

Gap Analysis of Digital Traceability Implementation in Small-Scale Halal Industries

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Abstract

The rapid growth of the halal industry in Indonesia has increased the demand for more transparent, accountable, and integrated product management systems. One technological innovation that supports this need is digital traceability, a technology-based tracking system that enables stakeholders to access information related to the origin of raw materials, production processes, storage, and product distribution. Through digital traceability, consumers can verify the halal integrity of products more easily, thereby enhancing trust and confidence in halal-certified products. Despite its potential benefits, the implementation of digital traceability among small-scale halal enterprises remains limited and faces several significant challenges.

This study aims to analyze the implementation gap of digital traceability systems among halal Micro, Small, and Medium Enterprises (MSMEs) using a qualitative research approach. Data were collected through direct interviews with owners and managers of small-scale halal food businesses located in Ujungnegero. The findings indicate that most halal MSMEs have not yet adopted digital traceability systems effectively. Several factors contribute to this situation, including limited digital literacy among business owners, high implementation and maintenance costs, inadequate technological infrastructure, and a lack of technical guidance and training from relevant institutions.

Furthermore, the study reveals a substantial gap between increasing consumer expectations for halal transparency and the readiness of MSMEs to adopt digital technologies. While consumers are becoming more concerned about product authenticity and traceability, many MSMEs still rely on conventional record-keeping methods. Therefore, a gradual implementation strategy, supported by government policies, training programs, technological assistance, and collaboration among stakeholders, is essential to facilitate digital transformation and improve the competitiveness and sustainability of the small-scale halal industry in Indonesia.

Keywords: Digital traceability, halal industry, MSMEs, gap analysis, halal supply chain, digital transformation.

1. Introduction

The halal industry has experienced rapid growth in recent years, not only in Muslim-majority countries but also globally. This growth is driven by increasing consumer awareness of halal certification, quality, and product safety. Consumers no longer rely solely on the halal label as a guarantee, but are also beginning to question the production process, the source of raw materials, and how products are distributed. This behavioral shift demands greater transparency in the halal supply chain.

One approach deemed capable of addressing this need is the implementation of digital traceability. This system enables comprehensive product tracking using digital technology, allowing for better documentation of every stage of the supply chain. In the context of the halal industry, digital traceability serves not only as a quality control tool but also as a mechanism to maintain the halal integrity of products. This becomes increasingly important when the supply chain involves multiple, geographically dispersed parties.

However, the implementation of digital traceability is not yet evenly distributed across all industrial sectors. Large companies tend to be more prepared to adopt this technology because they have adequate resources, both financially and in terms of infrastructure and human resources. In contrast, small-scale businesses, or MSMEs, still face various limitations that make it difficult for them to optimally implement digital systems. Yet, in many developing countries, including Indonesia, MSMEs are the backbone of the halal industry.

Several studies published in journals such as JIEHIS and PERFORMA indicate that the main challenges in technology adoption among MSMEs are not only related to costs, but also include aspects of organizational readiness and the external environment. This aligns with the Technology–Organization–Environment (TOE) approach, which explains that successful technology adoption is influenced by three main factors: technological characteristics, internal organizational readiness, and environmental pressures such as regulations and market competition.

In practice, many small businesses still rely on manual recording systems and trust-based relationships to conduct their business activities. This model is quite effective on a limited scale, but it has weaknesses when faced with demands for greater transparency and accountability. The lack of systematic documentation can also complicate the verification process, both for halal certification and to increase consumer trust.

This situation demonstrates a clear gap between the ideal concept of digital traceability and actual conditions on the ground. This gap is not only technical but also reflects the differences in capacity and readiness between large and small businesses. If not addressed promptly, this gap has the potential to widen the competitive gap, leaving halal MSMEs increasingly left behind in an increasingly competitive market.

Based on this background, this study aims to analyze the gap in digital traceability implementation in the small-scale halal industry. The primary focus of the study is to identify inhibiting factors and understand how the gap between ideal and actual conditions arises. By understanding this gap, it is hoped that a more realistic approach can be formulated that aligns with the characteristics of MSMEs, enabling digital transformation in the halal industry to be more inclusive and sustainable

2. Problem Formulation

Based on the results of the background research on the implementation of digital traceability in the small-scale halal industry, the research problems in this study are as follows:

1. What is the current state of digital traceability implementation in the small-scale halal industry?
2. What obstacles do business actors face in implementing digital traceability systems in the small-scale halal industry?
3. What is the gap between modern digital traceability standards and the actual conditions in the small-scale halal industry?
4. What factors influence the low implementation of digital traceability in the small-scale halal industry?

2.1. Research Objectives

The objectives of this study are:

1. To describe the current state of digital traceability implementation in the small-scale halal industry.
2. To understand the challenges faced by MSMEs in implementing digital traceability systems.
3. To analyze the gap between modern digital traceability standards and actual conditions in the field.
4. To determine the factors that influence the low implementation of digital traceability in the small-scale halal industry.

3. Literature Review

3.1. Traceability in the supply chain

Traceability in the supply chain refers to the ability to trace the history, location, and journey of a product through all stages of production and distribution. This concept is becoming increasingly important as the complexity of global supply chains increases. In the context of the food industry, traceability is also crucial for enhancing operational efficiency and ensuring the safety and quality of products reaching consumers.

Traceability is a crucial element in modern supply chain management systems because it reduces the risk of product non-conformities and increases transparency among supply chain actors. In the halal industry, this concept has an additional dimension: compliance with Sharia principles. This means that every raw material and production process must be traceable to ensure there is no non-halal contamination.

Furthermore, traceability plays a role in building consumer trust. When product information is clearly and transparently accessible, consumers will have greater confidence in the quality and halal status of the product. However, implementing traceability often faces challenges, especially for small businesses that lack a structured and digitized recording system.

3.2. Digital Transformation in Industry

Digital transformation is a process of integrating digital technology into all aspects of the business world. It can transform organizations that strive to deliver value to customers in modern industry. Digital transformation goes beyond simply utilizing advanced technology. This encompasses how we work across business and operational processes.

Transformation in the digital world has entered a phase of acceleration driven by technological advances such as the trending AI, the Internet of Things (IoT), and data-driven systems. These technologies enable business processes to be faster, more efficient, and based on real-time data. In the context of the halal supply chain, digital transformation enables the creation of a more transparent and accurate tracking system. Technologies like blockchain, for example, can be used to create immutable data, thereby increasing confidence in the halal nature of products. However, the adoption of digital transformation is not always smooth, especially for small businesses with limited resources.

Infrastructure limitations, implementation costs, and low digital literacy are the main factors hindering the digital transformation process in the MSME sector. Therefore, digital transformation needs to be tailored to the organization's capacity for sustainable.

3.3. Blockchain in Halal Traceability

Blockchain is a decentralized, immutable, and transparent digital data recording technology. In the context of halal traceability, blockchain is used to permanently record every stage of production, preventing manipulation by any party.

The advantage of blockchain lies in its high level of security and its ability to build trust between parties, ensuring that every transaction or production process is automatically recorded and identifiable by both or all parties.

However, blockchain implementation in the small-scale halal industry remains very limited. This is due to high implementation costs, technological complexity, and a lack of understanding of the system among business actors. As a result, this technology is predominantly used by large companies

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3.6. MSMEs in the Halal Industry

Msme are the backbone of the halal industry in Indonesia, as the majority of halal business actors come from this sector. MSMEs play a crucial role in providing halal products to the wider community, particularly in the food and beverage sector.

Despite their significant role, MSMEs face various limitations in adopting digital technology. Limited capital, lack of digital literacy, and limited access to training are the main obstacles hindering their digital transformation.

As a result, many MSMEs still use manual systems to manage their businesses. This makes it difficult to implement a digital traceability system, which requires structured and well-documented data.

3.7. Digital Traceability Implementation Gap

The digital traceability implementation gap refers to the difference between the ideal state of a digital traceability system and the actual situation on the ground. Ideally, every halal product should be digitally traceable from start to finish.

However, in reality, many MSMEs have not been able to implement this system due to various reasons.⁵ Discussion

The data results were obtained from interviews with MSMEs in Ujung Negoro

Table 1: Aspect

Aspect	Informant 1 (I1) – Owner of MSME A	Informant 2 (I2 – Manager of MSME B)	Main Findings
Use of digital traceability	Has not used a digital system; still uses manual methods (ledger & WhatsApp)	Still uses semi-digital tools; simple Excel spreadsheets	Both MSMEs have not fully implemented digital traceability
Understanding of digital traceability	Has general knowledge but has never implemented it	Understands the basic concept but does not understand the system in detail	Digital literacy remains limited
Raw material recording system	Recorded manually in a ledger	Recorded in Excel and partially manually	Recording systems are not digitally integrated
Main constraints	High costs and lack of technical knowledge	Unstable internet connection and no dedicated personnel	Key barriers: human resources, infrastructure, and costs
Readiness for digitalization	Not yet ready due to cost and knowledge limitations	Ready if training and external support are provided	Readiness is still at a moderate level

Aspect	Informant 1 (I1) – Owner of MSME A	Informant 2 (I2 – Manager of MSME B)	Main Findings
Future expectations	Wants a simple, easy-to-use system	Wants training and assistance for digitalization	There is a desire for digital transformation
External support	Has never received specialized training	Has not received guidance on halal digital systems	Institutional support is minimal

Tabel 2: Component

Component	Ideal Digital Traceability Condition	Field Condition (SMEs)	Gap
Recording System	Integrated digital (real-time tracking)	Manual / simple Excel	No integrated system
Human Resources (HR)	Understand digital technology	Low digital literacy	Competency gap
Infrastructure	Stable internet & complete digital devices	Unstable internet	Technological gap
Cost	Affordable / subsidized	Expensive	Financial gap
Halal Tracking Implementation	Transparent from raw materials to final product	Cannot be fully traced yet	Traceability system gap

3.8. Discussion and Results

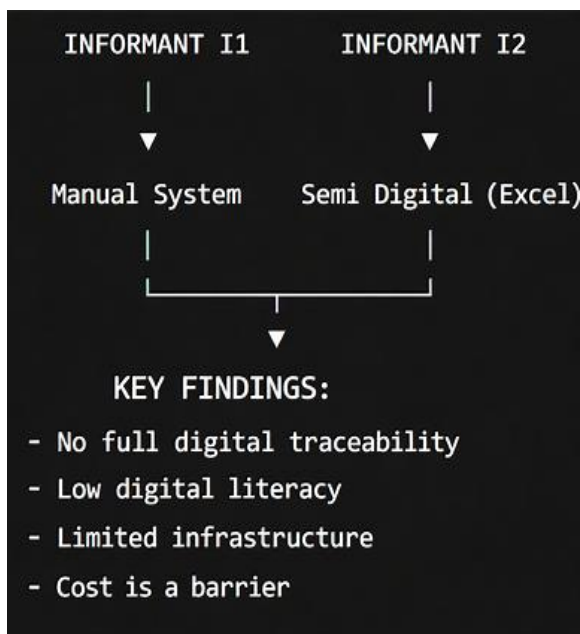


Fig. 1: Key

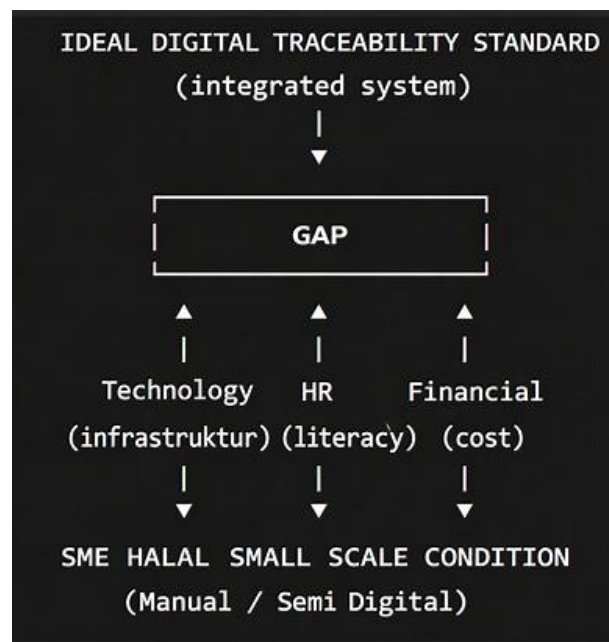


Fig. 2: Gap

Research findings indicate that the implementation of digital traceability in small-scale halal industries is still in its initial stage and has not yet reached an optimal level. Interview data reveals that both informants still rely on manual and semi-digital systems for recording raw materials and production processes. This suggests that digital transformation has not yet become a core component of halal MSME operations, despite the growing need for traceability systems in the Industry 4.0 era.

Theoretically, digital traceability within the halal supply chain should provide transparency, data accuracy, and end-to-end product traceability. In practice, however, MSMEs face various constraints, such as low digital literacy, inadequate technological infrastructure, and limited funds for implementing digital systems. This aligns with previous research findings identifying technology costs, limited knowledge, and suboptimal policy support as the primary challenges MSMEs face in implementing halal supply chains.

A gap is also evident regarding human resource readiness. Business owners continue to rely on conventional systems because they lack a workforce capable of specifically managing digital systems. This reinforces the finding that digital transformation for halal MSMEs is not merely a matter of technology but also depends on organizational and human readiness. Other studies further emphasize that halal supply chain digitalization requires the integration of technology, regulations, and business capacity to function effectively.

Thus, it is evident that implementing digital traceability in halal MSMEs is not solely a technological issue but a systemic one involving economic, human resource, and policy aspects. Without external support—such as training, technology subsidies, and mentoring—the gap between ideal standards and actual conditions will persist.

4. Conclusion

In conclusion, this study reveals a clear gap between modern digital traceability standards and the actual conditions of small-scale halal MSMEs. While ideal standards require an integrated, real-time, and transparent digital tracking system, MSMEs currently rely on manual or semi-digital systems in practice.

This gap is driven by three factors. First is the technology factor, specifically limited access to digital systems and unstable internet infrastructure. Second is the human resource factor, characterized by low digital literacy and a shortage of personnel who understand digital traceability systems. Third is the financial factor, as the high cost of implementing digital technology poses a major obstacle for MSME operators.

Therefore, a collaborative strategy involving the government, halal certification bodies, and the private sector is needed to accelerate digitalization within the halal MSME sector. Such efforts could include digital training, the development of simple and affordable systems, and policy support to ensure that digital transformation proceeds in a more inclusive and sustainable manner.

5. Suggestions

Based on the findings of this study, several recommendations can be proposed to improve the implementation of digital traceability in small-scale halal industries.

1. For MSMEs, it is recommended to gradually adopt digital recording systems, starting from simple and low-cost applications for managing raw materials, production processes, and product distribution. This step can help improve traceability without imposing a significant financial burden on businesses.
2. For the Government and Halal Certification Institutions, more intensive training and mentoring programs should be provided to enhance digital literacy among halal MSME owners. In addition, financial incentives or technology subsidies can be offered to support the adoption of digital traceability systems.
3. For Technology Developers, there is a need to design digital traceability platforms that are simple, affordable, and user-friendly, taking into account the characteristics and limitations of small-scale halal enterprises.
4. For Academic Institutions and Researchers, further studies should be conducted using larger samples and different industrial sectors to obtain a more comprehensive understanding of digital traceability implementation in the halal industry. Future research may also employ quantitative approaches to measure the influence of technological, organizational, and environmental factors on digital traceability adoption.
5. For Future Halal Supply Chain Development, collaboration among MSMEs, government agencies, halal certification bodies, universities, and technology providers should be strengthened to create an inclusive digital ecosystem that supports transparency, consumer trust, and the sustainable growth of the halal industry in Indonesia.

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