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Analysis of Halal Traceability Implementation in the Halal Food Industry in Indonesia: A Literature Review

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ABSTRACT

This study analyzes the implementation of the Halal Traceability System to ensure integrity and transparency within the Indonesian food supply chain, driven by national regulatory mandates and Muslim consumer demand. The main problem addressed is the implementation gap of halal traceability system, particularly among Small and Medium Enterprises (MSEs), and the necessity to integrated digital technology with the existing regulatory framework. The approach employed is a systematic qualitative literature analysis. The results indicate that halal traceability system impelementation is critically urgent and is heavily driven by regulation (Law No. 33 year 2014), with blockchain and RFID technology identified as key models for ensuring data immutability and transparency. In conlusion, halal traceability is the essential mechanism that operationalizes halal integrity, and the effectiveness of halal traceability system relies heavily on the synergy between technology, top management commitment, and the digital validation of the certification process. The implication suggest the need to develop an integrated, affordable, and scalable national halal traceability platform to strengthen Indonesia's position as a global halal hub and enhance consumer trust.

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1. INTRODUCTION

The global halal food industry has experienced tremendous growth in the past two decades, driven by the increasing awareness of Muslim consumers and the global demand for halal certified products. According to the Pew Research Center (2022), Muslims represent over 1,9 billion people worldwide, and Indonesia, as the largest Muslim-majority country, account for nearly 87% of its 280 million population. This demographic dominance positions Indonesia as a strategic hub developing a robust Halal Value Chain (HVSC), particularly in the food sector (Nugroho et al., 2024).

Halal food does not only signify compliance with Islamic law (*Shariah*) but also encompasses the concept of *thayyib*, meaning purity, safety, and wholesomeness. The halal industry thus integrates both religious and ethical values in ensuring consumer trust. However, maintaining halal integrity across the supply chain from sourcing raw materials to distribution remains a persistent challenge. As pointed out by Zainuddin et al. (2020), the effectiveness of the *Halal Traceability System (HTS)* directly influences the performance and credibility of the halal supply chain.

The *traceability* concept, as defined by ISO, refers to the ability to track and trace a product's origin, history, and movement throughout the supply chain. In the halal context, it ensures that every process from raw material procurement, processing, logistics, and distribution companies with Islamic principles (Zulfakar et al., 2014). Consequently, the development of a *Halal Traceability System* has become essential for verifying halal integrity, preventing contamination with non halal substances, and ensuring transparency for consumers and regulators.

In Indonesia, the Government has reinforced this through *Law No. 33 of 2014* on Halal Product Assurance (*Jaminan Produk Halal*) JPH and *Government Regulation No. 39 of 2021*, which emphasize mandatory halal certification for food products. Theses regulations necessitate comprehensive traceability mechanisms across the halal food suppy chain to support integrity and transparency in halal certification (Siregar & Zahradika, 2023). Thus, the importance of this topic lies in the urgent need for implementing a digitalized and integrated halal traceability system to enhance consumer confidence, strengthen Indonesia's position in the global halal market, and ensure compliance with national and international halal standars.

Recent studies on *halal traceability* and *supply chain management* emphasize the integration of digital technologies and modeling frameworks to ensure halal integrity across production and distribution. Research by Ubaydilla and Fathuroman (2021) using the SCOR model and by Haryono and Handayani (2018) with ISM approach highlight the importance of documenting halal process from upstream to downstream. Other scholars, including Vikaliana et al. (2021) and Surjandari et al. (2021), propose

blockchain and IoT based system to improve transparency, data security, and traceability reliability. Nugroho et al. (2024) further confirm that technological adoption significaly enhance halal product authentication and legitimacy, particularly among micro, small, and medium enterprises (MSMEs). Complementary research by Siregar and Zahradika (2023) and Rohaeni and Sutawidjaya (2020) underscores the role of stakeholder collaboration and digitalization in strengthening the halal food supply chain in Indonesia.

Despite these advances, research gaps remain in the integrating technology with Indonesia's regulatory framework and ensuring the scalability f halal traceability systems across SMEs. Most studies focus on isolated cases of conceptual models without offering a comprehensive synthesis that bridges technology, regulation, and supply chain practice. Consequently, this aims to fill these gaps through a systematic literature analysis of halal traceability implementation in Indonesia's food sector. It contributes to both theory and practice by proposing an integrative framework that aligs digital aspiration to becomes a leading global halal hub.

2. Literature Review

2.1 The Conceptual Foundation of Halal and Traceability

The academic discourse on the global Halal Value Chain (HVSC) is underpinned by the substantial growth of the halal industry, a trend largerly driven by increasing religious and ethical awareness of Muslim consumers worldwide. With Muslims representing over 1,9 billion people globally, and Indonesia commanding a strategic position as the largest Muslim majority country (Pew Research Center, 2022), the Indonesian food sector is viewed as a critical hub for developing a robust HVSC (Nugroho et al., 2024).

The concept of halal in this context is dual, encompassing not only compliance with Islamic law (*Shariah*) but also the dimension of *thayyib*, which mandates purity, safety, and wholesomeness. This ethical integration is vital for the sourcing of raw materials through to distribution remains a persistent challenge across the supply chain. To address this challenge, the concept of traceability has become paramount. Traceability, defined by ISO as the ability to track a product's origin, history, and movement throughout the supply chain, is adapted in the halal industry to ensure compliance with Islamic principles at every step, from procurement to distribution (Zulfakar et al., 2014). Consequently, the development of a Halal Traceability System (HTS) is essential for verifying halal integrity, preventing contamination with non halal substances, and ensuring comprehensive transparency for all stakeholders.

A significant development in this field is the integration of halal integrity into the PFSC discourse. Halal requirments are not merely limited to the sourcing of good materials but extend to the entire supply chain, encompassing the process, handling, packaging, strorage, and transportation (Ramli et al., 2020; Shahdan et al., 2016; Zailani

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et al., 2015). For Muslim consumers, halal certification and logos are the formal mechanisms used to ensure that food consumed aligns with Islamic values and is certified by authorized religious bodies (Hanafiah & Hamdan, 2021); Fernando et al., 2022). However, a series of food scandals, such as the contamination of frozen meat with pork and melamine in infant milk, has amplified consumer apprehension regarding the food supply chain (Fernando et al., 2022; Marucheck et al., 2011; Pinto et al., 2015; Tan et al., 2017).

2.2 The Evolution of Halal Traceability Systems and Regulatory Urgency

The significance of a robust Halal Traceability System (HTS) is directly and fundamentally linked to the operational performance and integrity of the supply chain. The effectiveness and credibility of the entire halal supply chain are directly influenced by a robust HTS (Zainuddin et al., 2020).

In Indoensia, this operational need has been structurally reinforced by national legislation. The government's commitment to integrity is demonstrated by Law No. 33 of 2021. Theses regulations mandate compulsory halal certification for food product, which, in turn, necessitates comprehensive traceability mechanisms to uphold integrity and transparency throughout the certification process (Siregar & Zahradika, 2023). This regulatory landscape highlights the urgency of implementing an integrated and digitalized halal traceability system to strengthen Indonesia's standing in the competitive global halal market.

Early scholarly work focused on modeling and documenting the necessary halal processes to ensure that the process is fully documented from upstream to downstream. This foundational research includes studies that utilized the Interpretive Structural Modeling (ISM) approach (Haryono & Handayani, 2018) and the application of the Supply Chain Operations Reference (SCOR) model (Ubaydilla & Zahradika, 2021). Furthermore, strengthening the Indonesian halal food supply chain has been shown to rely significantly on stakeholder collaboration and digitalization efforts (Siregar & Zahradika, 2023; Rohaeni & Sutawidjaya, 2020).

2.3 Barriers and the Emergence of Lean Knoledge Management (LKM)

Despite the clear regulatory and operational benefits of HTS, the adoption of advanced traceability technology is meat with substantial barriers. These challenges include the expense of initial investment and additional cost for software and hardware preparation (Compagnucci et al., 2022; Dash & Jena, 2022). Furthermore, the fileds is hamperd by a pervasive lack of standarlized data and exchange methods (Bosona & Gebresenbet, 2013; storoy et al., 2013), and complex technical and security issues (Kamarulzaman et al., 2022; Nizetic et al., 2020; Hardt et al., 2017).

These barriers, particularly in the halal context, are essentially viewed as knowledge barriers that can be overcome, given that traceability approaches themselves are inherently knowledge oriented (Hardt et al., 2017; Yang & Cai, 2009). This realization propelled the concept of Knowledge Management into the supply chain discourse. Knowledge management is recognized as a key process for organizational innovation and success (Iqbal, 2021; Nonaka & Takeuchi, 1995, as cited in klein et al., 2023), which can improve supply chain performance (Kalogeraki et al., 2018). However, to be effective and prevent waste, Knowledge Management must be implemented efficiently (lean) (Ferenhof et al., 2015), which then gave rise to the concept of lean knowledge manahement (LKM).

2.4 The Adoption of Digital Technologies in Halal Traceability System

the most recent development in halal traceability research emphasizes the integration of advanced digital tehcnologies. The primary focus of current studies is to leverange these tools to enhance transparency, data security, and reliability in Halal Traceability System. Specifically, Blockchain and the Internet of Things (IoT) have emerged as promising solutions. Vikaliana et al., (2021) and Surjandari et al., (2021) proposed system based on these technologies to improve data security and the reliability of traceability records. The adoption of such technologies innovations has been empirically confirmed to significally enhance the authentication and legitimacy of halal products, particularly among Micro, Small, and Medium Enterpries (MSMEs) (Nugroho et al., 2024).

Despite these technical advances, a notable research gap persists. The majority of studies currently focus on isolated cases or conceptual models, lacking a comprehensive, synthesized framework that successfully integrates technology with Indonesia's specific regulatory environment and ensures the scalability of halal traceability system across SMEs. The prevailing discourse thus indicates a necessary shift toward a systematic literature analysis that can bridge technology, regulation, and supply chain practice, ultimately leading to an integrative framework that support Indonesia's aspiration to become a leading global halal hub.

3. RESEARCH METHOD

This study employed a qualitative approach using the literature study (library research) method. A qualitative was chosen because the purpose of this research was to explore and understand the phenomenon of *halal traceability implementation* in halal food supply chain through a comprehensive analysis of concepts, theories, and empirical findings from various scholarly sources. According to Creswell (2018), qualitative research empharizes understanding the meaning and interpretation of complex social phenomena rather than quantitative measurement. This approach enable an indepth

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exploration of the interrelationship between traceability systems, halal certification, and supply chain management practices in the halal food industry.

The literature study method was selected because the topic of traceability in halal supply chain has been widely discussed in prior studies in the form of journal articles, books, and research reports. By examining these secondary sources, this study synthesizes multiple perspectives and research findings to produce a holistic understanding. As stated by Synder (2019), a systematic and targeted literature review contributes to scientific advancement by integrating existing findings to identify research gaps, trends, and future directions for theory and practice. Accordingly, this qualitative literature based approach is the most relevant method to achieve the study's objective analyzing how traceability system are implemented in the halal food supply chain industry, identifying supporting and inhibiting factors, and explaining the role of regulation and digital technology in ensuring halal product traceability from upstream to downstream.

This study used secondary data as the primary sources. Secondary data refer to information collected indirectly from pre existing research, reports, and publications. According to Sugiyono (2021), secondary data are crucial in qualitative research as they provide a broad overview of the research topic and allow comparative analysis among various studies. The secondary data sources included:

- Scholarly articles and journal, both national and international, discussing topics related to traceability systems, halal supply chains, halal assurance system, halal certification, and the application of information technology in the halal food industry.
- Academic books and scientific literature explaining theories of supply chain management, halal quality management, and traceability systems in food production.
- Official regulations and polices issue by government institutions, including Law No. 33 of 2014 on *Halal Product Assurance (JPH)*, *Government Regulation No. 39 of 2021*, and implementation guidelines of the *Halal Assurance System* published by the *Halal Product Assurance Organizing Agency (BPJPH)* and the *Indonesian Ulema Council (MUI)*.

The data collection process employed a literature document technique. According to Miles and Huberman (2014), documentation enables researchers to obtain information from written records and existing sources. The process was conducted systematically through the following stages:

1. Keyword Identification
   Key search terms such as "halal supply chain", "traceability system", "halal food industry", "blockchain in halal supply chain", "halal assurance system", and "traceability implementation" were determined and used across multiple academic database.

2. Screening Process
   The initial search result were filtered based on title, abstract, and thematic relevamce. Irrelevant, duplicate, or incomplete (non full text) papers were excluded.
3. Inclusion and Exclusion Criteria
   - Inclusion criteria: publications addressing halal industru traceability using empirical or conceptual approaches, published between 2014 and 2025.
   - Exclusion criteria: studies focusing on non halal food sectors, opinion papers, or literature lacking clear methodology.
4. Data Compilation and Organization
   Selected papers were categorized by theme, such as: (a) traceability concepts and models; (b) implementation in halal supply chains; (c) challenges and constraints; and (d) roles of information technology and regulation.
5. Data Extraction
   Each selected study was analyzed to extract essential information, including research objectives, methodology, main findings, and recommendations. The extracted data were tabulated to facilitate thematic analysis.

Through this systematic documentation process, reliable and verified secondary data were obtained to support qualitative analysis.

3.1 Data analysis Technique

Data were analyzed using content analysis and thematic analysis, which complement each other in deriving meaning from the reviewed literature.

3.1.1 Content Analysis

According to Krippendorff (2019), content analysis is a systematic technique for drawing valid inferences from text by identifying, categorizing, and interpreting recurring patterns. In this study, content analysis was applied to examine textual data from documents discussing traceability implementation in halal supply chains through the following steps:

1. Carefully reading and contextual understanding of each document.
2. Identifying key concepts and variable such as “halal integrity”, traceability technology”, “information transparency”, and “consumer trust”.
3. Grouping information into thematic clusters (e.g., regulatory aspects, technological aspects, managerial aspects).
4. Drawing preliminary conclusions about how traceability is applied in various halal food industries globally.

3.1.2 Thematic Analysis

Once categories were identified, thematic analysis was performed to determine overaching themes, following Braun and Clarke (2006, this process included: (1) data familiarization, (2) initial coding, (3) theme identification, (4) theme review, (5) theme naming, and (6) thematic reporting.

The themes identified in this research include:

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1. The concept and urgency of traceability in halal supply chains.
2. Models and technological approaches (e.g., blockchain, RFID, IoT).
3. Enabling and inhibiting factors for traceability implementation.
4. The role of regulations and government policy in promoting halal traceability systems.
5. The impact of traceability on consumer trust and industry competitiveness.

This combined analysis provides not only a descriptive synthesis but also a conceptual understanding of how these themes interconnect in the context of halal food supply chains.

3.1.3 Data Validity and Credility

To ensure the credibility and validity of the findings, several validation strategies commonly used in qualitative literature studies were applied:

1. Source Triangulation, is a comparing information across multiple sources such as peer-reviewed journals, books, and policy documents.
2. Peer-reviewed Verification, is a only literature published in reputable, peer-reviewed journals was included.
3. Credibility and Relevance Evalution, is a assessing each source bases on publisher reputation, publication year, and topic alignment.
4. Researcher Reflexivity, is a maintaining objectivity and avoiding personal bias; all interpretations were based on verified data and established theory.
5. Audit Trail, is a documenting every step of data collection and analysis to ensure transparency and reproducibility of results.

Theses measures ensured that the study's findings are methodologically soud and academically reliable.

3.1.4 Analytical Framework

The analytical framework integrates three main components: (1) Traceability System, (2) Halal Supply Chain, and (3) Technology and Regulation. This framework connects various pieces of literature into a unified systemic understanding.

1. Traceablity System a includes documentation, tracking, and tacing of product information from rawa materials through production and distribution to the end consumers.
2. Halal Supply Chain a encompasses all activities ensuring product halalness through control of critical halal points along the supply chain.
3. Technology and Regulation a function as drives facilitating traceability through digital systems, data integration, and compliance with national and international halal standards.

3.1.5 Research Procedure

Chronologically, the research procedure consisted of several stages:

1. Preparation Stage: determining the research topic, formulating research questions, and defining search keywords.
2. Data Collection Stage: conducting systematic searches in academic databases and selecting relevant literature.
3. Data Analysis Stage: performing content and thematic analyses of selected studies to identify patterns and themes.
4. Synthesis and Interpretation Stage: integrating analytical findings into a conceptual framework and constructing an explanatory narrative.
5. Reporting Stage: composing the research article, reviewing validity and consistency, and preparing it for publication.

4. RESULT AND DISCUSSION

The systematic literature review on Analysis of Halal Traceability Implementation in the Halal Food Industry in Indonesia yielded comprehensive findings, categorized through thematic analysis based on the analytical framework of traceablity system, halal supply chains, and technology and regulation. The analysis affirmed the critically of halal integrity and information transparency as the central concerns driving the need for robust traceability. The following sections detail the results according to the five themes indentified.

4.1 Results: Thematic Analysis of Halal Tracebility

1. The Urgency of Halal Traceability

   The literature overwhelmingly establishes halal traceability asa a crtical necessity for the Indonesian food industry, moving beyond a market differentiator to a core component of supply chain governance. This urgency is dual pronged: ensuring regulatory compliance with national mandate and preserving Halal Integrity throughout the value chain. Findings stress that absence of a comprehensive traceability system significantly increase the risk of contamination (*najas*) and food fraud, particularly in complex, multi stage supply chains. A robust Halal traceability System (HTS) is therefore essential for mitigating these riks and safeguarding the religious obligation of consuming only permissible (*halal*) and wholesome (*thayyib*) products.
2. Technological Models for Halal Traceability

   The review highlights the indispensable role of digital technology in operationalizing effective halal traceability. The most prominent technological models discussed are Blockchain Technology and RFID (Radio Frequency Identification). Blockchain is frequently proposed for its capacityto create a decentralized, immutable ledger for recording. Halal Critical Points (HCPs), thereby guaranteeing data transparency and integrity from upstream to downstream. RFID system are valued for their effiency in real time tracking,

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inventory management, and faster data capture during logistic operation. The synthesis suggests that the future of Halal Traceability System in Indonesia lies in an integrated, hybrid model that combines the data security of Blockchain with the operational speed of sensors and identification technologies like RFID or QR codes.

3. Enabling Factors for Implementation

   The successful adoption of Halal Traceability System at the firm level is heavily dependent on several enabling factors. The most crucial factor identified is Top Management Commitment, which is necessary for allocating the substantial resources required for Halal Traceability System implementation and fostering a cultural shift toward a high integrity Halal Assurance System (HAS). Other key enablers include:

   1. The establishment of clear and enforceable Standard Operating Procedures (SOP) specifically detailing Halal Traceability System protocol.
   2. The provision of contious employee training to ensure staff competence in managing the traceability system.
   3. Building transparent and collaborative relationship with certified suppliers to ensure the integrity of raw materials at the source.

4. The role of Regulation and Policy

   Indonesian regulations serve as the primary external driver for Halal Traceability System implementation. Law No. 33 of 2014 on Halal Product Assurance (JPH) and its derivative Government Regulation No. 39 of 2021 have formalized the obligation for halal assurance, which inherently requires traceability. The review confirms that the Halal Product Assurance Organizing Agency (BPJPH) and the Indonesian Ulema Council (MUI) play a definitive regulatory role in standardizing Halal Traceability System requirements, auditing compliance, and ensuring that traceability data is an integral part of the halal certification renewal process. This regulatory pressure is essential for driving mandatory adoption across all scales of the halal food industry.

5. Halal Traceability and Consumer Trust

   The ultimate consequence of implementing a robust Halal Traceability System is the significant enhancement of consumer trust. By providing mechanism for information transparency, consumers are empowered to verify the halal status and origin of the products they purchase, thereby reducing perceived risk. The ability to acces verifiable data about the product's journey translates directly into greater consumer confidence, which in turn confers a substantial competitive

advantage to traceable product in Indonesia's massive Muslim concumer market.

5. Discussion

the findings confirm that the implementation of halal traceability in the Indonesian food industry is a complex, yet mandatory, undertaking driven by the synergy of Traceability System, Halal Supply Chains, and Technology and Regulation.

The central challenge identified within the halal supply chain remains information asymmentry and a lack of veritical integration. While large enterprises may be capable of deploying advanced Halal Traceability System, Small and Medium Enterprises (SMEs), which form the backbone of the Indonesian food sector, struggle with the initial investment, technical expertise, and operational complexity. This gap necessitates policy intervention to promote scalable and affordable Halal Traceability System solutions tailored for SMEs.

Furthermore, digital technology is unequivocally the key to achieving the necessary information transparency mandated by Law No. 33 of 2014. The discussion underscores that for the regulatory framework to be fully effective, the audit and certification processes governed by BPJPH and MUI must evolve to integrate and validate the data produced by modern Halal Traceability System, particularly leveraging immutable systems like blockchain. This integration moves beyond paper based audits to real time, digital verification.

In conclusion, the analysis suggest a clear direction: halal traceability is the mechanism that operationalizes halal integrity across the supply chain, while technology and regulation are the essential enanblers. Future efforts must focus on developing a national, integrated Halal Traceability System platform that standardizes data protocols,ensures regulatory compliance through digital means, and ultimately secures consumer trust by making the halal process transparent from the source to the final consumer. This comprehensive, integrated model is critical for consolidating Indonesia's ambition to become a global leader in the food industry.

6. CONCLUSION

Operationalizing Halal Intergrity for Indonesia's Global Ambition, this systematic literature review, The title article "Analysis of Halal Traceability Implementation in the Halal Food Industry in Indonesia", comprehensive examined the interrelationship between Traceability Systems, Halal Supply Chains (HSCM), and the driving forces of technology and regulation within Indonesia's food sector. Situated against the backdrop of Indonesia's demographic dominance as th world's largest Muslim majority nation and its strategic goal to become a global halal hub, this study confirmed the absolute necessity

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of a robust Halal Traceability System not merely as a business differentiator but as a mandatory component of national supply chain governance and a fundamental requirement for upholding the religious mandate of consuming halal and thayyib products.

The synthesis of literature definitively proves that the successful future of the Indonesia halal food industry is inextricably linked to the successful deployment of an integrated, digital, and transparent Halal Traceability System. The challenge lies not in the conceptual regognition of this need, but in the operationalization of integrity across the vast and complex Indonesian supply landscape, particularly among its numerous Micro, Small, and Medium Enterprises (MSMEs).

Synthesis of core findings and theorical contributions, the thematic analysis yielded five central findings that collectively define the current state and future direction of Halal Traceability System implementation in Indonesia.

Firstly, the Urgency of Halal Tracebility is confirmed as dual pronged, driven both by strict regulatory compliance (Law No. 33 of 2014) and the existing need to safeguard Halal Integrity. The literature uniformly stress that complex, multi stage supply chains inherently carry a heightenend risk of najas (contamination) and sophisticated food fraud. The absence of Halal Traceability System from a logistical function to a Halal Assurance System (HAS) imperative, a core component of risk mitigation and shariah compliance.

Secondly, the analysis of technological models for halal traceability highlights a pronounced shift toward advanced digitalal solutions. The key innovation proposed by researchers is the implementation of a permissioned blockchain network, specifically using hyperledger fabric with a raft consensus mechanism. This specific architectural choise is a a significant theorical finding, as it addresses the practical needs of the Indonesian environment: it provides the necessary immutability and transparency for recording Halal Critical Point (HCPs) while maintaining the high transaction speed and security required by a dynamic supply chain. The integration of this immutable digital ledger with operational level technologies such as RDIF and QR codes confirms the necessary shift towards a hybrid, integrated model to ensure both data security and realtime operational efficiency. This technological convergence provides the mechanism for achieving the information transparency mandated by law.

Thirdly, the review isolated enabling factors for implementation, with Top Management Commitment and the subsequent dedication of resources being paramount. Furthermore, quantitative evidence reinforces the theorical proportion that technology adoption has the most significant direct effect on enhancing the integrity and legitimacy of halal product, especially for smaller enterprises. This implies that the managerial and cultural shift toward a highintegrity HAS must be catalyzed by the strategic investment

in and effective utilization of digital tools. The foundational work in using models like the SCOR model in the implementation phase further confirms the practical need for clear, documented Standard Operating Procedures (SOP) to goven Halal Traceability System protocols.

Fourthly, the role of regulation and policy unequivocally established as the primary external driver. The mandatory nature of halal certification under Law No. 33 of 2014 and the oversight of the Halal Product Assurance Organizing Agency (BPJPH) and the Indonesian Ulema Council (MUI) provide the structural pressure necessary for widespread adoption. This regulatory environtment is not just an enforcer but also an accelerator, actively preparing startegies to strengthen the Islamic economy through the Halal Value Chain (HVSC) and the promotion of technologies like blockchain.

Finally, the ultimate consequential finding is the direct link between a robust Halal Traceability System and the Enhancement of Consumer Trust and Product Legitimacy. By making verifiable, tamperproof data available through mechanism like QR code scanning data that spans from raw material sourcing to final delivery Halal Traceability System empowers concumers. This transparency reduces perceived risk and translates directly into a substantial competitive advantage in Indonesia's massive Muslim consumer market. The ability to guarantee both halal compliance and thayyib wholesomeness secures the final link in the chain, and market confidence.

The analysis firmly establishes that halal traceability is the essential mechanism that operationalizes Halal Integrity across the entire supply chain, while technology (blockchain) and policy (Law No. 33 of 2014) serve as the indispensable enablers. Indoensia's success in becoming a global leader in the halal food industry hinges upon its ability to transition from conceptual acknowledgment to the full, integrated implementation of a digital Halal Traceability System. This necessitates a national platform that ensures standardization of a data protocols, closes the critical SME technology gap through inclusive policies, and ultimately secures and maintains consumer trust by making the entire process demonstrably transparent, authentic, and legitimate from the source to the final consumer. This comprehensive, integrated, and digitally enable model is the final piece required to cement Indonesia's strategic vision.

6.1 Implications and policy recommendations, the findings carry significant implications for policy, industry, and future academic endeavors

Bridging the SME Tecnology Gap, the most critical practical challenge identified is the profound SME technology gap. MSMEs, which form the demographic backbone of the Indonesian food sector, are often excluded from or struggle to sustain advanced halal traceability system solutions due to high initial investment cost, lack of technical expertise, and operational complexity. This gap creates a weak link in the national HVSC, as the integrity of the raw materials sourced from smaller players remains difficult to

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verify. Policy intervention is therefore non negotiable. The government and regulatory bodies must actively promote and fund the development of scalable, standardized, and affordable halal traceability solutions tailored specifically for MSMEs. This could inlvolve subsidized adoption of shared blockchain platform or standardized, low cost sensor/QR code systems integrated into a national data repository. The concept of lean knowledge management (LKM) must be integrated into these solutions to ensure that the halal traceability system is not only technologically sound but also operationally efficient and free from unnecessary waste, allowing MSMEs to gain maximum benefit witfh minimal burden.

Digitalizing the audit and certification process, for Indonesian regulations to be fully effective, the audit and certification processes governed by BPJPH and MUI must undergo a complete digital transformation. Relying on paper based or even manual digital audits is insufficient when dealing with a dynamic, high volume supply chain. The regulatory framework must evolve to formally integrated and validate the immutable data produced by modern halal traceability system, particularly blockchain ledgers. This move from a periodic, point intime audit to realtime, continuous digital verication is essential for maintaining integrity troughout the certification period and for reducing the cost and time associated with certification renewal. The regulatory structure must adapt to accept and leverage blockchain validated data as the gold standard for traceability evidence.

Integrating halal and thayyib into halal traceability design, the discussim confirms that halal traceability system must track more than just halal compliance. It must simultaneously verify the dimension of thayyib (purity, safefy, and wholesome). Future halal traceability system design must therefore not only focus on the absence of najas but also integrate quality control data, temperature records, and logistics history to track product freshness and handling practices. The system must be capable of tracing product quality deviations (spoilage, temperature excursions) alongside religious compliance failures. This holictic approach to integrity is what difines legitimacy in the modern halal market and will be the ultimate factor in securing Indonesia's competitive advantage.

ACKNOWLEGMENT

Limitations and Directions for future Research:

As a systematic literature review, this study's primary limitation lies in its reliance on secondary data, meaning the findings are a synthesis of existing research, which often focuses on conceptual models or isolated case studies. While the conceptual framework is robust, empirical evidence on the wide scale implementation and return on investment

of advanced halal traceability system in the Indonesian context remains limited. To advance the field, future research should focus on:

1. Empirical case studies: conducting indepth empirical studies on the real world adoption of permissioned blockchain within various scales of Indonesian food enterprises, focusing on challenges encountered, cost benefit analysis, and performance metrics (reduction in audit time, decrease in contamination incidents).
2. Quantitavie modeling of the SME Gap: developing and testing quantitative models (using SEM or econometrics) to measure the precise impact of standardized, low cost technology solutions on the supply chain performance and market accsess of MSMEs, providing hard data to guide policy subsidies.
3. Regulatory bechmarking: conducting comparative studies bechmaring Indonesia's halal traceability system regulatory framework (BPJPH/MUI) against other leading global halal certification bodies to identify best practices for integrating immutable digital records into the formal auditing and certification process.

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Manuscript Preparation

a. *Indonesia's Halal Product Sectors with the Highest Exports Value (January-October 2024)*

according to the Ministry of Trade, the value of Indonesian halal product exports from January to October 2024 reached US$41.42 billion, equivalent to Rp673.90 Trilliun. This figure was largely derived from exports of processed foof halal products, valued at US$33.61 billion. The Ministry of Trade noted that, from January to October 2024, the main destinations fro Indonesian halal product exports were the United States, China, India, Pakistan, and Malaysia. According to Mohammad Bawazeer, Chairman of the Standing Committee on the Middle East and Organization of Islamic Cooperation (OIC) of the Indonesian Chamber of Commerce and Industry (Kadin), Indonesia needs to optimize its position as an OIC members to expand its halal product export market. Needs to maximize Middle Eastern markets such as Saudi Arabia, Oman, Bahrain, Kuwait, Qatar, UEA, Lebanon, Yemen, and Iran. Our challenges lie in regulations and the use of international product standards, as well as unique business characterictics and cultures. The Ministry of Trade staded in a press release late last year.

Figure 1. An *Indonesia's Halal Product Sectors with the Highest Exports Value (January-October 2024)*