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A review of intentions to use artificial intelligence in Big Data Analytics for Thailand agriculture

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ABSTRACT

This study explains the essentials of artificial intelligence (AI) in big data analytics for the agriculture industry during the COVID-19 pandemic. The systematic review approach was employed for the documentary and analysed using content analysis. In addition, the literature and previous studies were obtained from various research articles on EBSCO, Google Scholar, Scopus, Web of Science, and ScienceDirect. The criteria for inclusion were studies that were related to AI in big data analytics for agriculture, were published in English, and were peer-reviewed. Five independent reviewers assessed search results, extracted data, and evaluated the studies' quality to summarise and report the findings. The results reveal that the COVID-19 pandemic has increased the utility of AI in big data for agricultural business operations. For instance, AI-enabled supply chain management enables businesses to accurately predict demand spikes and decreases and adjust material volumes and routes. AI can collect more extensive data, which can assist the production team in predicting more accurate delivery times and inventory adjustments. Adaptability, high performance, precision, and cost-effectiveness are the central concepts of AI in agriculture. AI agriculture applications include soil, crop, weed, and disease management. The direct application of AI throughout the agricultural sector could represent a paradigm shift in agricultural practices. AI-powered farming solutions enable farmers to accomplish more with fewer resources, enhance crop quality, and guarantee a rapid GTM (go-to-market) crop strategy. Thus, AI adoption is based on the TAM model's perceived ease of use, usefulness, and social influence. The recommendation is to research qualitative and quantitative approaches for further study and clarification of the essence of AI in the agriculture industry.

Keywords: *big data analytics, artificial intelligence (AI), agriculture industry, intentions to use, systematic review*

1. INTRODUCTION

Big data analytics has been hailed as a game-changing strategy, and many businesses are investing heavily in big data analytics (Tong-On et al., 2021). Artificial intelligence (AI) is the simulation of human intelligence operations by computers, specifically computer systems. AI excels at specific tasks and changes almost every sector of a country's economy by allowing computers to make sound decisions that lead to more efficient operations (Limna, 2022). To effectively respond to the unprecedented challenges posed by COVID-19, many governments have been forced to forge a closer relationship with science and lean toward data-driven decisions. Indeed, technological advancements and proliferation have resulted in unprecedented production of mobile, and digital devices, as well as a vast amount of structured and unstructured data to be mined by businesses and governments for sound and timely decision-making (Sheng et al., 2021). AI and big data are also essential for many businesses during the COVID-19 pandemic. Using AI and big data in business will likely improve a company's operations during COVID-19. Different activities in practical operations and business value rely heavily on technology. When a company uses AI and big data to increase its intrinsic value and help business operations, it signals to the workforce that employees will adapt well, and the company will operate more efficiently and effectively (Chou, 2016; Davenport et al., 2020). The COVID-19 pandemic has elevated the effectiveness of AI and big data in business operations. For example, AI-powered supply chain management enables businesses to accurately forecast demand spikes and declines and adjust material volumes and routes. Furthermore, AI and big data can be used to collect more comprehensive data, which can help the sales team forecast more precise delivery timings and inventory adjustments. As a result, during times of crisis, such as COVID-19, businesses can provide superior customer service to current and prospective customers (Chen & Biswas, 2021). Thus, artificial intelligence (AI) is crucial for any industry, especially during the COVID-19 pandemic.

2. LITERATURE REVIEW

2.1. Agriculture Industry During the COVID-19 Pandemic

Agriculture continues to be a significant source of growth in Southeast Asian countries, including Thailand. Overall, agricultural production in the region has continued to grow, particularly in terms of harvest and area (Gregorioa & Ancog, 2020). The COVID-19 pandemic has struck Thailand in four waves. Compared to the previous waves, the fourth wave of COVID-19 had the highest number of confirmed cases and deaths. Following each pandemic wave, the government imposed public health control measures such as lockdowns, transportation restrictions, working from home, getting COVID-19 vaccinations, and closing department stores, restaurants, markets, and food stores. These measures have had an impact on a variety of sectors, including agriculture. Thailand's agricultural industry is vital to the country's economy. Agriculture contributed THB 1.36 trillion to Thailand's gross domestic product (GDP) in 2020, accounting for 8.65 per cent of the country's total GDP (Jandawapee et al., 2022; Limna et al., 2022; Sapbamrer et al., 2022). The spread of COVID-19 increased demand for canned tuna, opening new export opportunities for Thailand to be a significant exporter. However, this global market surge was caused by panic buying and did not last long. Thailand is also a substantial producer of processed chicken. Yet, COVID-19 harmed processed chicken exports because it disrupted transportation and logistics systems, resulting in higher trade costs (Thammachote & Trochim, 2021). Moreover, the COVID-19 pandemic has served as a wake-up call for food systems that have already been on the verge of collapse for decades. Food systems include all stages of food production, such as preparation, processing, distribution, consumption, and disposal. Furthermore, adequate food delivery to

consumers necessitates using land, agricultural inputs, infrastructure, shipping, and various actors, such as farmers and retailers. Thus, COVID-19-caused lockdowns and disruptions have complicated interactions among these various food system elements. Additionally, during the COVID-19 pandemic, the food system was disrupted from primary supply to final demand. Despite the observed panic buying, supermarkets in Thailand were able to stay well-stocked at the start of the COVID-19 outbreak. Even so, many items, mainly fruits and vegetables, were missing from store shelves a few days later (Boyacı-Gündüz et al., 2021; Fan et al., 2021; Wannaprasert & Choenkwan, 2021). Furthermore, the COVID-19 pandemic also significantly impacts Thailand's import-export agriculture industry. For instance, it caused a supply chain disruption in the rubber industry in 2020. Many countries' lockdown measures reduced global demand for natural rubber, and the value and volume of Thailand's exports fell. Exports began to recover by the end of 2020, due in part to an increase in demand for medical gloves and the relaxation of lockdown measures (Thammachote & Trochim, 2021). Therefore, the agriculture industry during the COVID-19 pandemic in Thailand is because of the usefulness of AI adoption.

2.2. Artificial Intelligence (AI) Adoption in the Agriculture Industry

Various agricultural techniques have adapted rapidly to AI in recent years. The concept of cognitive computing imitates the thought process of humans using a computer model. This results in disruptive technology in AI-powered agriculture, rendering its service in interpreting, acquiring, and reacting to various situations (based on the acquired knowledge) to increase productivity. To harvest benefits in the field by catching up with the most recent advancements in the agricultural sector, farmers can be provided with solutions via chatbot platforms (Dharmaraj & Vijayanand, 2018). The agricultural supply chain is highly complex. AI is altering the production, distribution, and consumption of food. Researchers use AI-powered technologies to provide knowledge and advice regarding crop rotation planning, planting times, water and nutrient management, pest management, disease control, optimal harvesting, food marketing, product distribution, and other agriculture-related tasks throughout the entire food supply chain (Liu, 2020). Assessing agricultural land suitability is one of the most important agricultural development tools. Several new technologies and innovations are being implemented in agriculture as an alternative to collecting and processing farm information. The rapid development of wireless sensor networks has prompted the creation of low-cost and small sensor devices. The Internet of Things (IoT) enables automation and decision-making in the agricultural sector. To evaluate agricultural land suitability, a system that integrates sensor networks with AI systems such as neural networks and Multi-Layer Perceptron (MLP) is utilised (Vincent et al., 2019). Recent agricultural applications of AI have been observable. To maximise yield, the sector must overcome numerous obstacles, such as improper soil treatment, disease and pest infestation, extensive data requirements, low output, and a knowledge gap between farmers and technology. The core concept of AI in agriculture is its adaptability, high performance, precision, and affordability. The applications of AI in agriculture include soil management, crop management, weed management, and disease management (Eli-Chukwu, 2019). A direct application of AI or machine intelligence across the agricultural sector could represent a paradigm shift in how farming is currently practised. AI-powered farming solutions enable farmers to do more with less, improve crop quality, and ensure a rapid GTM (go-to-market) crop strategy (Khandelwal & Chavhan, 2019).

2.3. The Theory Acceptance Model (TAM) Model

The technology acceptance model (TAM) is a critical theoretical framework for explaining technology usage behaviour that has been validated in various technologies across various populations (Choung et al., 2022). In 1989, Davis used TAM to explain computer usage behaviour. The goal is to describe the general determinants of computer acceptance that explain user behaviour across various end-user computing technologies and user populations. The basic TAM model included and tested two specific beliefs: perceived usefulness and perceived ease of use (Lai, 2017). These two fundamental constructs in TAM condition a person's attitude toward using technology, influencing their behavioural intention to use it (Sánchez-Prieto et al., 2019). Perceived usefulness is defined as the potential user's subjective likelihood that using a specific system will improve his or her activity. In contrast, perceived ease of use refers to the degree to which the potential user expects the target system to be effortless. Other factors known as external variables in TAM can also influence a person's belief in a system (Lai, 2017) TAM2, which incorporates other theoretical constructs to TAM, discovered that social influence processes and cognitive processes influence user acceptance of technology (Lee et al., 2006). Social influence changes people's thoughts, feelings, or behaviours to meet the demands of a social environment caused by others. It is the intentional or unintentional change in behaviour that one person causes in another. Additionally, social influence has long been recognised as a significant factor in consumer behaviour, and no one in this world can avoid the influence of others. The reason is that people change their ideas and actions to meet the demands of a social group, and this is due to a person's perception of the need to behave in a certain way to meet social pressure (Phetnoi et al., 2021).

2.4. Intentions to Use AI in Big Data Analytics

Big data and AI are direct concepts and terms used as core elements in this digital era. Big data also enables marketers to make better predictions in terms of prediction and knowledge of marketing behaviour. It aids in making the best business decisions and promoting production success. In all marketing environments, marketing behaviours and the market turbulence model and method positively impact early decision-making and production development (Limna et al., 2021). AI in big data analytics has captivated public attention and profoundly shaped the social, economic, and political spheres (Elish & Boyd, 2018). AI technologies rapidly expand in many sectors as organisations want to enhance business performances and beyond (Ranjan, 2009; Shin & Hwang, 2022). Several factors influence the intention to use AI and big data analytics (Baharuden et al., 2019). The perception of AI enhancing the efficiency and effectiveness of work, as well as a positive and longer-term outlook on AI's future about human labour, as an assistant or a competitor, the perception of the technology's ultimate harm or benefit (does it harm or benefit humanity), and its ability to eventually make ethical and moral judgments, all influenced individuals' willingness to support AI technologies (Ahn & Chen, 2022). Furthermore, coffee shop owners in Krabi, Thailand, believe that implementing big data analytics and AI is critical for their businesses. Adopting new technologies and transforming coffee shops into digital enterprises contribute to their success (Limna et al., 2022). Business intelligence and data analytics have impacted the business performance of Thailand's hotel industry. The majority of the respondents expressed interest in artificial intelligence and believed that the rapid advancement of artificial intelligence in hotel management should be taken into account because it can improve corporate performance (Tong-On et al., 2021). AI technology has improved consumer experiences in the retail fashion industry. Perceived usefulness, ease of use, reliability, and joyfulness play a significant role in consumers' adoption and continued use of AI (Shin &

Hwang, 2022). Therefore, the intention to use AI in the agricultural industry is related to the TAM model in perceived ease of use, usefulness, and social influence.

3. RESEARCH METHODOLOGY

Purposeful sampling entails researchers utilising their knowledge to select the most beneficial sample. This method is commonly employed in qualitative research. The objective is to acquire exhaustive knowledge (Siripipatthanakul et al., 2022). The texts are a typical starting point for qualitative content analysis. The goal is to transform a large quantity of text into a highly organised and concise summary of key findings (Siripipatthanakul & Bhandar, 2021). The researchers applied the systematic review method to the documentary, and the data were analysed using content analysis. Additionally, the proposed articles from the databases of ScienceDirect, PubMed, Google Scholar, Scopus, and Web of Science were included to explain AI in agricultural data analytics, were published in English and had been peer-reviewed. Five independent reviewers analysed search results, extracted data, and assessed the quality of the studies to summarise and report the findings. The data collection and analysis were between May 28th and July 15th, 2022.

4. RESULTS

The food system was disrupted during the COVID-19 pandemic, from primary supply to final demand. Despite the observed panic buying, the supermarkets maintained adequate stock levels at the onset of the COVID-19 outbreak. However, many items, primarily fruits and vegetables, were missing from store shelves. In this digital era and during the COVID-19 pandemic, big data and artificial intelligence (AI) are direct concepts and terms utilised as fundamental elements. Thus, big data also enables marketers to make more accurate predictions based on their knowledge of marketing behaviour and their ability to predict it. It promotes production success and aids in making the best business decisions. In all marketing environments, marketing behaviours and the market turbulence model and method positively influence early decision-making and production development. Several new technologies and innovations are being implemented in agriculture as an alternative to data collection and processing. The rapid growth of wireless sensor networks has led to the creation of low-cost and small sensor devices. The Internet of Things (IoT) facilitates automation and decision-making in the agricultural industry. A system that combines sensor networks with AI systems such as neural networks and Multi-Layer Perceptron (MLP) is used to assess agricultural land suitability. AI has been observed in recent agricultural applications. To maximise yield, the sector must overcome numerous obstacles, including improper soil treatment, disease and pest infestation, extensive data needs, low output, and a knowledge gap between farmers and technology. The central concepts of AI in agriculture are its adaptability, high performance, precision, and cost-effectiveness. Some AI applications in agriculture are soil management, crop management, weed management, and disease management. The direct application of AI or machine intelligence across the agricultural sector could represent a paradigm shift in farming practices. AI-powered farming solutions allow farmers to accomplish more with fewer resources, improve crop quality, and ensure a rapid GTM (go-to-market) crop strategy.

5. CONCLUSION

The technology acceptance model (TAM) is a crucial framework for explaining technology usage behaviour that has been validated across multiple technologies and populations. TAM to describe computer usage patterns. The objective is to describe the universal factors that explain user behaviour across diverse end-user computing technologies and user populations.

The fundamental TAM model incorporated and evaluated two specific beliefs: perceived usefulness and perceived usability. These two fundamental TAM constructs condition an individual's attitude toward technology use and influence their behavioural intent to use it. Perceived usefulness is the subjective likelihood that using a particular system will improve the potential user's activity. In contrast, perceived ease of use is the extent to which a potential user anticipates the target system to be simple. A person's belief in a system can also be influenced by other variables known as external variables in the theory of acceptability modelling (TAM). Social influence processes and cognitive processes influence user acceptance of technology, according to TAM2, which adds other theoretical constructs to TAM. Thus, the TAM model could explain why the users intend to use AI in data analytics in the agricultural industry.

6. RECOMMENDATION FOR FURTHER STUDY

This study is a systematic review and may not explain the relationship of the TAM model to predicting intention to use AI in agriculture. Thus, the recommendation is to investigate qualitative and quantitative approaches to further investigate and clarify the intention to use AI in the agriculture industry.

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