INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 14, Issue 12, (2024) E-ISSN: 2222-6990

AI Technology Utilization Mapping for Small Medium Enterprises: An E-commerce Perspective

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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v14-i12/24152 DOI:10.6007/IJARBSS/v14-i12/24152

Published Date: 14 December 2024

Abstract

With the popularization of AI technology, small and medium-sized enterprises can now leverage AI technology in e-commerce. However, there is a threshold for the use of technology, and the adoption of different levels of artificial intelligence technology also causes specific problems from the aspects of capital, technology, organizational structure, and enterprises. Due to the problems, this article aims to propose e-commerce process and mapping for AI utilization in SMEs. This article utilizes Google Scholar as the data source and selects 31 related literatures through classification to conduct literature research. Based on the classification of different levels of small and medium-sized enterprises, this article discusses the factors influencing enterprises' adoption of AI technology in business from the lens of technology, organization, and environment. Through a summary of existing research, artificial intelligence technology is categorized into three categories and five levels. The technologies at each level are then analyzed in detailed based on the descriptions, capabilities, and applications, with a focus on highlighting their technical and application characteristics. Finally, from an e-commerce perspective, this article attempts to map AI technology in e-commerce for small and medium-sized enterprises. This would initiate towards assisting enterprises at different levels to which they can utilize AI technology and effectively leverage it in e-commerce, and to address development challenges plus enhancing the competitiveness of their e-commerce operations.

Keywords: Artificial Intelligence, Intelligence Level, SMES, AI in E-commerce, AI Utilization Map

Introduction

With the development of the Internet, more and more small and medium-sized enterprises are expanding their product and service market through e-commerce. The Malaysian

government predicts that by 2025, approximately 76% of small, medium, and micro enterprises in the country will engage in e-commerce. They will also implement the "Digital Malaysia" digital economy development plan to promote the construction of digital infrastructure and adopt new-generation information technology (Economic Planning Unit, 2021). With the development of e-commerce, the level of informatization of enterprises is also continuously strengthened. Due to the weak capital and technical foundation, small and medium-sized enterprises need to invest significant manpower and time in technical tasks such as image processing and video production in the process of e-commerce operations (Sharma et al., 2022). Additionally, aspects like selection, pricing, promotion, settlement, and transportation in the e-commerce process require real-time intelligent management through an integrated multi-functional system to enhance efficiency and reduce costs (Mnyakin, 2020). Artificial intelligence technology can effectively address these requirements. The application of artificial intelligence technology in the field of e-commerce is considered suitable for enterprise operations.

The definition of small and medium enterprises varies slightly among different countries. Taking China and Malaysia as examples, enterprises are categorized into three groups based on their size: medium, small, and micro (Hashim, 2005; Chen, 2006). The specific requirements for annual operating income, number of employees, and other criteria for enterprises vary across different countries and industries (MIIT, 2011). Table 1 shows the classification criteria for small, medium, and micro enterprises (SMEs) in Malaysia (SME Corp Malaysia, 2013).

Table 1
Definition by Size of SMES Operation in Malaysia

	Manufacturing	Services &Other Sectors
Micro	Annual turnover of less than RM 300,000 or fewer than 5 full-time employees	Same as manufacturing
Small	Sales turnover from RM 300,000 to less than RM 15 million OR full-time employees from 5 to less than 75	Sales turnover from RM300,000 to less than RM 3 million OR full-time employees from 5 to less than 30
Medium	Sales turnover from RM 15 million to not exceeding RM 50 million OR full-time employees from 75 to not exceeding 200	Sales turnover from RM 3 million to not exceeding RM 20 million OR full-time employees from 30 to not exceeding 75

Enterprises with different types of standards, due to different operating revenues and personnel composition, exhibit distinct requirements for operational enhancement. These requirements determine their adoption of AI technology and what level of technology they embrace. For enterprises, they are generally influenced by technology, organization, and the environment.

In the field of e-commerce, AI technologies such as intelligent chatbots, image recognition, and intelligent recommendations have been preliminarily applied, providing a lot of convenience and efficiency improvements for the development of enterprise e-commerce (Halima et al., 2022). However, there is a threshold for the use of technology, and the adoption of different levels of artificial intelligence technology also causes specific problems from the aspects of capital, technology, organizational structure, and enterprises (Crockett et

al., 2021). Due to the problems, this article aims to propose e-commerce processes and mapping for AI utilization in SMEs.

Literature Review

With the continuous progress and popularization of artificial intelligence technology, more and more small and medium-sized enterprises are beginning to recognize the importance and application value of artificial intelligence technology (Schlögl et al., 2019). However, due to the limitations of small and medium-sized enterprises in terms of capital and technology, they also face many challenges in adopting AI technology (Crockett et al., 2021). At the same time, in different countries and industries, due to the differences in technical systems, innovation systems, and other factors, the implementation of AI in small and medium-sized enterprises also exhibits regional and industrial disparities (Kinkel et al., 2022). Generally speaking, small and medium-sized enterprises are still in the exploratory stage of applying artificial intelligence. With the increasing popularity of AI technology and the decreasing costs, more and more small and medium-sized enterprises will be able to adopt AI technology (Ulrich & Frank, 2021).

Different scholars have conducted extensive research on the implementation of artificial intelligence in businesses. Hassan and Abdulkhaleq (2022) showed that artificial intelligence can improve the efficiency of enterprises, help enterprises obtain a stronger competitive position and better meet market demand. However, due to the difference in strength among enterprises, especially small and medium-sized enterprises, AI technology still has a certain threshold for them. Through a literature review, Govori and Sejdija (2023) found that the cost and technology of artificial intelligence are the biggest obstacles to the implementation of small and medium-sized enterprises. However, as costs decrease, the integrated use of artificial intelligence technology will become increasingly convenient. In addition, the business scale of enterprises also influences the scope and depth of AI technology that enterprises can use. Tom Butler et al. (2021) proposed a 5-level AI capability evaluation model and AI capability matrix. Enterprises can clearly determine the AI capability level achieved through the standards of various capabilities in the capability matrix and combine the capabilities of enterprises and AI. Andreas Kaplan et al. (2019) divided the evolution of AI into three stages: narrow sense, general purpose, and super. They outlined the characteristics of AI technology in each stage and pointed out that the current universal application is narrow sense AI. This delineation provides a clearer vision for the future development of AI. Serb Alexander et al. (2019) state that AI systems are composed of five different abstraction layers, ranging from the physical layer to the agent layer, each subject to complexity and performance trade-offs, which help in layering AI technologies from the infrastructure level. Andrew Kear et al. (2020) divided AI into three levels: system intelligence, neural intelligence, and transverse intelligence. Different levels correspond to various human participation requirements and have broad applications in different fields.

Based on the three-tier AI technology division and combined with the current application status, this article divides the AI level into five levels, and each level makes a detailed analysis of each level from three aspects: method, ability and application, to enrich the AI theory and enhance the application value to enterprises.

Research Methodology

Secondary data that is literature review was performed to develop the article. This is based on academic articles and industry white papers that are available in the public domain. The subtopic includes the definition of small and middle enterprises in Malaysia & China, the context of SMEs based on the Technology, Organization & Environment (TOE) model, and the level of AI technology. In order to ensure the objectivity and consistency of literature data collection, this research defines clear inclusion and exclusion criteria: English literature, comprehensive basic information, can browse the full text, content related.

Because Google Scholar is rich in academic information and sorted according to the relevance of retrieval, this research retrieved keywords from the Google Scholar database and selected the top ten search records as research data based on the research content of sub topics, the result shown in Table 2. And then, through reading the abstract and conclusions, we assessed the quality of the article, and the theme of the literature meet the research content, and finally select 31 articles as the final research data. Finally, according to the sub topic classification, the selected literature is summarized.

Table 2
Searches in Google Scholar Database

Database	Search	Search Results
Google Scholar	"levels of AI", "Hierarchy of AI", "classification of AI"	30
	"levels of SMEs in Malaysia"	10
	"SMEs adoption AI technology", "SMEs AI technology TOE"	20
	"SMEs process in e-commerce"	10

TOE Model and its Context for SMEs

The TOE model (Tornatzky and Fleischer, 1990) summarizes the influencing factors of an enterprise or organization on innovative technology into three levels: technology, organization, and environment. It is widely used in the research of enterprise technology adoption and various information systems. The technical level refers to the existing technology and the technology that has not been introduced or utilized by the enterprise. It is usually needs to consider technical advantages, compatibility, complexity, and other aspects, such as the adoption of artificial intelligence technology planned by small and medium-sized enterprises. The organizational level usually includes the enterprise scale, management structure, human resources, and its foundation, such as the support of the managers of small and medium-sized enterprises, enterprise technical ability. The environmental aspect generally refers to the influence from partners, competitors, or governments, which can be pressure or support, such as the encouraging policies of local governments for the digital upgrading of small and medium-sized enterprises.

At the technical level, the enterprise's informatization foundation and the technical capabilities determine the extent and scope of technical issues it can address, and significantly influence the complexity of the artificial intelligence technology it intends to implement (Baabdullah et al., 2021). Moreover, the AI technical competencies of human resources, the quality of data, and technological complexity can impede enterprises from effectively utilizing artificial intelligence technology (Bhalerao et al., 2022).

At the organizational level, the enterprise manager's desire for more advanced intelligent system technology to address issues in enterprise management, as well as their understanding and endorsement of technology, significantly influence the adoption of AI (Ikumoro & Jawad, 2019; Sharma et al., 2022). Additionally, the scale and financial capacity to support the implementation of new technology (Bhalerao et al., 2022), all play a decisive role in the use of AI technology.

At the environment level, the business pressure brought by competitors, partners, and customers is an important external driving force that determines whether an enterprise adopts artificial intelligence technology (Su et al., 2023; Badghish & Soomro, 2024), such as the demand for system integration and meeting customer demands. In addition, due to the resource constraints of small and medium-sized enterprises, the use of AI technology requires government support in terms of policies, technology, and other resources (Badghish & Soomro, 2024).

The influencing factors of AI technology adoption in SMEs are shown in Table 3. All types of enterprises need to make decisions and choices based on their own development. Due to different operational requirements and individual capabilities, the levels of AI technology that can be chosen and successfully used will also differ.

Table 3
Influencing Factors of SMEs Adoption of AI Technology under TOE Model

	Technology	Organization	Environment	Reference
TOE Model for SMEs Adopting AI	-Fundamentals of Informatization -Technical ability -Technical complexity -Data quality	-Executive support -Organization scales -Financial capacity	-Government support -External pressure (competitors, partners, customers)	Baabdullah et al., 2021 Bhalerao et al., 2022 Ikumoro & Jawad, 2019 Sharma et al., 2022 Su et al., 2023

Artificial Intelligence (AI) Technology Category

As an essential component of the new generation of information technology, artificial intelligence has made significant advancements in its theory, technology, and application after years of development, which has a profound impact on the development of society and the economy (Makridakis, 2017). With the widespread application of artificial intelligence technology, the first generation of artificial intelligence designed to solve specific tasks is the main application, also referred to as Narrow AI (Kaplan & Haenlein, 2019). Its intelligence is weak, generally lower than the level of human intelligence, and requires significant human activities to complete tasks. Examples include AI programs like ChatGPT, which has question-and-answer capabilities, and Copilot Designer, which can create images based on descriptions.

The second category is General AI, whose intelligence level is equal to that of human beings. It can solve problems in various fields and successfully complete tasks with minimal human intervention (Andrew et al., 2020). Applications such as intelligent manufacturing,

industrial automation systems, and smart city management systems are examples of General AI.

The third category is Super AI, which refers to self-aware artificial intelligence. Intelligence is superior to that of human beings, enabling it to autonomously complete and solve problems without human intervention (Kaplan & Haenlein, 2019). The famous examples are the Jarvis intelligent system in Marvel films, or the Skynet system in Terminator films.

Based on the three categories shown in Table 4, we subdivide the AI technology level into five levels. In each level, we conduct in-depth research on the AI technology, focusing on three aspects: description, capabilities, and applications (Schmid et al., 2021). In our extensive research, we intend to map the capabilities and applications of e-commerce processes for small and medium-sized enterprises. This could provide a comprehensive understanding of the technology level they can utilize that will further improve the processes and technology fit (Wei & Pardo, 2022).

Table 4
Category of Artificial Intelligence (AI), its Level, Capabilities and Applications

	Category	**Level**	**Description**	**Capabilities**	**Application**	**References**
Lower Intelligence than Human ↕ Higher Intelligence than human	Narrow Artificial Intelligence (NAI)	Simple Basic	Simple traditional algorithm technology, specific field applications, low cost AI	- Specific domain processing capabilities - Basic data processing and analysis capabilities	Common single-function applications -ChatGPT 3.5 -Copilot Designer	Meytus, 2018 Kaplan et al., 2019
		Professional Basic	AI for specialized handling of domain-specific tasks and more advanced features	- Specific domain processing capabilities - More analytical capabilities, more professional processing capabilities	Advanced single-function applications -ChatGPT 4.0 -Adobe Firefly Advanced functions - Recommendation system	Kaplan et al., 2019 Andrew et al., 2020
	General Artificial Intelligence (GAI)	Basic General	Common AI for Multi domain Decision Processing	- Multi-domain task handling capability - General learning, understanding and reasoning capabilities	-General multifunctional systems -Intelligent logistics management system -Smart home control system	Schmid et al., 2021 Kaplan et al., 2019

		Advanced General	Multifunctional intelligent decision-making AI system with advanced technology	- Broader field and task handling capabilities - Greater ability to reason, create, and understand emotions	Advanced multi-functional system -Smart city management system -Intelligent manufacturing and industrial automation systems	Schmid et al., 2021 Serb et al. 2019 Andrew et al., 2020
	Super Artificial Intelligence (SAI)	Super	Self-aware AI systems of the future	Ability to deal with problems in all fields such as cognition, emotion, and social interaction	May cover all aspects of various fields -Skynet (Terminator) -Jarvis Intelligent System (Marvel)	Kaplan et al., 2019 Andrew et al., 2020 Floridi et al., 2018

Simple Basic AI

Simple basic AI usually uses simple and traditional technologies and algorithms to solve tasks and issues in specific fields through traditional data processing and analysis (Meytus, 2018). It has basic data processing and analysis capabilities, and its application functions are basic and limited. It is usually free or low paid artificial intelligence, such as simple AI question answering, simple graphics recognition, and other functions. Its advantages are low cost and simple operation; the disadvantage is that the ability of analysis and processing is sometimes lower than that of human beings (Kaplan & Haenlein, 2019).

Professional Basic AI

Professional basic AI usually adopts relatively advanced algorithms and technologies and has the ability to conduct professional analysis and processing of problems or tasks within specific fields. The application layer typically offers increasingly sophisticated functions that assist humans in solving specific problems more effectively. At present, both enterprises and individuals use more artificial intelligence to address professional challenges, such as product recommendation systems and advanced AI design. Its advantage is that it has a high level of expertise, surpassing or equaling that of human beings in processing and analyzing information within a specific field (Kaplan & Haenlein, 2019). On the downside, the cost is relatively high and operating it may necessitate certain professional foundational knowledge (Andrew et al., 2020).

Basic General AI

The basic general artificial intelligence usually adopts more traditional machine learning algorithms and data processing technologies, such as ordinary neural network, natural language processing, and computer vision (Schmid et al., 2021). It has the ability to handle tasks in various fields and to learn and understand things in general. It is an important multi-functional application system applied in the fields of industrial production, enterprise

supervision, logistics, and transportation. It usually involves basic data analysis, automated processes, and simple decision-making functions. Its advantage lies in its ability to integrate the requirements of enterprise operation and management for multitask processing with a relatively high level of automation. It is an artificial intelligence that can reach the human level (Kaplan & Haenlein, 2019). The disadvantage is that the use cost is high, and the system requires manual participation for operation and maintenance.

Advanced General AI

Advanced general AI usually adopts advanced and complex technologies and algorithms, such as hybrid neural networks, reinforcement learning, and knowledge representation (Schmid et al., 2021). To enhance its reasoning, creativity, and understanding abilities, enabling it to tackle problems and tasks across a wider range of fields. It is a multifunctional application system with advanced intelligent behavior and decision-making functions (Serb et al., 2019). It is mainly used in large-scale production operations, massive data processing, and analysis. It is a necessary application for large-scale enterprise organizations or municipal management. Its advantages include advanced technology, high efficiency, and high-performance artificial intelligence that require less human participation (Andrew et al., 2020). The disadvantage is that the use cost is expensive, the maintenance cost is high, and a certain technical team is required for development, operation, and maintenance.

Super AI

Super artificial intelligence is a sophisticated, state-of-the-art technology and algorithm with the capability to deal with problems in all fields such as cognition, emotion, social interaction, and self-awareness in future artificial intelligence systems (Kaplan & Haenlein, 2019). Its application fields can cover all areas and aspects, and it surpasses human capabilities in every aspect (Andrew et al., 2020). Its advantage is that it can realize self-learning and self-renewal without human involvement. The disadvantage is that it is difficult to be widely used in the commercial field due to the high costs and technology investments involved, and it also includes certain unpredictable factors (Floridi et al., 2018).

SMEs Major Processes in E-commerce

E-commerce process is the general term for a series of activities involved in online sales of goods and services. The e-commerce process of enterprises in the network environment mainly includes information display, promotion, business services, payment, and transportation (Qian, 2007; Zhao et al., 2008). As shown in Table 5, at each stage of the e-commerce process, due to differences in capital, manpower, skills, and the foundation of various types of enterprises, the problems they face in e-commerce operations and the aspects they hope to improve through new technologies will also be different (Badghish et al., 2024). Small and micro enterprises are weak in various aspects. In e-commerce, AI is typically utilized in a narrow sense. For example, they can use free basic AI to assist with their work, reduce the difficulty, and use cost-effective professional basic AI to improve the efficiency of work tasks (Rui, 2020). Small enterprises can choose between professional basic AI or basic general AI according to their business needs to achieve a balance between cost and benefit (Lee, 2021). Faced with a large number of data processing and comprehensive operation and maintenance management, medium-sized enterprises can introduce general artificial intelligence for data analysis and prediction to improve the digital operational capabilities in the process of e-commerce, so as to optimize enterprise workflows and reduce

costs (Miroedova, 2023). Through categorizing AI technology levels in the e-commerce process, various types of enterprises can clarify their own direction of use, identify the technological divide of AI, and establish a strong foundation for the future advancement and development of enterprises.

Table 5
Ecommerce Processes and Proposed Mapping of Artificial Intelligence (AI) for SMEs

Ecommerce Processes	**AI Level**	**SME Type**	**Example**
Display	Simple Basic	Micro & Small	Graphics recognition, Generate content
	Professional Basic	Small & Medium	Personalized Recommender
	Basic General	Medium	Precise advertising, Data analysis
Promotion	Simple Basic	Micro	Basic data analysis
	Professional Basic	Small	Dynamic pricing
	Basic General	Medium	Market analysis, Precision strategy
Service	Simple Basic	Micro	Basic service
	Professional Basic	Small	Premium Service
	Basic General	Medium	Complex solving
Payment	Simple Basic	Micro & Small	Basic processing
	Professional Basic	Small & Medium	Fraud detection
	Basic General	Medium	Monitoring, Security measures
Delivery	Simple Basic	Micro & Small	Basic management
	Professional Basic	Small & Medium	Inventory optimization
	Basic General	Medium	Intelligent logistics management

In essence, the use of e-commerce in the operation of small and medium-sized enterprises is to upgrade and expand the traditional business processes through Internet technology (Costa & Castro, 2021). When the new generation of information technology develops and matures, the use of AI technology in e-commerce by small and medium-sized enterprises will further enhance their competitiveness in the online market. Therefore, SMEs should seize the technological benefits of artificial intelligence at the earliest opportunity. They should take advantage of various artificial intelligence applications in the production and service processes of their businesses to achieve technological innovation, improve efficiency, and foster the growth and expansion of their enterprises (Chen et al., 2022). In each e-commerce process, small and medium-sized enterprises can utilize AI technology tailored to their business needs to enhance performance (Halima et al., 2022). For example, small and microenterprises can use graphic creation AI to realize the specialized processing of product images. Small enterprises can also utilize an AI product promotion system for intelligent

product promotion, while medium-sized enterprises can benefit from AI CRMs for intelligent customer management.

Conclusion

This article primarily categorizes and analyzes artificial intelligence technology to clarify the boundaries of methods, capabilities, and applications at each technical level as clearly as possible. This allows enterprises of different levels and types to clearly comprehend the level of AI technology they can utilize to address development challenges. This is particularly important for small and medium-sized enterprises because it helps them understand and determine the direction of AI technology. From the perspective of e-commerce, AI plays an important role in improving the operational efficiency, customer experience, and market competitiveness of small and medium-sized enterprises. Examples of AI applications include intelligent customer service systems, personalized recommendation systems, artificial intelligence data analysis and prediction, and AI dynamic pricing. The application of these AI technologies not only enhances the operation and market competitiveness of SMEs in e-commerce but also creates ample opportunities for their growth. Enterprises at different levels determine the level of technology they can use based on the diversity of production resources they can obtain. Artificial intelligence is not only a technological advantage for SMEs but also a technological divide at a certain point in time. In the future, the mapping framework between AI technology level and e-commerce processes of small and medium-sized enterprises will be enhanced to help SMEs in further improving e-commerce efficiency. This will strengthen the digital operational foundation of businesses and facilitate a new phase of enterprise management informatization upgrade. This mapping will guide SMEs better utilize AI technology in e-commerce, optimize business processes, and promote the rapid development of enterprises in the digital economy.

Funding

This research is supported by the project “Application Research of Artificial Intelligence Technology in e-Commerce Enterprises in Anhui Province”, with Fund Number 2024AH052502.

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