GUIDING TRANSFORMATION: A THREE-DIMENSIONAL FRAMEWORK FOR DIGITAL MATURITY AND AI INTEGRATION IN MALAYSIAN SMES

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Abstract. The rapid changes occurring in the current digital landscape present significant hurdles for Malaysian Small and Medium Enterprises (SMEs), particularly in establishing sufficient digitalization maturity and successfully incorporating Artificial Intelligence (AI) technologies into their operations. Despite the growing accessibility of various digital resources, a stark reality is that a mere 6.8% of Malaysian SMEs are currently equipped to fully embed AI across all their business activities. This research endeavours to bridge this critical deficiency by formulating a comprehensive strategic framework that directly links organizational maturity in digitalization with their readiness to adopt AI. A systematic literature review was executed using the PRISMA methodology, meticulously examining 60 peer-reviewed scholarly articles retrieved from prominent academic databases. Drawing upon these crucial insights, the study proposes a targeted, three-dimensional framework designed specifically to navigate the digital transformation journey for Malaysian SMEs. This framework is comprised of three core components: (1) Digital Infrastructure and Capability, (2) Strategic Alignment and Governance, and (3) Innovation and Value Creation. This structured framework offers actionable, practical guidance aimed at overcoming the prevalent challenges associated with advancing digitalization maturity and successfully implementing AI, creating a clear, sustainable route for the digital transformation of Malaysian SMEs.
Keywords: *digital maturity, AI integration, SMEs in Malaysia, digital transformation, strategic framework, PRISMA*

Introduction

Malaysia is prioritizing its digital development, evident in initiatives like the Ministry of Education's 2019-2023 ICT Transformation Plan designed to improve digital learning (Hamzah et al., 2021). Malaysia is prioritizing its digital transformation, demonstrated by the strategic 2020 budget allocation intended to move the nation toward a digital-first, high-income economy (Haron et al., 2023). The focus on digitalization now includes SMEs, with studies indicating that digital marketing, data-driven decisions, and agility are crucial for their success within Malaysia's changing digital environment (Nurlan et al., 2024). Moreover, integrating digital technologies such as Artificial Intelligence (AI) is vital for SMEs to significantly boost their competitiveness and stimulate growth (González-Varona et al., 2021). The maturity of digitalization is crucial for SMEs because they must develop adequate digital capabilities in order to succeed within the digital economy (González-Varona et al., 2021). Studies underscore that SMEs must invest in digital skills development and innovation as a necessary step to enhance their competitiveness (Hu, 2024). In addition, utilizing online marketplaces and employing digital marketing innovations are recognized as principal strategies for SMEs to achieve a competitive advantage in Malaysia (Dass and Md Johar, 2022; Jaafar and Khan, 2022). Furthermore, the

widespread use of digital signatures and e-invoicing is essential for propelling Malaysia's digital economy forward and improving its overall competitiveness (Azni et al., 2024; Hong, 2024). Jaish et al. (2023) emphasized the significance of SMEs as a major economic driver in Malaysia, noting that they contribute 98.5% to the country's economy. Moreover, Wahab et al. (2019) stated that SMEs are key contributors to Malaysia's economic growth and are essential in shaping the economic environment to help the nation achieve high-income status. A large number of SMEs in Malaysia are currently in the early stages of digital maturity, as indicated by the fact that only 6.8% are fully ready to effectively utilize AI technologies (DNA, 2019). Many SMEs find it difficult to integrate digital transformation across their operations, frequently resulting in strategies that run in parallel and are not properly aligned (Hải, 2021).

Literature review

Digital maturity in SMEs

Digital maturity is vital for SMEs, particularly within Malaysia, as they work to navigate and succeed in the continually evolving digital landscape. Studies have defined the different dimensions of digital maturity for SMEs, stressing the need for these companies to improve their digital capabilities so they can remain competitive (Omol et al., 2023). Assessing the digital maturity of SMEs is critical for achieving sustainable socio-economic development, leading to the creation of models that evaluate this maturity using diverse criteria and indicators. During the COVID-19 pandemic, SMEs responded distinctively based on their digital maturity level; some rapidly accelerated their transformation, while others concentrated only on specific digital functions (Priyono et al., 2020). A conceptual model for SME digital transformation was suggested in Indonesia, stressing the need to tailor adaptation strategies based on their digitalization maturity, literacy, and liquidity capabilities (Muditomo and Wahyudi, 2021).

Additionally, integrating AI technologies is acknowledged as a core element for improving SME efficiency, strengthening decision-making processes, and boosting overall performance (Prasanna et al., 2019). The embrace of AI, alongside technologies like Fintech and cybersecurity, offers SMEs significant potential for fueling growth and innovation (Okoye, 2024). Strategies including machine learning algorithms, natural language processing (NLP), and predictive analytics have been suggested for SMEs to improve brand equity and deepen customer engagement in the digital era (Indrasari, 2024). Overall, for SMEs in Malaysia to effectively utilize digital technologies, maintain competitiveness, and achieve sustainable growth in the digital era, understanding and improving their digital maturity is essential.

AI integration in SMEs

The process of Small and Medium-sized Enterprises (SMEs) adopting Artificial Intelligence (AI) offers both potential benefits and challenges. Although larger companies have significantly progressed in using AI applications, SMEs face distinct obstacles that slow their adoption, including insufficient financial and human resources (Schönberger, 2023). It is vital to understand the current level of AI adoption among SMEs, given that this factor can significantly affect both their competitiveness and operational efficiency. Research suggests that AI could potentially improve SME operational efficiencies, strengthen customer engagement, and accelerate product

innovation (Charllo, 2024). However, the successful integration of AI within SMEs demands targeted strategies to effectively overcome challenges and maximize its benefits (Tominc, 2024). The challenges SMEs face in adopting AI include financial limitations, a lack of expertise, and the difficulty associated with implementing complex AI solutions. Successfully overcoming these challenges can lead to enhanced efficiency, better regulatory compliance, and contribute significantly to sustainable development (Baena-Navarro, 2024). Conversely, the potential benefits of AI adoption for SMEs are extensive, covering improvements in decision-making processes, greater productivity, and elevated customer experiences (Schönberger, 2023). By tackling these challenges and utilizing the benefits of AI, SMEs can effectively position themselves for both growth and competitiveness in the digital era.

Strategic frameworks for digital transformation

Established frameworks for digital transformation are essential for guiding Small and Medium-sized Enterprises (SMEs) toward successful digitalization. These frameworks provide structured ways for SMEs to manage the difficulties of digital transformation and boost their competitiveness. For instance, the Reasonable Digital Transformation Model for SMEs emphasizes the key strategies of becoming a digital business, digitizing operations, and collaborating with digital partners (Muditomo and Setyawati, 2022). Furthermore, research highlights that frameworks are crucial for evaluating SME readiness, considering the impact of Industry 4.0, and guiding digital transformation efforts (Parra-Sánchez, 2023; North et al., 2019). These frameworks help SMEs understand their digitalization level, create organized digital roadmaps, and address limitations concerning resources (Re et al., 2023a). Moreover, these frameworks are useful for addressing challenges unique to SMEs, including resource limitations, knowledge deficits, and the essential mindset shifts required for successful digital transformation (Yuen and Baskaran, 2024). By employing these frameworks, SMEs can leverage the potential benefits of digital transformation, such as greater efficiency, improved customer experiences, and sustainable growth (Yuen and Baskaran, 2023; Priyono et al., 2020). In conclusion, reviewing existing frameworks emphasizes the critical need for tailored strategies that allow SMEs to successfully adopt digitalization, stay competitive, and achieve enduring business performance in the digital era.

Gaps in literature

The fragmented nature of digital transformation strategies used by SMEs in Malaysia represents a significant gap in the existing literature that requires attention. Existing research emphasizes that tailored strategies are important for SMEs to successfully manage digital transformation. However, there is a shortage of comprehensive frameworks specifically created to deal with the unique challenges that SMEs in Malaysia encounter when adopting digital technologies. This study seeks to bridge this gap by identifying the key AI applications for SMEs, exploring the associated benefits and challenges, and assessing their impact on business processes (Schönberger, 2023). By concentrating on the specific environment of SMEs in Malaysia, this research aims to offer insights for developing cohesive and effective digital transformation strategies that can boost the competitiveness and sustainability of these enterprises.

Materials and Methods

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was selected for the systematic literature review because of its structured approach, which involves key steps such as identification, screening, eligibility analysis, and inclusion. This methodology guarantees transparency, replicability, and rigor throughout the review process (Iliescu et al., 2024; Albuquerque et al., 2021). Following PRISMA guidelines allows researchers to systematically collect, evaluate, and synthesize relevant literature, which results in a comprehensive overview of existing knowledge on a particular topic (Sina et al., 2023; Riaño et al., 2022). The PRISMA framework is broadly accepted and recognized as the standard for systematic reviews across different fields, which in turn improves the credibility and quality of research outputs (Jacobs et al., 2019). The data collection process for a systematic literature review involves several key steps, and the findings are the result, as shown in *Figure 1*. Firstly, establishing eligibility criteria and identifying information sources is essential. This step involves defining the research question, choosing relevant databases, and determining appropriate search terms (Sevgi, 2021). Next, both practical and methodological screening are employed to identify studies that satisfy the established criteria (Sevgi, 2021). Data collection requires extracting pertinent information from the chosen studies for subsequent analysis (Ngsurukh et al., 2021). A clear research question guides the systematic review process, guaranteeing thorough literature collection and data extraction (Turkson et al., 2021). The PRISMA methodology offers a structured approach that encompasses defining inclusion and exclusion criteria, selecting databases, screening studies, and collecting data (Szewczyk et al., 2022).

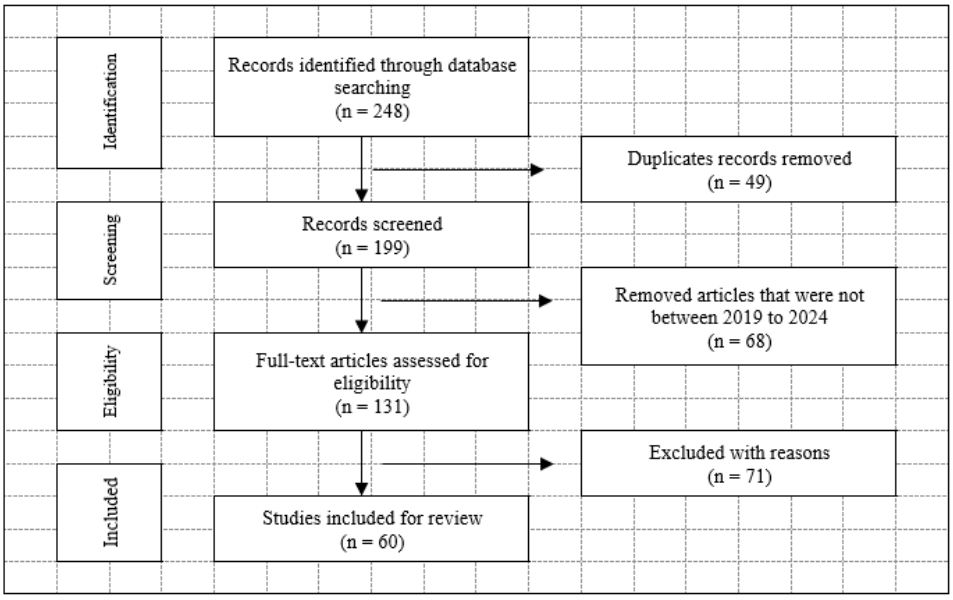

Figure 1. *PRISMA selection process of relevant literature.*
Source: Regona et al. (2022).

Results and Discussion

Digital infrastructure and capability

The significance of strong technological foundations and expert human resources is essential for Small and Medium-sized Enterprises (SMEs) in the current digital era. Research consistently shows that SMEs possessing advanced technological capabilities and a digitally skilled workforce are better able to improve their competitiveness, operational efficiency, and overall performance (Blažinauskytė, 2023; Kádárová et al., 2023). A solid digital infrastructure allows SMEs to streamline processes, enhance decision-making, and efficiently adapt to evolving market demands (Omrani et al., 2024; Hải, 2021). Skilled human resources are essential for driving digital transformation initiatives within SMEs, as they are crucial for both implementing and maximizing the benefits of digital technologies (Ahmad, 2024; Brink et al., 2023). Practical recommendations for SMEs to boost their digital infrastructure and capability involve investing in technology resources, offering ongoing training to upskill employees, and cultivating an organizational culture of innovation and digital literacy (Sibiya, 2023; Lei et al., 2022). Collaborating with external partners or consultants can also help SMEs by providing access to specialized expertise and guidance for their digital transformation efforts (Jadhav et al., 2023; Muridzi, 2023). Adopting Industry 4.0 technologies, like the Internet of Things (IoT) and digital marketing tools, can significantly improve SMEs' operational efficiency and market adaptability.

Strategic alignment and governance

Aligning digital initiatives with organizational goals and ensuring effective leadership are vital for Small and Medium-sized Enterprises (SMEs) to achieve success in their digital transformation efforts. The necessity for strategic alignment is emphasized by the importance of integrating digital strategies with broader business objectives to spur growth, innovation, and competitiveness (Sagala and Őri, 2024; Warner and Wäger, 2019). Effective leadership is critical for guiding digital transformation initiatives, promoting a culture of innovation, and ensuring that digital efforts are consistent with the organization's vision and values (Khanzad and Gooyabadi, 2022; Trenerry et al., 2021). SMEs can implement several strategies to achieve strategic alignment and governance in their digital transformation efforts. Firstly, SMEs should thoroughly assess their current digital capabilities, identify any gaps, and ensure digital initiatives are aligned with their long-term business goals (Re et al., 2023b; Ta and Lin, 2023). Developing a digital strategy roadmap that details key milestones, resource allocation, and performance metrics can help SMEs remain on schedule and evaluate the impact of their digital initiatives (Awonuga, 2024; Fernández et al., 2023). Additionally, investing in employee training and development to boost digital skills, cultivating a culture of continuous learning and innovation, and setting up clear governance structures can further support strategic alignment during digital transformation (Prihandono, 2024).

Innovation and value creation

Artificial Intelligence (AI) is a primary driver of innovation for Small and Medium-sized Enterprises (SMEs), allowing them to create new business models, improve customer value, and achieve a competitive advantage. Previous research has shown that

AI significantly improves operational efficiencies, customer engagement, and product innovation for SMEs (Charllo, 2024). By using AI technologies, SMEs can access data-driven insights for better decision-making, operational efficiency, and personalized customer experiences (Okoye, 2024). Embracing AI empowers SMEs to innovate, streamline processes, and respond effectively to market changes. SMEs can implement diverse strategies to maximize customer value and gain a competitive edge by utilizing AI. Firstly, it is crucial to invest in AI technologies that align with business goals and customer needs, such as AI-powered chatbots for better customer service (Sharma et al., 2024). Additionally, utilizing AI tools for data analytics allows SMEs to understand customer preferences and behaviors, which helps in creating personalized marketing strategies and product offerings (Badghish and Soomro, 2024). Collaborating with AI service providers or consultants can furnish SMEs with specialized expertise for the effective implementation of AI solutions (Dass and Md Johar, 2022). Furthermore, promoting AI literacy among employees and providing training programs can improve the organization's capability to leverage AI for innovation and growth (Indrasari, 2024).

Proposed framework

Due to the rapid digital transformation in business, Small and Medium-sized Enterprises (SMEs), especially in Malaysia, must improve their digitalization maturity and effectively integrate Artificial Intelligence (AI) to maintain competitiveness. This framework provides a three-dimensional model to assist SMEs in Malaysia with evaluating and enhancing their digital capabilities, strategic alignment, and innovation potential. The framework stresses the importance of establishing strong digital infrastructure, ensuring AI initiatives align with business strategies, and cultivating innovation to maximize AI's full potential. The chart in *Figure 2* visually represents the three-dimensional framework across three key axes: Digital Infrastructure and Capability, Strategic Alignment and Governance, and Innovation and Value Creation. Collectively, these dimensions represent the essential elements that determine an SME's maturity in digitalization and their readiness for AI integration. The green area within the chart highlights the designated AI Integration zone. This area suggests that SMEs with high levels of strategic alignment, innovation, and digital infrastructure are better prepared to successfully adopt and integrate AI technologies. These businesses are more likely to harness the benefits of AI, including improved decision-making and greater operational efficiency. The blue area signifies the Digital Maturity zone, which represents the broader digital capabilities of SMEs. SMEs in this zone have achieved moderate to high levels of digital infrastructure, strategic governance, and innovation. These businesses are more adaptable to the rapidly evolving digital environment and are able to leverage digital tools and AI to sustain both growth and competitiveness.

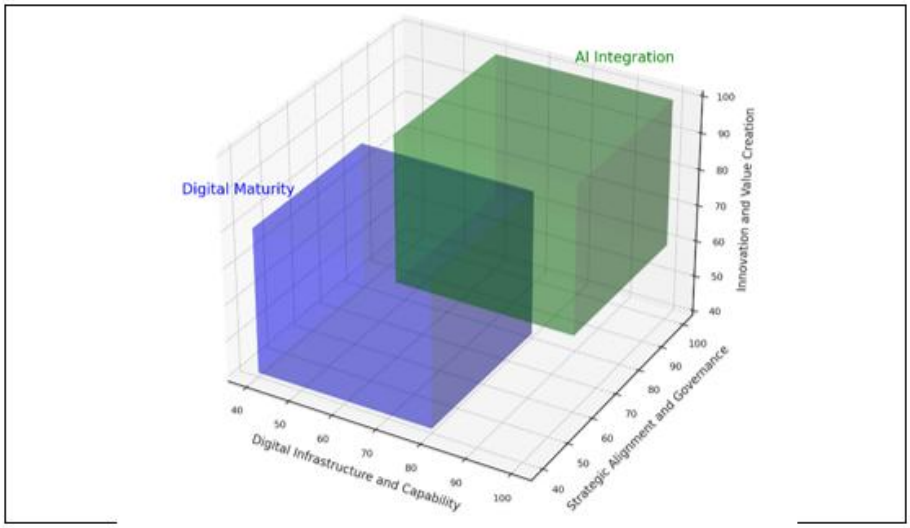

Figure 2. *Three-dimensional framework for digital transformation strategies in SMEs in Malaysia.*

Conclusion

The maturity in digitalization and AI integration within SMEs in Malaysia are crucial factors for their sustained competitiveness and growth in the evolving digital economy. The proposed three-dimensional framework stresses the necessity for SMEs to build strong digital infrastructure, guarantee strategic alignment, and cultivate innovation. Although Malaysia's digital landscape has made significant progress, a considerable number of SMEs are still in the early stages of digitalization maturity. This framework acts as a guide for these businesses to enhance their digital capabilities, align AI initiatives with their business objectives, and drive innovation to maintain competitiveness. The analysis demonstrates that SMEs with robust digital foundations, strategic governance, and an emphasis on innovation are better prepared to utilize AI technologies. However, the challenges posed by limited financial and human resources, alongside the complexity of AI adoption, represent significant barriers. Overcoming these challenges through targeted strategies such as investing in digital skills, collaborating with external partners, and aligning digital initiatives with business goals, is essential for SMEs to utilize the benefits of AI. In conclusion, integrating AI within the digitalization maturity framework is not optional but a necessity for SMEs in Malaysia that aim to succeed in the digital age. This study offers a comprehensive approach to tackling the unique challenges of SMEs in Malaysia and emphasizes the need for a strategic, innovation-driven, and digitally mature method for AI integration. By following this framework, SMEs can significantly boost their competitiveness, operational efficiency, and capacity for innovation, thus contributing to Malaysia's wider economic goals.

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Conflict of interest

The authors confirm that there is no conflict of interest involved with any parties in this research study.

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