enough to try new technologies straight away without hesitation.	24%
Paranoids	Seeing the potential of the technology but very concerned about security, privacy and the risk of fraud.	31%
Pioneers	Optimistic and keen to use technology, but often hampered by technical constraints and in need of guidance.	12%
Sceptics	Sceptical, distrustful of the benefits of new technology, and only using it when necessary or as a last resort.	12%
Laggards	Very resistant to change, highly reliant on traditional, conventional methods, and opposed to digital innovation.	21%

Source: Adapted from Chandra et al. (2024).

A critical analysis of the above data reveals a significant challenge: the group of entrepreneurs classified as Paranoids (31%), Sceptics (12%), and Laggards (21%) accounting for 64% of the total SMEs population. This suggests that the majority of West Sumatra entrepreneurs have

substantial psychological obstacles to implementing new technologies, which are motivated by unease and insecurity. Only 9% of entrepreneurs are interested in financial technology like P2P lending because of this lack of confidence and high level of concern (Chandra et al., 2024). Thus, before introducing them to more sophisticated AI technology, this cognitive barrier becomes a significant obstacle that needs to be overcome.

The Importance of Digital Literacy

One important factor influencing the effectiveness of company transformation is the level of digital literacy among SMEs' owners. Based on the foundational concept by Gilster (1997), Digital literacy now encompasses a sophisticated "cognitive and socio-emotional capacity" to critically comprehend, assess, filter, and use information from diverse digital sources in everyday situations rather than just "technical operational skills" (such typing or clicking buttons). The ability of entrepreneurs to make data-driven strategic decisions is heavily emphasized by digital literacy (Gilster, 1997).

One of the main obstacles preventing SMEs in West Sumatra from innovating is a lack of digital literacy (Nurlina et al., 2023). Entrepreneurs are vulnerable to major digital security concerns including fraud, phishing, and the theft of private company information when they are unable to comprehend how digital platforms operate. As a result, their TRI model's insecurity component rises. Therefore, increasing entrepreneurs' trust in AI requires a thorough improvement in digital literacy.

Entrepreneurial Orientation

For SMEs entrepreneurs, Entrepreneurial Orientation (EO) is the cornerstone of strategic thinking. Referring to the classic framework by Miller (1983) as well as Covin and Slevin (1989), Three complementing primary behaviors are used to characterize EO: (1) Innovativeness, which is the propensity to encourage new concepts, inventions, experiments, and creative processes; (2) Proactiveness, which is the capacity to foresee future market demands and take action before rivals; and (3) Risk-taking, which is the readiness to commit corporate resources to initiatives with uncertain outcomes (Miller, 1983; Covin & Slevin, 1989). Due to the instrument's shown flexibility and suitability for use in small-scale business management, these three elements must be implemented concurrently.

The Minangkabau trading culture, which places a strong focus on proactive initiative, autonomy, and leadership quality, has a significant impact on these EO traits. In West Sumatra, SMEs with high EO scores typically have a greater readiness to take chances when implementing digital technologies, such as artificial intelligence (Nurlina et al., 2023). However, EO does not directly affect performance; instead, a mediator variable is needed to convert strategic attitudes into observable business results.

Innovation Capability as a Mediator

In order to rectify the attribution problems in the prior draft and guarantee the precision of scholarly references, the Innovation Capability construct in this study is referred to the model of Putri and Susanto (2022) (rather than Lumpkin & Dess, 1996, which describes the aspects of competitive and proactive aggression). A company's dynamic capacity to convert innovative concepts, expertise, and tactics into new business procedures, systems, goods, or services that add value to the market is known as innovation capability (Putri & Susanto, 2022). According

to the suggested conceptual framework, innovation capability plays a crucial mediating role between the performance of entrepreneurial AI adoption and entrepreneurial orientation (EO).

Scaffolding Theory Vygotsky & DiMaggio & Powell's Institutional Isomorphism

This subsection critically introduces Vygotsky's Socio-Cultural Theory (1978) and DiMaggio and Powell's (1983) Theory of Institutional Isomorphism as a foundational supporting theory that supports the suggested ecosystem intervention in order to avoid the problem of "theoretical drift" that startled readers in the previous draft (where these theories suddenly appeared in the implications section without their foundations being discussed).

The Zone of Proximal Development (ZPD) and scaffolding were first proposed by Vygotsky in his 1978 theory. According to this theory, learning and the development of a person's cognitive abilities are not isolated or immediate processes; rather, they are accomplished through systematic direction from a "More Knowledgeable Other" (MKO) prior to reaching complete independence. In this regard, SMEs in West Sumatra fall under the ZPD of AI technology; without "scaffolding" (training, funding, and technical advice) supplied gradually by outside organizations, they are unable to make the natural shift from traditional business to AI automation.

The Theory of Institutional Isomorphism by DiMaggio and Powell (1983) then addresses how institutional environmental forces cause organizations or business units to adapt and become similar (isomorphic). There are three primary mechanisms of isomorphism: (1) Coercive Isomorphism, which results from formal or informal pressure from authorities, such as government policies; (2) Mimetic Isomorphism, where organizations mimic the practices or structures of other organizations deemed more successful in order to deal with market uncertainty; and (3) Normative Isomorphism, which is motivated by common social and professional norms. This theory is extremely pertinent to the explanation of why West Sumatra's socio-religious and local government organizations—like the Provincial Government, the MUI, and merchant associations—play a critical role in fostering a normative ecosystem and positive pressure that pushes SMEs to embrace AI.

Conceptual Framework for AI Adoption

This concept paper offers a comprehensive Conceptual Framework for AI Readiness and Adoption based on the critical evaluation and literature highlights synthesis mentioned above. This framework is intended to show how entrepreneurial traits (Digital Literacy and Entrepreneurial Orientation), the technological readiness dimension (TRI 2.0), the mediating function of Innovation Capability, and the moderating effects of collaborative ecosystem support (Open Innovation and Engagement Theory) are dynamically interrelated. The conceptual framework is represented in Figure 1:

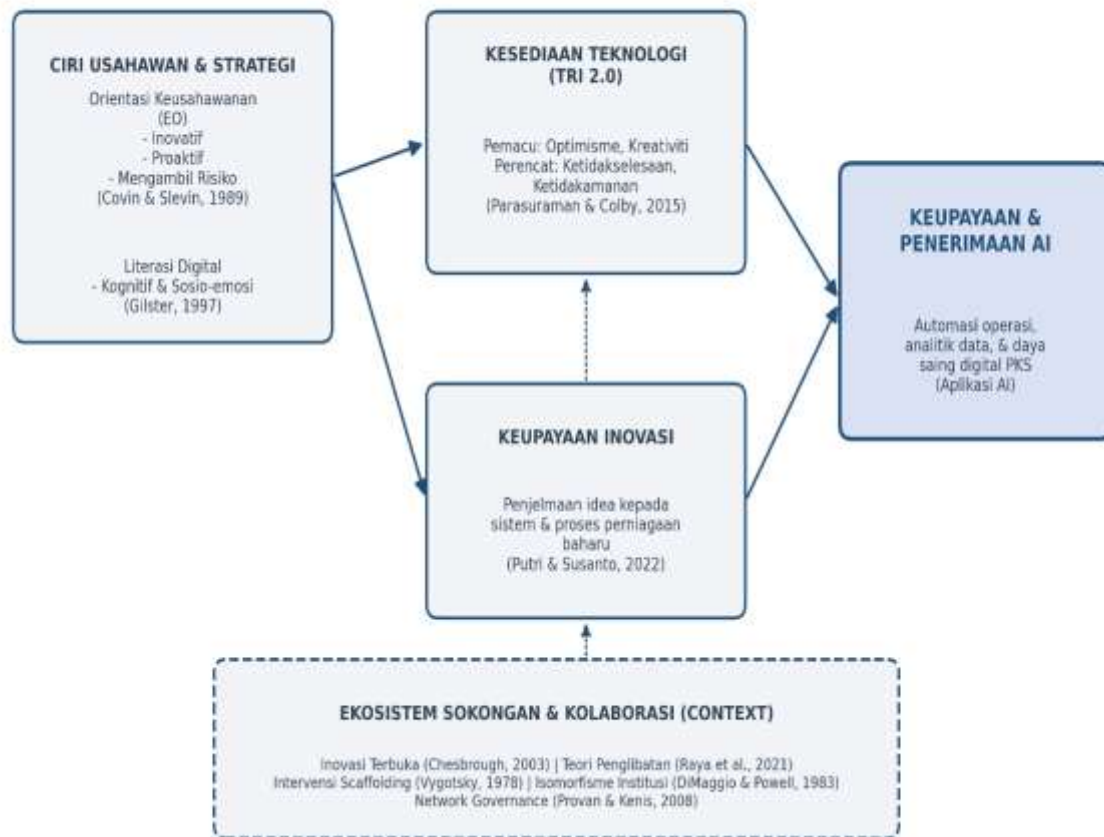


Figure 1: Conceptual Framework of AI Readiness and Adoption among SMES Entrepreneurs.

According to this conceptual framework, entrepreneurs' intrinsic capacities are shaped by independent variables (antecedents) such as digital literacy and entrepreneurial orientation (EO). The levels of Technology Readiness (TRI 2.0) and the entrepreneurs' Innovation Capability are simultaneously influenced by both of these antecedents. Efforts to improve technology readiness must concentrate on lowering the inhibitor dimensions (discomfort and insecurity) rather than just encouraging technological sophistication because the vast majority of West Sumatra entrepreneurs (64%) are categorized as Paranoids, Sceptics, and Laggards (Chandra et al., 2024) (Parasuraman & Colby, 2015). Furthermore, Innovation Capability acts as a mediator linking EO with the actual performance outcomes of AI adoption (Putri & Susanto, 2022).

This conceptual paper also integrates the Open Innovation model by Chesbrough (2003) and the Engagement Theory by Raya et al. (2021) as an external collaborative approach. Given that SMES entrepreneurs have very significant resource constraints (with 99.77% having capital of < 1 billion Rupiah), they are unable to build, buy, or operate AI technology on their own. To improve their capacity for digital innovation, SMEs' business models must make use of outside cooperation, information exchange, and expertise sharing with a variety of stakeholders,

including the government, academic institutions, financial institutions, and technology suppliers.

Conceptual Discussion and Implications

According to this framework's critical analysis, the adoption of cutting-edge technologies like artificial intelligence (AI) cannot possibly happen naturally or be left up to the market without aggressive and structured intervention, since the majority of SMEs in West Sumatra still fall into a high-resistance zone (Chandra et al., 2024). If the entrepreneurs' self-efficacy in managing such intelligent systems is lacking, basic technology literacy is insufficient (Compeau & Higgins, 1995). It is necessary to help entrepreneurs develop the cognitive confidence that they can manage AI for the growth of their companies. Two aspects of strategic intervention are suggested in order to put this conceptual framework into practice:

Scaffolding Theory-Based Practical Education Intervention

In order to provide targeted, phased training infrastructure and "Scaffolding" programs, the regional government (West Sumatra Provincial Government), educational institutions, and religious organizations (like the West Sumatra regional MUI) must work together as authoritative institutions in accordance with Vygotsky's Theory (1978). This system is essential for helping entrepreneurs move from the fear zone (paranoid) to the adaptive zone (explorer/pioneer). Three methodical stages of execution are suggested for this scaffolding model:

Phase 1: Building a Foundation (Basic Digital Literacy):

By educating fundamental cybersecurity concepts, customer data protection, and the usage of safe digital transaction platforms, the main goal is to eradicate digital insecurity. This instruction is given in a laid-back style with a focus on local culture.

Phase 2: Operational Integration (Simple Automation Systems):

Following the development of digital confidence, entrepreneurs receive coaching on basic operational automation, such as digital inventory management, automated digital bookkeeping, and e-commerce connected with simple data analytics systems.

Phase 3: AI Democratisation (Practical AI Applications): At this stage, scaffolding (support) is gradually reduced as the entrepreneur's self-sufficiency increases. Entrepreneurs are introduced to free generative AI applications for marketing content creation, the use of chatbots for automated customer service, and simple seasonal demand forecasting systems.

This approach is in line with the concept of Normative Isomorphism and Coercion (DiMaggio & Powell, 1983). The active involvement of community figures and religious institutions in West Sumatra, where the community strictly adheres to the adat principle "Adat Basandi Syarak, Syarak Basandi Kitabullah" (a society based on Islamic law), will provide entrepreneurs with strong moral and social legitimacy to adopt digital technology as part of sharia-compliant and divinely sanctioned economic endeavours.

Open Innovation-Based Collaborative Networks

To overcome the capital constraints faced by 99.77% of SMES entrepreneurs in West Sumatra (BPS West Sumatra Region, 2024), strategic collaboration through a Network Governance

approach is crucial. Referring to Provan and Kenis (2008), effective network governance (such as Lead-Organization-Led or Network Facilitation Organization) can unite diverse entities to achieve collective goals that are unattainable individually. The integration of the concepts of Open Innovation (Chesbrough, 2003) and Engagement Theory (Raya et al., 2021) suggests the establishment of a Quadruple-Helix Network Ecosystem comprising four main actors:

Local Authority (West Sumatra Provincial Government)

Acts as a provider of positive coercive isomorphism through supportive policies, subsidised internet financing in remote districts, and the provision of SMEs digital incubator zones.

Academic Institutions (Universities)

Local universities such as Universitas Andalas (UNAL) and Universitas Negeri Padang (UNP) act as knowledge providers (MKO). Students and lecturers can go into the field through community service programmes to deliver continuous AI scaffolding training.

Private Sector & Technology Providers (Fintech & AI Providers)

Provide low-cost, user-friendly AI technology solutions adapted to the local language, as well as providing access to alternative financing such as strictly screened P2P Lending.

MSMES Entrepreneur Community (Associations & Cooperatives)

Act as a platform for peer-to-peer best practice sharing (peer learning), reducing the discomfort dimension through positive mimicry (imitating successful business peers).

Through this organised network governance, financial risks and technical uncertainties in adopting AI can be shared. This will increase the self-assurance of small and medium-sized business owners, remove mental obstacles (insecurity), and allow them to take advantage of AI technology's benefits to increase the added value of West Sumatran local goods.

Conclusion And Recommendations

Conceptually, the degree of digital literacy, the entrepreneurs' entrepreneurial orientation, and the efficacy of lowering technological insecurity all interact dynamically to determine how well SMEs entrepreneurs in West Sumatra can use and adopt Artificial Intelligence (AI) technology. Digital transformation cannot occur naturally since local entrepreneurs' technology readiness score (TRI 2.0) is still at a low-middle level (score 3.06), with 64% of the population in the resistance zone (Chandra et al., 2024). Structured educational programs, focused digitalization drivers, and inclusive local policies are crucial.

As a policy implication, Indonesia local government should stop implementing inefficient one-time digital training programs and instead work with nearby institutions to create long-term mentoring programs based on the scaffolding model. To close the digital divide, governments should also give special attention to building digital infrastructure outside of West Sumatra's major cities. To reduce financial and technological risks, SMEs' owners must actively cultivate an entrepreneurial mindset and take part in network governance.

Acknowledgement

Thank you for Faculty of Economics and Business, Universitas Negeri Padang, Indonesia and Faculty of Management and Economics, Universiti Pendidikan Sultan Idris, Malaysia, which give supported for this publication.

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