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The Role of Artificial Intelligence in the Halal Industry

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Abstract: The halal industry has developed into a promising business opportunity in the industrial era, and many countries are interested in it. Artificial intelligence (AI) has been used in the halal industry to ensure production processes comply with halal standards, improving the safety and quality of halal products. AI can scan, inspect, and monitor any errors that may occur in a product, providing several potential benefits to the halal industry, including improving halal compliance, streamlining the supply chain, and increasing efficiency and productivity. The development of the halal industry in Indonesia shows a positive trend that is increasingly growing, due to awareness of the importance of halal products as a part of lifestyle. This awareness is not only shared by Muslims but also by non-Muslims. This high awareness of halal products will have a positive impact on business opportunities in the halal industry. The Indonesian government has been active in developing the halal industry to encourage the growth of the halal industry.

Keywords: *Artificial Intelligence, Halal Industry, Halal Cosmetic, Halal Tourism*

1. Introduction and Background

Halal is not just a new trend but has become a new paradigm. Halal is now considered a very important part of Muslim life. When people become more aware of halal products, this encourages businessmen to be more sensitive in running their businesses. Halal business is not only a matter of producing halal goods and services, but also a matter of building a strong business strategy (Utomo et al., 2020). According to a report from the State of the Global Islamic Report (2019), there are around 1.8 billion Muslims as consumers of the halal industry. Consumer opportunities in the halal industry increase by 5.2% every year with total consumer spending reaching USD 2.2 trillion. Indonesia has enormous potential in developing the halal industry. This is due to the large number of Muslim residents in this country. Indonesia accounts for around 12.7% of the total Muslim population in the world. It is estimated that the population in Indonesia reaches 273 million people, which means that around 87.2% of the total population in this country is Muslim (Fathoni, 2020).

The halal industry and artificial intelligence have a very strong relationship in increasing efficiency and productivity and ensuring the halalness of the products produced. Artificial intelligence is part of computer science or computing that produces expert systems, algorithms, and programs to imitate the human brain and make human-like decisions in various situations and circumstances (Dhamija & Bag, 2020). Previous studies have discussed the role of artificial intelligence in various industries. The influence of artificial intelligence in the halal tourism industry in South Korea (Marlinda et al., 2021), the food industry (Kakani et al., 2020; Mavani et al., 2022), the manufacturing industry (Lee et al., 2018), health industry (Gautam et al., 2022), the construction industry (Abioye et al., 2021), the accounting industry (Luo et al., 2018), and the oil and gas industry (Sircar et al., 2021).

Artificial intelligence in the halal industry has a very important role and prospects. Artificial intelligence systems can verify ingredients and products automatically, enabling the certification process to be more efficient. AI can be used to identify haram ingredients in products. Artificial intelligence (AI) can be used to monitor the supply chain of halal products, ensuring the authenticity and sustainability of products throughout the journey from producer to consumer. AI can help manufacturers develop new products that meet halal standards more quickly and efficiently, with analysis of consumer data and market trends.

2. Literature Review

Development of Halal Industry: The halal industry has the potential to make a significant contribution to the economy, especially in countries with large Muslim populations. In Indonesia, the halal industry is seen as a key sector for economic growth, and the government actively encourages its development through policies and regulations. The growth of this industry is also influenced by the awareness of the Muslim community which prioritizes halal products, as well as the increasing demand of non-Muslim consumers who are looking for halal options for health and other reasons. Nowadays, every Muslim is aware of the importance of the halal concept (Handriana et al., 2020; Aoun & Tournois, 2015). Halal assures customers that the product has followed all guidelines by the teachings of the Islamic Religion. The halal industry is not limited to food products but covers various sectors such as pharmaceuticals, cosmetics, tourism, fashion, finance, media, and entertainment.

Artificial Intelligence: Artificial intelligence is a system that can perform various tasks that usually require human intelligence when operated. Artificial Intelligence takes the form of a machine that can imitate human behavior developed with knowledge of human thinking and can carry out human thinking procedures (Disemadi, 2021). Artificial intelligence is divided into two categories, namely narrow artificial intelligence and general artificial intelligence. Narrow artificial intelligence is used to complete simple tasks such as managing business schedules and answering customer questions. Meanwhile, general artificial intelligence can handle complex problems such as driving cars, robotics, and overcoming language barriers (Dhamija & Bag, 2020). The role of Artificial Intelligence has been widely studied by several researchers in various industries, including the food industry (Kakani et al., 2020), Industry 4.0 Based Manufacturing Systems (Lee et al., 2018), Health Industry (Gautam et al., 2022), construction industry (Abioye et al., 2021), Accounting Industry (Luo et al., 2018), Application of machine learning and artificial intelligence in the oil and gas industry (Sircar et al., 2021).

Table 1: Role of Artificial Intelligence in Various Industries

No	Industry	The Role of Artificial Intelligence	Source
1	Food	• Improved customer experience • New product development • Improved product quality	(Khan et al., 2023) (Kakani et al., 2020)
2	Manufacture	• Increased efficiency and productivity • Improved product safety and quality • New product development • Improved customer experience	(Kim et al., 2019) (Lee et al., 2018)
3	Health	• Increased efficiency and productivity • Improving the quality and accessibility of Health services • Development of new drugs and treatments	(Al Kuwaiti et al., 2023) (Gautam et al., 2022)
4	Construction	• Design and planning • Project management • Quality control • Production • Operations and maintenance	(Schia et al., 2019) (Abioye et al., 2021)
5	Accountancy	• Data analysis • Fraud detection • Predict economic trends	(Hasan, 2022) (Luo et al., 2018)

3. Research Methodology

This research is qualitative descriptive research that uses a content analysis approach using secondary data obtained from scientific articles and other relevant documents. The data obtained was then analyzed to

produce descriptive explanations in the form of words, images, and symbols related to the object of this research.

Discussion

The Role of Artificial Intelligence in the Halal Food Industry in Indonesia

Artificial intelligence technology in the halal food industry to ensure production processes comply with halal standards (Peristiwo, 2019).

Assisting in the Halal Certification Process

In recent years, the awareness of halal food certification has increased, particularly from consumers' perspective. The increasing attention to halal food certification research is caused by increasing public awareness, concern, and knowledge about halal food (Ab Talib et al., 2017). Artificial Intelligence helps carry out risk analysis of raw materials, production processes, and supply chains to ensure product halal. Artificial Intelligence (AI) also helps the halal certification process by automating verification and validation, as well as speeding up the issuance of halal certificates. Through application development and synergy with related institutions, such as Bank Indonesia and educational institutions, the Halal Product Guarantee Administering Agency (BPJPH) of the Indonesian Ministry of Religion is exploring the use of AI technology for halal services. The application of AI in the halal industry can help reduce costs, improve product safety and quality, and predict trends to accelerate halal certification. (KEMENKOPUKM, 2023).

Monitoring Production Processes

The use of artificial intelligence (AI) in the food industry has experienced growth over the years due to various factors such as food sorting, grade smoking and parameter prediction, quality control, and food safety (Mavani et al., 2022). A knowledge-based system is a computer program that uses knowledge from various sources, information, and data to solve complex problems. There are three main categories in this system, namely expert systems, knowledge-based artificial intelligence, and knowledge-based engineering (Mavani et al., 2022). The food industry has used Expert Systems (ES) for various purposes because these systems have been proven to provide significant benefits, especially in the decision-making process. A knowledge-based expert system has been applied in white winemaking during the fermentation process for monitoring, intelligent control, and data recovery. Expert Systems (ES) can be used to monitor in real-time the food production process so that it remains by halal standards.

Detecting haram materials

Authenticity is an important food quality characteristic. Food mixing has varied from the addition of natural compounds to much more serious cases of contamination with dangerous substances (Syahariza et al., 2005). Many analytical methods have been used for the analysis of food additives such as differential scanning calorimetry (DSC), Fourier transform infrared spectroscopy (FTIR), gas chromatography (GC), high-pressure liquid chromatography or high-pressure liquid chromatography (HPLC), nuclear magnetic resonance (NMR), and DNA-based methods (Syahariza et al., 2005). Artificial Intelligence can be used to detect contamination of haram ingredients such as pork in food using computer vision techniques.

The Role of Artificial Intelligence in the Halal Fashion Industry

Predict Fashion Trends

Artificial Intelligence is used to predict future halal fashion trends based on historical data and Muslim consumer preferences. This helps Muslim fashion designers in determining appropriate designs (Katarya & House, 2022). Some ways to do this include: a) Collect historical data on halal fashion trends over the past few years. b) Analyze trend data such as models, colors, cuts, and textures that are popular each season. c) Studying Muslim consumers' preferences for Muslim clothing from survey results and product reviews. d) Utilize machine learning to analyze historical data patterns and consumer preferences. e) Machine learning then predicts halal fashion trends for the next season based on the detected patterns.

Production Process Automation

Artificial Intelligence can automate Muslim clothing production processes such as cutting, sewing, and quality control so that it is more efficient. Apart from that, AI can also help in production scheduling and logistics (Guo et al., 2011). Some examples of the use of AI in the halal fashion industry include; a) Computer Aided Design (CAD) - designing clothing designs digitally using computer software. Helping Muslim fashion designers in designing clothing models. b) Cutting - AI and automatic machines are used to cut the fabric according to the desired pattern. Reduces fabric waste and is more accurate. c) Sewing - automatic sewing machines equipped with sensors and cameras can sew clothes automatically following a specified sewing pattern. Reduces stitching errors. d) Quality control - AI cameras and sensors can detect finished product defects such as stitching errors, stains, holes, and others. Ensure product quality is more consistent. e) Scheduling & logistics - AI can help optimize production scheduling and raw material logistics as well as finished product distribution to make it more efficient.

Virtual Try-on

Virtual try-on allows consumers to try on clothes digitally using photos of themselves. This is done by realistically mapping clothing images onto the user's body (Han et al., 2018). Virtual try-on proposes an end-to-end neural network architecture that can accurately predict the wear on the user's body. The result is that Virtual Try-on can place and adjust clothing images to the user's body very realistically in various body poses and types of clothing. VITON opens up the possibility of virtual try-ons for fashion e-commerce purposes, for example visualizing consumers wearing clothes they want to buy online.

Fashion Designing

Artificial Intelligence can analyze fashion trend data from runways, magazines, and social media to inspire themes and colors for new collections. Generative algorithms such as generative adversarial networks (GANs) and variational autoencoders (VAE) have been able to produce clothing designs automatically after being trained with fashion design datasets (Zhou et al., 2016). Fashion designers can determine design boundaries or criteria such as style, dominant color, or motif to the AI algorithm, which then produces hundreds of unique and creative clothing designs. AI can also help develop a fashion designer's initial design into hundreds of design variations by changing details such as materials, motifs, and clothing cuts. AI can also help develop a fashion designer's initial design into hundreds of design variations by changing details such as materials, motifs, and clothing cuts. The fashion design process becomes more efficient and productive with the help of AI, so designers can focus on design creativity and innovation (Zhou et al., 2016).

The Role of Artificial Intelligence in the Halal Tourism Industry

Chatbot for customer service

New technological advances powered by artificial intelligence (AI), such as virtual guides and virtual hosts, Chatbots, smart rooms, and digital personal assistants, have drastically changed the experience in the tourism industry (Battour et al., 2022). A chatbot is a software program often referred to as a robot or bot, which functions to carry out conversations with customers using natural language. This chatbot is a form of artificial intelligence that focuses on the user. The chatbot can answer tourists' questions regarding halal tourist destinations, halal food, and other facilities in real-time (Melián-González et al., 2021). This process can be carried out in text or voice format using special devices such as Google, Siri, Amazon Alexa, computers, and smartphones (Pillai & Sivathanu, 2020). Chatbots have several advantages, including saving time, building social relationships with consumers, building trust with users, and establishing emotional bonds between customers and companies. The great advantage of chatbots lies in their ability to set appointments, set reminders, book tickets, as well as provide up-to-date information about traffic and weather (Battour et al., 2022).

Personalized halal travel recommendations

Artificial intelligence (AI) algorithms can be used to provide personalized halal travel recommendations based on Muslim travellers' preferences and interests. The use of social media has also influenced the perception and reputation of halal tourism in Indonesia, which can be a data source for developing halal tourism recommendation algorithms (Mardiana, 2022). Artificial intelligence (AI) algorithms can be used to

provide personalized halal travel recommendations based on the preferences and interests of Muslim tourists (Stephenson, 2014).

Translation of tourism content into various languages

Artificial intelligence (AI) can translate tourism content such as descriptions, reviews, and travel guides into various languages. AI can translate tourism content such as descriptions, reviews, and tourist guides into various languages (Mardiana, 2022). The use of AI in tourism content translation has several advantages, such as: a) Improve translation quality. AI can help create more accurate and relevant translations, taking into account the context and nuances of the original content. b) Reduce costs and time. AI can prevent human errors in the translation process, thereby reducing the time and costs required for this process. c) Improve translation quality. The use of AI in translating tourism content can help provide information that is more accurate and easier to understand for tourists, both local and foreign.

The Role of Artificial Intelligence in the Halal Cosmetics Industry

Cosmetics are any substances or preparations that are intended to come into contact with various external parts of the human body (epidermis, hair system, nails, lips, and external genitals) and with teeth or oral mucous membranes. Cavity with the sole or primary purpose of cleaning, scenting, changing the appearance, and/or protecting or maintaining good condition (Nohynek et al., 2010). The use of artificial intelligence (AI) has become very important in the halal Cosmetics industry. AI is used to ensure the halalness of the ingredients used, automate production processes, analyze consumer data, such as skin type, skin condition, and needs, and improve customer service. Artificial Intelligence can help understand consumer needs and preferences better. Apart from that, Artificial Intelligence can also be used to develop personalization features for halal cosmetic products, such as a color selection feature for cosmetic products that suits the consumer's skin color. With this feature, consumers can feel more satisfied with the products they use (Putu Wahyu Dwinata, 2023).

5. Conclusion

The halal industry can be considered as a new opportunity in the industrial world that is currently of interest to countries around the world. Artificial intelligence has been widely used in the halal food industry to ensure production processes comply with halal standards. Artificial intelligence has succeeded in improving the safety and quality of halal food products by ensuring that they are produced correctly and free from contamination from non-halal products. Artificial intelligence is capable of scanning, checking, and monitoring any errors that may occur in a product.

Artificial Intelligence (AI) provides several potential benefits for the halal industry, including improving halal compliance, streamlining supply chains, and increasing efficiency and productivity. In recent years, the development of the halal industry has shown an increasingly positive trend. This is due to awareness of the importance of halal products as part of a lifestyle. This awareness is not only shared by Muslims but also by non-Muslims. This high awareness of halal products will have a positive impact on business opportunities for business actors in the halal industry. In recent years, the Indonesian government has been active in developing the domestic halal food industry. This is marked by the government's efforts to encourage the growth of the halal industry.

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