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THE INFLUENCE OF SUPPLY CHAIN DIGITALIZATION ON HALAL SUPPLY CHAIN IMPLEMENTATION IN THE HALAL INDUSTRY

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ABSTRACT: This study examines how digital innovation in supply chains enhances halal supply chain effectiveness in Indonesia, with implementation success as a mediating mechanism. It contributes theoretically by advancing a socio-technical model that positions digitalization as an enabling condition contingent on organizational and regulatory alignment rather than a direct driver. Using PLS-SEM on survey data from 170 halal-certified food and beverage producers, the findings show that digital technologies significantly improve supply chain success but do not directly translate into implementation. Instead, effective halal practices fully mediate this relationship. The results highlight that technological adoption requires institutional support and managerial commitment. Practically, the study informs policymakers and industry actors to design integrated digital–halal strategies. However, its cross-sectional design and regional focus limit generalizability, suggesting future longitudinal and multi-context studies to capture dynamic transformation patterns.

Keywords: Digitalization; Halal Supply Chain; Digital Technology; Halal Industry

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INTRODUCTION

In recent times, the shift toward digital methods has become a global phenomenon, fundamentally reshaping logistics frameworks and supply chain management practices. Contemporary supply chains increasingly rely on digital tools to enhance operational efficiency, transparency, and coordination among stakeholders, ranging from raw material suppliers to end consumers. These technologies enable real-time monitoring, more accurate demand forecasting, and data-driven decision-making processes (Jange et al., 2024). Within this global transformation, Indonesia occupies a strategically important position in the halal industry. As the world's most populous Muslim country, with approximately 242.7 million Muslims, Indonesia faces rapidly growing domestic and international demand for halal products (World Population Review, 2025). In response, both government institutions and private sector actors have intensified efforts to strengthen halal standards across supply chains in order to enhance the global competitiveness of Indonesian halal products. Consistent with this trend, Indonesia exhibits substantial and sustained market demand for halal goods and services, particularly in the halal food and beverage sector (Jauhari, 2024). The integration of digital technologies has therefore been widely promoted as a critical driver for maintaining halal compliance, improving distribution efficiency, and reinforcing international competitiveness within the halal industry (Qizwini, 2025). This policy and industry momentum is reflected in the rapid growth of certified enterprises, with 140,943 halal-based industries across Indonesia having obtained halal certification, particularly in the food and beverage sector (Pusat Industri Halal, 2025).

In line with these developments, digital initiatives such as halal traceability systems have been increasingly adopted to enable consumers and regulatory authorities to verify halal status in real time (Masudin et al., 2022; Zafar et al., 2025). Prior studies suggest that such digital systems enhance supply chain transparency, strengthen consumer trust, and reduce risks related to fraud and contamination (Susanty et al., 2024). Digitalization has also been shown to facilitate closer collaboration among producers, logistics providers, and halal certification bodies, thereby accelerating certification processes and reducing operational costs (Ginantaka & Zain, 2017). However, despite these promising advancements, the adoption of digital technologies within Indonesia's halal supply chains remains uneven. Structural barriers—including limited digital infrastructure, high investment costs, and low levels of digital literacy, particularly among micro, small, and medium enterprises (MSMEs)—continue to constrain the effective operationalization of digital systems (Maimuna et al., 2024).

Consequently, although investments in digital technologies within halal supply chains have increased, empirical evidence regarding their direct impact on halal supply chain implementation remains inconclusive. Much of the existing literature on supply chain digitalization and technology adoption implicitly assumes a technologically deterministic logic, whereby the adoption of digital tools is expected to directly translate into improved system implementation and compliance outcomes (Noor, 2024; Yazıcılar Sola & Güzel, 2025). Such assumptions, however, remain theoretically underexplored in the specific context of halal supply chains, where implementation is not merely a technical process but is deeply embedded within institutional regulations, halal certification regimes, and organizational commitment. As a result, existing theories struggle to explain why digitalization may enhance system capability, transparency, and monitoring, yet fail to directly ensure the effective operational implementation of halal supply chain practices. This unresolved theoretical tension—situated at the intersection of technology adoption and institutional governance—constitutes the central research problem addressed in this study. Accordingly, the present research investigates whether halal supply chain success functions as a mediating mechanism that translates digital capability into effective operational implementation within the halal industry.

Prior literature on halal supply chains and digitalization reveals several persistent gaps despite notable advances. Studies such as Azzi et al. (2019) demonstrate that blockchain enhances transparency and traceability, yet they rely heavily on conceptual arguments with limited empirical validation. Similarly, Zailani et al. (2010) emphasize the role of institutional pressures, particularly regulatory forces, in driving halal adoption, but overlook the integration of digital technologies. Expanding this discussion, Ali et al. (2021) show that ERP and blockchain systems can strengthen halal assurance; however, their findings remain context-specific and lack broader generalizability. More recent work by Harsanto et al. (2024) highlights the importance of

research, development, and regulatory support in reinforcing halal supply chains among MSMEs, though it does not incorporate mediation mechanisms. Likewise, Kurniawan et al. (2025) confirm that blockchain and IoT enhance transparency and trust, yet scalability issues for MSMEs remain unresolved. In a narrower context, Sarasi et al. (2025) find that traceability improves product quality, although their focus is limited to culinary enterprises (Source: Data Processing, 2025).

Collectively, these studies expose three critical gaps. First, there is an overemphasis on direct effects, where digitalization is often assumed to directly influence halal supply chain implementation without considering intervening mechanisms. Second, despite the dominance of MSMEs in the halal sector, limited attention is given to their structural constraints, including low digital literacy, inadequate infrastructure, and financial barriers. Third, the interaction between institutional support, regulatory frameworks, and technological adoption remains insufficiently explored, leaving a fragmented understanding of how these elements jointly shape halal supply chain outcomes. Responding to these gaps, the present study develops and empirically tests a mediation model in which halal supply chain success operates as an intervening variable linking digitalization to implementation. It examines both direct and indirect pathways through which digital technologies influence halal supply chain practices within the Indonesian context. Accordingly, the study addresses two central research questions: whether digitalization exerts its influence directly or through supply chain success, and what strategic interventions government and industry actors can adopt to optimize digital adoption for sustainable and efficient halal supply chain systems.

THEORETICAL REVIEW

Implementation of Halal Supply Chain

According to Dwita & Sadana, (2021), a supply chain is an activity to produce a product, in which the involvement of all parties is integrated, from production to distribution to consumers. In the context of halal implementation, Safitry Al-Fauziah et al., (2022) mentions several things, including: halal form, halal method of obtaining, and halal method of processing. The concept of the halal supply chain refers to the management of the flow of products and information in a halal manner from the initial production stage to the end consumer. This process involves warehousing, sourcing, transportation, goods handling, stock control, purchasing, and order management, all of which are carried out in accordance with Sharia principles (Supian, 2016). The adoption of a halal supply chain by entrepreneurs is essential as a strategic approach to maintaining halal compliance throughout the production process and reinforcing product credibility, which ultimately contributes to increased confidence among Muslim consumers in the marketed products (Mohd Sirajuddin, 2024).

According Harsanto et al., (2024) to their research, the implementation of the halal supply chain (Y) is measured using five key indicators, namely: Production process, Materials used, Storage process, Distribution process, and Handling process. These five metrics guarantee adherence to recognized norms at each point within the halal distribution network. Research by Sarasi, V., Yunizar, & Satmoko, (2025) it was determined that the ability to trace products is a crucial element in confirming their adherence to halal standards, alongside implementing effective tracking procedures to uphold quality consistently across the entire supply network (Andespa et al., 2024) the principal obstacles in putting Halal Supply Chain practices into action within Micro, Small, and Medium Enterprises were brought to light, focusing on getting suitable halal-certified ingredients and competently running manufacturing operations. Kurniawan et al., (2025) the study further indicated that integrating Blockchain along with IoT technologies into the halal supply network could greatly improve openness and allow for products to be monitored continuously as they move, which guarantees they adhere to stringent halal requirements.

Digitalization of Supply Chain

Digitalization of Supply Chain in this study is conceptualized as a technological subsystem comprising five key indicators adapted from Azzi et al. (2019) and Zailani et al. (2010), namely halal tracking systems, end-to-end process traceability from raw materials to finished goods, digital information transparency, and integrated halal information systems. Prior studies suggest that advanced digital technologies, such as blockchain, the Internet of Things (IoT), artificial

intelligence (AI), and digital twin technologies play a crucial role in enhancing transparency, strengthening traceability, and improving consumer trust in halal products (Ellahi et al., 2025). These technologies enable real-time monitoring of halal status, reduce contamination risks, and support compliance with halal regulations across supply chain stages.

However, drawing on Socio-Technical Systems Theory, this study argues that digitalization alone does not automatically translate into effective halal supply chain implementation. Technological capabilities must be aligned with organizational routines, certification governance, regulatory compliance, and inter-organizational coordination to become operationally impactful (Bostrom & Heinen, 1977; Ali et al., 2021). In this context, halal supply chain success is theorized as a mediating mechanism that reflects the extent to which digital tools are meaningfully embedded within social-institutional structures, including halal certification processes and stakeholder collaboration. Accordingly, Hypothesis 1 is proposed not as an assumed linear relationship, but as a boundary-condition test that examines whether digitalization can exert a direct effect on halal supply chain implementation in the absence of socio-technical alignment.

H1: The adoption of digital technologies within the supply chain affects the effectiveness of halal supply chain implementation.

Halal Supply Chain Success

The achievement of a successful halal supply chain is strongly influenced by a set of enabling organizational and institutional factors, including government support, information technology resources, competent human capital, formal halal certification mechanisms, and integrated traceability systems across the supply chain (Azzi et al., 2019). Digitalization, particularly through information systems, enhances transparency, efficiency, and accuracy in halal verification processes. Furthermore, the adoption of advanced technologies such as the Internet of Things (IoT), big data analytics, blockchain, and enterprise resource planning (ERP) systems facilitates effective monitoring and coordination of supply chain activities, thereby strengthening compliance with halal requirements and reducing the risk of regulatory violations (Tariq et al., 2020; Ali et al., 2021).

Drawing on Socio-Technical Systems Theory, these technological capabilities contribute to Halal Supply Chain Success when they are effectively aligned with organizational processes and institutional governance structures. Accordingly, Halal Supply Chain Success is conceptualized as an organizational and institutional capability that enables halal governance, encompassing regulatory support, information system integration, human resource readiness, certification infrastructure, and traceability maturity. In contrast, Halal Supply Chain Implementation represents the operational enactment of halal principles across supply chain activities, including production handling, storage integrity, and distribution control. This distinction positions halal supply chain success as a capability-building condition that precedes and enables effective implementation, rather than as an operational outcome itself (Tieman et al., 2019; Maflahah et al., 2025). The research path is also presented in Figure 1.

H2: The success of the halal supply chain significantly influences the effectiveness of halal supply chain implementation.

H3: Digitalization of Supply Chain influences Halal supply chain success.

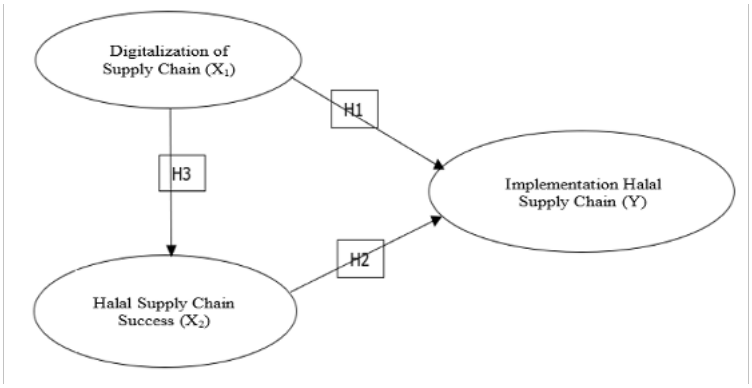


Figure 1. Research Model

The conceptual model developed in this study contributes both theoretically and practically by advancing a theory-driven understanding of digitalization within halal supply chains. Grounded in Socio-Technical Systems Theory, this study conceptualizes digitalization not as a direct determinant of halal supply chain implementation, but as a technical enabler whose effectiveness depends on its alignment with social and institutional subsystems. In the context of halal supply chains, digital technologies function as technical infrastructures that support transparency, traceability, and information integration, while governance mechanisms, halal certification processes, regulatory compliance, and organizational commitment constitute the social-institutional subsystem. Consistent with socio-technical logic, effective halal supply chain implementation emerges only when these subsystems are jointly optimized rather than when technology is adopted in isolation (Ali et al., 2021; Bostrom & Heinen, 1977; Trist & Bamforth, 1951).

Within this framework, the proposed mediated model theoretically advances halal supply chain scholarship by positioning halal supply chain success as a socio-technical translation mechanism that converts digital capability into operational implementation. This mediating role challenges the prevailing assumption of a straightforward, linear relationship between supply chain digitalization and halal implementation, instead highlighting the indirect and conditional nature of digitalization's impact. By empirically confirming that digitalization does not directly improve halal supply chain implementation, the model refines existing theories of technology adoption in halal industry contexts and aligns with prior studies that emphasize the contingent role of organizational readiness and governance structures (Tariq et al., 2020; Harsanto et al., 2024).

Furthermore, Institutional Theory provides complementary explanatory power by elucidating how regulatory frameworks, halal certification authorities, and normative compliance pressures shape the effectiveness of digital technology adoption. In halal supply chains, institutional forces determine whether digital tools are meaningfully embedded into certification processes, monitoring systems, and inter-organizational coordination, thereby influencing overall supply chain success (Zailani et al., 2010; Tieman et al., 2019). From this perspective, halal supply chain success reflects institutional legitimacy and governance maturity rather than mere technological sophistication.

Practically, the model contributes to industry and policy by emphasizing that digitalization investments must be strategically aligned with initiatives that strengthen overall halal supply chain success, including certification governance, stakeholder collaboration, human resource readiness, and traceability systems. The findings demonstrate that digital tools become impactful only when embedded within a robust halal ecosystem supported by regulation, infrastructure, and organizational commitment. This insight has direct implications for government initiatives and industry practices in Indonesia, suggesting that sustainable digital transformation in the halal sector requires integrated socio-technical strategies rather than fragmented or technology-centric deployments.

RESEARCH METHOD

This study adopts a quantitative approach using a cross-sectional survey to examine the relationships among supply chain digitalization, halal supply chain implementation, and halal supply chain success. This design enables empirical testing of hypothesized relationships through primary data collected from practitioners within the halal industry. The population comprises halal-certified food and beverage manufacturers in Indonesia, particularly in Greater Jakarta (Jakarta, Bekasi, Bogor, and Depok) and Banten, which represent key industrial hubs with a high concentration of certified producers. Data were collected by distributing 500 online questionnaires via Google Forms to firms registered with the Halal Industry Center, resulting in 170 valid responses and a response rate of 34%. Respondents included company representatives responsible for halal certification, operations, or supply chain management. A non-probability stratified sampling technique was employed to ensure representation across firm size, product category, and location, given the absence of a comprehensive sampling frame.

The research instrument consisted of a structured questionnaire measuring three constructs. Supply chain digitalization (X1) was operationalized using five indicators adapted from Lee et al. (2022) and Zailani et al. (2010), while halal supply chain success (X2) included six

indicators derived from Aziz et al. (2021) and Maflahah et al. (2025). The implementation of halal supply chain practices (Y) was measured using three indicators adapted from Ummah (2022) and Usman (2020). All variables were assessed using a six-point Likert scale ranging from strongly disagree to strongly agree, allowing more nuanced responses and reducing neutrality bias. Data collection was conducted between July and September 2025 through online distribution channels, with participation being voluntary and confidential. Supporting documents such as company reports and certification records were also reviewed to validate responses.

Data analysis was performed using Structural Equation Modeling with the SmartPLS 4 application. The PLS-SEM approach was selected due to its suitability for analyzing complex models involving mediation, its robustness with moderate sample sizes, and its minimal distributional assumptions. The analysis proceeded in two stages. First, the measurement model was evaluated to ensure reliability and validity through Cronbach's alpha, composite reliability, and Average Variance Extracted, alongside discriminant validity using the Fornell–Larcker criterion. Second, the structural model was assessed to test the hypothesized relationships by examining path coefficients, t-values, and p-values derived from a bootstrapping procedure with 5,000 resamples.

RESULTS

A total of 170 valid responses were collected from halal-certified food and beverage companies in Greater Jakarta and Banten. Most respondents were based in Jakarta (63.5%) and engaged in processed food production (44.1%). In terms of firm size, the majority employed more than 200 workers (38.2%), while most firms had been established for more than 16 years (59.4%). These characteristics indicate that the sample largely represents established firms with significant operational experience in the halal-sector.

The convergent validity assessment indicates that all selected indicators demonstrate factor loadings greater than 0.70, as presented in Table 1. Moreover, the Average Variance Extracted (AVE) values for all constructs surpass the recommended cut-off of 0.50, while the composite reliability indicators exceed 0.70, as presented in Table 2. In particular, the Supply Chain Digitalization construct (X1) demonstrates a composite reliability of 0.949 and an AVE of 0.789, indicating strong internal consistency and adequate convergent validity. In addition, the assessment of discriminant validity using the Fornell–Larcker criterion confirms that each construct is empirically distinct from the others, as shown in Table 3.

Table 1. Convergent validity

Construct	Indicator (Likert Scale 1-6)	*t*-value	Loading Factor
Digital of Supply Chain (DSC)	DSC1	49.562	0.904
	DSC2	115.223	0.949
	DSC3	61.368	0.923
	DSC4	27.146	0.912
	DSC5	10.059	0.740
Success of Halal Supply Chain (KHS)	KHS1	6.888	0.714
	KHS2	19.430	0.901
	KHS3	40.745	0.904
	KHS4	19.266	0.762
	KHS5	34.103	0.876
	KHS7	29.790	0.821
Implementation of Halal Supply Chain (PHS)	PHS3	9.164	0.869
	PHS4	9.046	0.941
	PHS5	15.424	0.864

Note: Of the 17 Statement Items, 3 items were discarded because they were not suitable (KHS6, PHS1, and PHS 2)

Source: Output of SmartPLS 4.0 (2025)

Table 2. Constructing Reliability and Validity

Construct	Alpha	rho_A	CR	AVE
Digitalization of Supply Chain	0.931	0.938	0.949	0.789
Halal Supply Chain Success	0.910	0.920	0.931	0.693
Implementation of Halal Supply Chain	0.872	0.901	0.921	0.796

Source: Output of SmartPLS 4.0 (2025)

Table 3. Discriminant Validity (Fornell-Larcker Criterion)

Constructs	Supply Chain Digitalization	Halal Supply Chain Success	Implementation of Halal Supply Chain
Supply Chain Digitalization	0.889		
Halal Supply Chain Success	0.777	0.833	
Implementation of Halal Supply Chain	0.534	0.687	0.892

Source: Output of SmartPLS 4.0 (2025)

The structural model results are summarized in table 4. The path coefficients analysis showed considerable links between the different variables evaluated as part of this study's model. These overall results indicate that integrating digital methods into the supply chain has a big impact on the halal supply chain's performance and its ultimate achievements. The findings indicate that supply chain digitalization does not significantly influence the implementation of the halal supply chain (H1). This is evidenced by a t-statistic value of 0.002 and a p-value of 0.998, leading to the rejection of hypothesis H1. These results imply that the adoption of digital technologies within the supply chain does not exert a direct impact on the operationalization of halal supply chain practices. In contrast, the relationship between halal supply chain success and its implementation (H2) was found to be highly significant, as indicated by a t-statistic of 6.894 and a p-value of 0.000, thereby supporting hypothesis H2. These findings demonstrate a strong and positive influence of halal supply chain success on its practical execution. Furthermore, the results demonstrate a statistically significant relationship between supply chain digitalization and halal supply chain performance (H3). This association is evidenced by a t-statistic of 19.613 and a p-value of 0.000, leading to the confirmation and acceptance of hypothesis H3. In essence, the digital transformation of the supply chain contributes positively and significantly to the effectiveness of the halal supply chain, which in turn plays a crucial role in shaping its implementation. These results indicate that the performance of the halal supply chain functions as a mediating factor in the relationship between supply chain digitalization and the practical execution of halal supply chain practices.

Table 4. Path Coefficients and Hypothesis Testing

Path Relationship	Effects	*t*-value	*p*-value	Decision
Digitalization → Implementation	0.000	0.002	0.998	Rejected
Success → Implementation	0.687	6.894	0.000	Accepted
Digitalization → Success	0.771	19.613	0.000	Accepted

Note: Path coefficients represent standardized estimates. Hypotheses are considered significant at $p < 0.05$.
Source: Processed research data (2025).

Figure 2 illustrates the research framework examined through the Partial Least Squares (PLS) approach. The findings reveal that DSC has a significant effect on KHS, as reflected by a path coefficient of 0.603. These results suggest that higher levels of digitalization in supply chain management contribute to improved reliability in the implementation of the halal system. Moreover, KHS exhibits a substantial effect on PHS, with a coefficient value of 0.472, highlighting that the reliability of the halal supply chain system is a critical determinant of successful halal supply chain implementation. In contrast, DSC does not show a direct influence on PHS. This suggests that supply chain digitalization does not immediately affect halal supply chain implementation; instead, its impact occurs indirectly through halal supply chain success (HHS). Thus, digitalization within the supply chain

contributes to halal supply chain implementation only when it first enhances the success of the halal supply chain itself. These results confirm the pivotal role of HHS as a mediating variable linking supply chain digitalization to halal supply chain implementation.

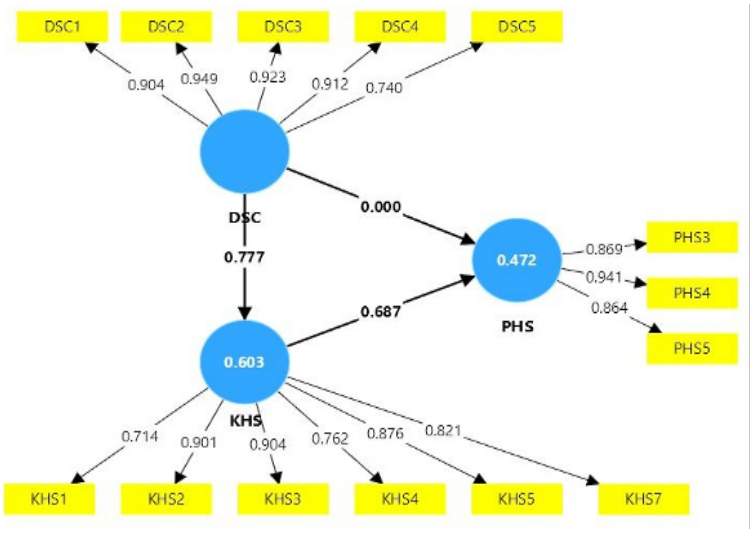


Figure 2. Research finding
Source: Smartpls 4 Path Output (2025).

DISCUSSION

The preliminary hypothesis testing indicates that the adoption of digital systems within the supply chain does not significantly influence the implementation of the halal supply chain, leading to the rejection of Hypothesis 1. These findings suggest that incorporating digital technologies into supply chain operations does not exert an immediate or direct impact on the operational execution of halal supply chain practices. While digitalization may enhance efficiency, transparency, and information availability, its effectiveness in driving halal implementation appears to be contingent upon other critical factors, such as the maturity of the halal system, regulatory and certification frameworks, and organizational commitment. This result is consistent with prior empirical evidence indicating that digital technologies function primarily as enabling infrastructures rather than direct drivers of halal system implementation. Zhao et al. (2023) demonstrate that supply chain digitalization supports halal implementation only when accompanied by adequate digital infrastructure, competent human resources, and strong managerial commitment. Similarly, (Ellahi et al., 2025) argue that the mere presence of digital tools does not automatically guarantee compliance with halal supply chain standards; instead, these technologies require institutional alignment, governance support, and internal organizational readiness to become operationally effective.

Beyond confirming prior findings, the primary theoretical contribution of this study lies in its corrective rather than incremental nature. By empirically demonstrating the absence of a direct effect between supply chain digitalization and halal supply chain implementation, this research challenges the technologically deterministic assumptions that dominate much of the existing technology adoption literature. Rather than treating digitalization as an autonomous driver of implementation outcomes, the findings reposition digitalization as a contingent enabler, whose influence materializes only through the success of the halal supply chain system. In this sense, halal supply chain success operates as a socio-institutional translation mechanism that converts digital capability into effective operational implementation. This refinement advances existing technology adoption theories by demonstrating that, within institutionally constrained supply chain contexts such as the halal industry, technological value is realized not through adoption alone but through its integration with governance structures, certification regimes, and organizational commitment.

According to the hypothesis test findings, the Halal Supply Chain's effectiveness greatly affects how well the Halal Supply Chain is put into practice; as a result, H2 is accepted. This

demonstrates that the success of the Halal Supply Chain has a beneficial effect on the implementation of the Halal Supply Chain. This means that successful companies implement halal systems in general, such as own halal certification, collaboration with institution officials, and traceability product, will be easier in applying halal standards in every stage in supply chain. Research by Tariq et al., (2020) the results of the study bolster this perspective, indicating that the successful establishment of a halal system hinges on the cooperative interaction of diverse stakeholders' capabilities and objectives.

This cooperation is essential for tracing the origins of materials in accordance with established standards. Therefore, hypothesis H2 is validated, affirming the significant impact of success within the halal supply chain in promoting the adoption of halal standards across the entire supply network. In addition, research by Ali et al., (2021) also confirms that success implementation of Halal Supply Chain can speed up implementation halal standards with existence close cooperation between companies and institutions halal certification this case This, the success of the Halal Supply Chain is functioning as solid foundation for company in apply halal policy in general comprehensive in the supply chain process.

The outcomes from the third hypothesis assessment reveal that Supply Chain Digitalization significantly influences the Halal Supply Chain's Success, showing the acceptance of H3. In other words, a greater degree of implemented supply chain digitalization leads to improved success in overseeing the halal supply chain. Digitalization makes the halal supply chain operations clearer, more precise, and more effective, notably concerning product tracking, quality control, and adherence to halal regulations. This aligns with prior investigations (Harsanto et al., 2024), research has indicated that using digital solutions significantly improves the clarity and correctness of halal validation; this includes employing blockchain to track products and ERP systems to handle supply chains. Supply chain digitalization allows companies to ensure that all products meet halal standards more efficiently and transparently. Therefore, hypothesis H3 is accepted, which indicates that the Digital Supply Chain contributes significantly to increasing the Success of the Halal Supply Chain. Thus, the analysis confirms that digitalization is a necessary but not sufficient condition for halal supply chain implementation. Its effectiveness depends on the synergy between technology, governance systems, and organizational commitment. This discovery enhances the theoretical comprehension of digital change within the halal sector by reorienting the discussion away from a solely technological standpoint and towards a socio-technical systems perspective, highlighting how institutional governance and organizational preparedness are crucial in deciding the eventual effectiveness of implementing halal supply chains.

CONCLUSION AND FURTHER STUDY

This study concludes that supply chain digitalization does not directly drive halal supply chain implementation but operates indirectly through halal supply chain success as a critical mediating mechanism. Digitalization functions as an enabler that enhances transparency, traceability, and data accuracy, yet effective implementation remains contingent on organizational commitment, regulatory support, and infrastructure readiness. The findings affirm that firms achieving higher levels of halal supply chain success demonstrate stronger compliance across operational stages, reinforcing the role of performance outcomes as the bridge between technology adoption and practical implementation. These results extend the socio-technical perspective by positioning digitalization as necessary but insufficient without institutional and managerial alignment.

However, the study is constrained by its regional focus on Jakarta and Banten, limiting generalizability across diverse Indonesian contexts, particularly in areas with weaker digital infrastructure. The cross-sectional design restricts the ability to capture dynamic transformation processes, while reliance on self-reported data introduces potential bias. Future research should adopt longitudinal and mixed-method approaches, expand geographic and sectoral coverage, and incorporate external variables such as regulatory enforcement, global certification standards, and consumer trust. Practically, policymakers and industry actors must prioritize integrated strategies that combine digital adoption with institutional strengthening, ensuring sustainable and scalable implementation of halal supply chain systems.

ETHICAL DISCLOSURE

This study was conducted in accordance with established ethical research standards. Participation was voluntary, and all respondents were informed about the purpose of the study prior to data collection. Informed consent was obtained from all participants, and they were assured of their right to withdraw at any stage without consequence. To ensure confidentiality, no personally identifiable information was collected, and all responses were anonymized and reported in aggregate form.

The data were used solely for academic purposes and were securely stored to prevent unauthorized access. The study did not involve any form of deception, coercion, or harm to participants. Furthermore, the researchers maintained objectivity throughout the data collection and analysis processes, ensuring that findings were reported accurately and without manipulation. This research complies with general ethical guidelines for social science research and upholds principles of integrity, transparency, and respect for participants.

CONFLICT OF INTERESTS

The authors declare no conflict of interest. This research was supported by a grant from the Ministry of Higher Education, Science, and Technology (Kemendiktisaintek) of the Republic of Indonesia in 2025. The funding body had no role in the design, data collection, analysis, or interpretation of the study, nor in the decision to publish the results. All authors participate actively in the research process, report writing, and the publication consequences.

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