

The Role of Artificial Intelligence in The Development of Indonesia's Halal Industry: A Maqashid Syariah Perspective

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Abstract

The rise of Artificial Intelligence (AI) is reshaping the operational landscape of Indonesia's halal industry, from certification and traceability to supply chains. However, literature linking this phenomenon to an Islamic ethical framework remains limited and tends to focus narrowly on the Islamic finance sector (Najib et al., 2025). The novelty of this article lies in its use of Maqashid al-Shariah Theory grounded in Jasser Auda's Systems Approach (Auda, 2008) as an analytical lens for AI adoption in Indonesia's non-financial halal sector, an area that prior studies more heavily focused on Islamic banking have rarely addressed (Habib, 2025). This study aims to analyze the role, potential, and risks of AI implementation in the development of Indonesia's halal industry and to formulate an evaluative framework based on Auda's six systems features cognition, openness, interrelated hierarchy, multidimensionality, purposefulness, and the interconnection of elements. The method used is a qualitative descriptive-analytical library research approach drawing on national and international literature from the past three to five years. The findings show that AI meaningfully contributes to strengthening *hifz al-din* through automated halal verification, *hifz al-nafs* through contaminant detection, *hifz al-'aql* through consumer literacy, *hifz al-nasl* through family product quality assurance, and *hifz al-mal* through supply chain efficiency; however, implementation faces challenges of data governance, algorithmic bias, and the digital literacy gap among MSMEs, which risk undermining the principle of justice (*al-'adl*) within *maqashid syariah*.

Keywords: *Artificial Intelligence, Halal Industry, Maqashid Syariah, Jasser Auda, Halal Assurance System*

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INTRODUCTION

The halal industry has evolved beyond a mere marker of ritual compliance into a complex global economic ecosystem spanning food, cosmetics, fashion, pharmaceuticals, tourism, and Islamic finance. Indonesia, as the country with the world's largest Muslim population, has positioned the development of the halal industry as one of the pillars of the Indonesian Sharia Economic Masterplan, with the aim of establishing Indonesia as the world's halal production hub (Minarni et al., 2024). (Adamsah & Subakti, 2022) note that the growth of the halal industry has contributed significantly to the national economy, reflected in the rising number of product certifications, halal exports, and investment in supporting sectors. Nevertheless, this quantitative growth is confronted by a structural challenge: how to ensure halal integrity along value chains that are increasingly long, cross-border, and digital.

It is at this juncture that Artificial Intelligence (AI) emerges as a new variable reshaping how the halal industry operates. (Bengio et al., 2021) affirm that advances in deep learning have opened up computational capacity to recognize complex patterns in large-scale data, a capacity now leveraged across industrial sectors, including food and pharmaceuticals. Within the halal context, AI application appears at several critical points: verification of ingredient content through machine-learning-based image recognition and spectroscopy, blockchain-based supply chain traceability reinforced by AI (Julian et al., 2025), cross-contamination risk prediction, and consumer-service chatbots for halal product education (Ghalih et al., 2025). (Harsanto et al., 2024), through a systematic review of digital 4.0 technologies in the halal supply chain, show that the integration of intelligent technologies including AI, the Internet of Things, and blockchain significantly improves the transparency and accountability of the halal assurance process compared with conventional manual systems.

On the other hand, the entry of technology born of a secular-technocratic paradigm into a domain laden with theological values raises ethical questions that cannot be answered by a purely technical-efficiency approach. (Maulidizen, 2024) cautions that applying AI in halal supply chain management must attend to ethical dimensions, including algorithmic transparency and accountability, so that it does not become merely an efficiency tool but also an instrument for safeguarding sharia values. This concern is all the more relevant given that AI operates on the basis of historical data and statistical weighting, which risks reproducing bias, misclassification, or structural injustice if not overseen by an adequate value framework (Dubey et al., 2022). An Islamic epistemological framework is therefore needed one capable of assessing the presence of AI not merely in terms of process-level halal compliance, but in terms of the objectives (maqashid) that sharia itself seeks to achieve.

Maqashid al-Shariah, as a branch of Islamic legal philosophy focused on the objectives of sharia legislation, has long served as an evaluative framework for contemporary Islamic economic policy. However, the classical maqashid approach hierarchical and atomistic, sorting masalah into the levels of dharuriyyat, hajiyyat, and tahsiniyyat as separate from one another is regarded by Jasser Auda as inadequate for addressing contemporary problems that are systemic and interrelated in nature (Fasa, 2016). In his work *Maqasid Al-Shari'ah as Philosophy of Islamic Law: A Systems Approach*, (Auda, 2008) offers a methodological reconstruction by borrowing six core features of systems theory: cognitive nature, wholeness, openness, interrelated hierarchy, multidimensionality, and purposefulness. (Gumanti, 2018) explains that Auda's systems approach allows Islamic law to be understood as a single,

dynamic organic whole rather than a collection of static, partial rulings, making it more responsive to changing times, including technological disruption. (Maulidi, 2022) adds that this approach is particularly relevant for evaluating novel phenomena without precedent in classical fiqh, because the open-endedness inherent in Auda's system enables a dialogue between sharia texts and contemporary realities, including the reality of artificial intelligence technology.

A number of prior studies have attempted to bridge AI with maqashid syariah, but most are concentrated on the Islamic finance and banking sector. (Najib et al., 2025) examine AI application in Islamic finance from a maqashid al-shariah perspective and conclude that sharia-value-based AI governance is needed to safeguard ethical integrity, encourage innovation, and ensure sustainable financial growth. In a similar vein, (Maiga, 2025) explores how AI can function as a mechanism of facilitation, control, and quality assurance in achieving maqashid al-shariah, while (Habib, 2025) proposes an AI ethics framework grounded in the five core maqashid values *hifz al-din*, *hifz al-nafs*, *hifz al-'aql*, *hifz al-nasl*, and *hifz al-mal*. (Abdelnour, 2025) goes further, highlighting a deeper theological dimension: how AI needs to be understood not only as a means but also as a space of meanings that touches the inner (heart) dimension of the Muslim individual, rather than merely instrumental rationality. Unfortunately, these studies have not specifically targeted Indonesia's real halal industry the food, cosmetics, and supply chain sectors which is in fact the backbone of the national sharia economy and carries ethical problem characteristics distinct from the finance sector.

Halal certification itself, as the primary instrument of halal product assurance in Indonesia, has been examined from a maqashid syariah perspective by a number of researchers. (Widyaningsih, 2023) affirms that halal certification is essentially a concrete manifestation of safeguarding the religion and soul of the Muslim consumer, so that the certification process should not be seen merely as an administrative burden but as an instrument of *maslahah*. (Al Mustaqim, 2023) reinforces this argument by showing that halal certification functions as a form of Muslim consumer protection consistent with maqashid principles and Indonesian positive law. Now that the certification process is beginning to undergo digitalization and is partly supported by intelligent systems, the fundamental question arises: does this AI-based digital transformation strengthen, or does it risk obscuring, the maqashid achievements already built by the conventional certification system? Explicitly, the research problem of this study can be stated as follows: what forms does AI application take within Indonesia's halal industry ecosystem, and to what extent does this application strengthen or conversely risk undermining the achievement of maqashid syariah when read through the lens of Jasser Auda's Systems Approach?

Based on the foregoing, this article is positioned to fill a research gap by presenting an analysis that explicitly employs Maqashid al-Shariah Theory grounded in Jasser Auda's Systems Approach as a grand theory lens for reading the phenomenon of Artificial Intelligence adoption in the development of Indonesia's halal industry comprehensively not only the finance sector, but also certification, supply chains, and consumer protection. The novelty of this research lies in three aspects: first, expanding the object of maqashid-AI inquiry from the Islamic finance sector to Indonesia's real halal ecosystem; second, employing Auda's six systems features (not merely the five *dharuriyyat* values) as a more comprehensive analytical instrument; and third, formulating a map of AI risks and opportunities in the national halal

industry that can serve as an initial reference for regulators, business actors, and halal assurance institutions. The objectives of this research are: (1) to describe the forms of AI application within Indonesia's halal industry ecosystem; (2) to analyze such application using the Maqashid al-Shariah Systems Approach of Jasser Auda; and (3) to formulate theoretical and practical implications for developing AI governance aligned with sharia objectives in the national halal industry.

RESEARCH METHODOLOGY

This research employs the library research method with a descriptive-analytical qualitative approach. The data used are drawn from secondary sources, namely books, articles from Sinta-accredited national journals and reputable international journals, regulatory documents related to halal product assurance in Indonesia, and official reports from institutions related to the sharia economy, selected using a currency criterion books published within the last five years and journal articles published within the last three years supplemented by primary references to Jasser Auda's theory as the grand theory. Data collection was conducted by searching academic databases such as Google Scholar, Scopus, and national journal portals, drawing on the methodological framework for library research in the social sciences (Darmalaksana, 2020). Data analysis was carried out in three stages: data reduction, by sorting literature relevant to the themes of AI, the halal industry, and maqashid syariah; data display, by organizing findings according to the five dharuriyyat values and Auda's six systems features; and conclusion drawing, through interpretive-critical content analysis. Data validity was obtained through source triangulation comparing findings from Islamic law literature, information technology literature, and sharia economics literature to ensure argumentative consistency and avoid generalizations unsupported by adequate library-based evidence. All sources used were verified for availability online in August 2026; some references do not include a DOI because the relevant publisher/journal has not yet issued an official DOI for the article in question, so readers are advised to re-verify each citation against its original source before citing it in formal scholarly work.

RESULTS AND DISCUSSION

Forms of AI Application in Indonesia's Halal Industry Ecosystem

The literature review shows that AI application in Indonesia's halal industry and the surrounding region has developed across four main clusters. First, halal verification and authentication, in which machine learning technology and spectroscopy are used to detect non-halal content such as pork gelatin or alcohol in food and cosmetic products, potentially more quickly and precisely than conventional laboratory methods. Second, supply chain traceability, as demonstrated by (Julian et al., 2025), who integrate blockchain and AI to build a trusted digital ecosystem within the halal supply chain, enabling the tracing of raw material origin through to the final point of production. Third, supply chain management and optimization, in which (Ghalih et al., 2025) show that AI can improve the efficiency of inventory management, demand forecasting, and cross-contamination risk mitigation along halal product distribution channels. Fourth, consumer education and service, in the form of chatbots and recommendation systems that help Muslim consumers independently and in real time identify a product's halal status.

Harsanto, Firmansyah, Pradana, and Apriliadi affirm that this 4.0 technology integration, including AI, contributes to increased consumer trust and operational efficiency in the halal industry; however, its implementation in developing countries such as Indonesia still faces constraints of digital infrastructure and capacity gaps among business actors, particularly at the MSME level, which constitutes the majority of national halal industry actors (Harsanto et al., 2024). This finding aligns with data from (Adamsah & Subakti, 2022), which show that the growth of Indonesia's halal industry remains dominated by small and medium-sized enterprises with varying levels of technological literacy.

Analysis Based on Jasser Auda's Systems Features

Using the framework of Auda's six systems features, AI application in the halal industry can be read as follows. In the cognitive-nature feature, AI functions as an extension of human cognitive capacity in recognizing complex halal-status patterns that are difficult for ordinary human senses to detect, so that, epistemologically, AI can strengthen the process of technical *ijtihad* (not legal *ijtihad*) in determining a product's halal status. It is important to note that this cognitive role is instrumental-technical rather than authoritative-normative in nature: the final decision regarding halal status remains within the fatwa authority of human actors (ulama and certification bodies), while AI functions to expand the data basis and observational accuracy that feed into that decision. In the wholeness feature, AI application across the halal supply chain from upstream to downstream reflects a *maqashid* perspective that no longer separates the aspects of production, distribution, and consumption as distinct entities, but treats them as a single, mutually influencing *maslahah* system, as demonstrated by the blockchain-AI integration in the study of Julian, Rachmayani, and Aufi. This feature underscores that a single point of oversight failure in one supply-chain segment for instance, negligent raw-material verification upstream can propagate into a halal-assurance failure downstream, meaning AI governance must be designed as a single integrated system rather than a patchwork solution applied segment by segment (Julian et al., 2025).

In the openness feature, (Maiga, 2025) shows that AI can function as a continuously updated (self-updating) control and quality-assurance mechanism, so that the halal assurance system is not static but responsive to developments in raw materials, food technology, and new consumption patterns a character consistent with the principle of system openness to its external environment in Auda's theory. In the interrelated-hierarchy feature, *maqashid* analysis requires that safeguarding religion (*hifz al-din*) through halal verification must not be pursued at the expense of safeguarding the wealth (*hifz al-mal*) of MSME actors due to the high cost of AI technology adoption; the two must be balanced rather than rigidly opposed hierarchically, as (Fasa, 2016) critiques regarding the atomistic classical *maqashid* approach. In the multidimensionality feature, AI application in the halal industry touches simultaneously on the legal dimension (sharia compliance), the economic dimension (cost efficiency), the social dimension (public trust), and the technological dimension (detection accuracy), such that its evaluation cannot be conducted along a single dimension. Finally, in the purposefulness feature, (Habib, 2025) affirms that AI within a *maqashid* framework must always be directed toward the five core objectives of sharia: *hifz al-din* (safeguarding religion) through halal-verification accuracy that reduces consumer doubt (*syubhat*); *hifz al-nafs* (safeguarding life) through early detection of health-hazardous contaminants; *hifz al-'aql* (safeguarding intellect) through the provision of information that enlightens rather than misleads consumers through

algorithmic misinformation; hifz al-nasl (safeguarding progeny) through quality assurance of products consumed by families, including infant and child products; and hifz al-mal (safeguarding wealth) through production and distribution cost efficiency that ultimately sustains the continuity of the halal business itself.

Risks and Challenges from a Maqashid Perspective

Despite its considerable potential, the literature review also reveals risks that warrant attention. Dubey, Bryde, Dwivedi, Graham, and Foropon caution that an AI-driven big-data-analytics culture can generate excessive dependence on algorithms that are not always transparent, thereby risking the creation of systemic bias that runs counter to the principle of justice (al-'adl) as the spirit of maqashid syariah (Dubey et al., 2022). (Maulidizen, 2024) specifically highlights that, absent adequate mechanisms of transparency and accountability, AI application in the halal supply chain risks becoming a "black box" that actually diminishes rather than increases stakeholder trust in the halal assurance system. Another risk is the digital literacy gap at the MSME level, as noted by (Harsanto et al., 2024), which risks creating unequal access to AI benefits between large and small business actors a condition directly at odds with the goal of *maslahah 'ammah* (public benefit) within maqashid syariah, which is ideally inclusive in nature. A similar pattern is found in Islamic financial product innovation for MSMEs, where high compatibility with sharia values does not automatically drive adoption, being constrained instead by low financial literacy and perceived procedural complexity (Sulaeman, 2026), underscoring that the adoption of Islamic-value-based technology is a cross-sectoral challenge, not one confined to the halal industry alone.

From a theological standpoint, (Abdelnour, 2025) stresses the importance of keeping AI in its position as a means (*wasilah*) rather than an end (*ghayah*), so that technology adoption does not reduce the spiritual and ethical dimensions of the halal concept to a merely technical-administrative matter. This analysis therefore affirms that the success of AI integration in Indonesia's halal industry is determined not solely by the technical sophistication of the system, but by the extent to which its governance is deliberately designed (purposeful design) to realize maqashid syariah fully and in a balanced manner, consistent with the systems features put forward by (Auda, 2008).

CONCLUSION

This research concludes that Artificial Intelligence holds a strategic role in the development of Indonesia's halal industry, particularly in halal verification, supply chain traceability, contamination risk management, and consumer education. Read through Maqashid al-Shariah Theory grounded in Jasser Auda's Systems Approach, such AI application has the potential to strengthen all five *dharuriyyat* values hifz al-din, hifz al-nafs, hifz al-'aql, hifz al-nasl, and hifz al-mal while simultaneously reflecting the systems features of cognition, wholeness, openness, interrelated hierarchy, multidimensionality, and purposefulness. Nevertheless, this potential is not automatically realized without adequate governance, given that the risks of algorithmic bias, insufficient transparency, and the MSME digital literacy gap risk undermining the principle of justice that constitutes the spirit of maqashid syariah itself.

The theoretical implication of this research affirms the relevance of Auda's systems approach as a more dynamic and contextual analytical framework compared with the

atomistic-hierarchical classical maqashid approach, particularly for reading cutting-edge technological phenomena such as AI, which are cross-dimensional in nature. Practically, regulators and halal product assurance institutions in Indonesia need to formulate AI governance guidelines that explicitly integrate maqashid syariah principles, rather than orienting solely toward technical efficiency. Business actors, particularly MSMEs, require mentoring support and incentives so that AI adoption does not become a new burden that instead threatens their hifz al-mal. Future research is encouraged to deepen this study empirically, for instance through case studies of halal certification institutions or MSMEs that have adopted AI technology, in order to more concretely test the theoretical propositions developed in this library research.

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