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Research Article

Halal Supply Chain Risk Management in Malaysia's Digital Era: An Integrated Framework with MYeHALAL, MyDigital, and Blockchain Infrastructure

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Abstract: The framework develops an integrated MYeHALAL with blockchain infrastructures in Malaysia's MyDigital national digital transformation agenda for a comprehensive HSCRM framework that suits Malaysia's digital economy. Institutional theory and risk governance theory underpin the study that adopts a combination of a systematic literature review with conceptual synthesis to determine the vital halal risks at different stages in the supply chain. In the proposed framework, Malaysia's blueprint for the digital economy is leveraged, along with its new infrastructure for blockchain, to enhance levels of traceability, oversight by regulatory institutions, and integrity assurance. The researcher has designed the framework to fit Malaysia's long-term goals. The target is positioning as a regional leader in the digital economy by 2030. These findings may present strategic and policy insights to regulators such as JAKIM and the Ministry of Science, Technology and Innovation, and its industry players, for positioning Malaysia as a global benchmark in digital halal governance in the near future.

1. INTRODUCTION

Malaysia is an iMalaysia global halal hub, and as such, robust and transparent halal supply chains that can move at the pace of the current online economy are needed. The Malaysia Digital Economy Blueprint "MyDigital" was launched in February 2021, outlining the strategic plan for the government's aspirations to turn Malaysia into a digitally driven, prosperous economy, among the global leaders in the digital economy by the year 2030. This strategic plan comes with a goal for the contribution of the digital economy sector towards the country's GDP of not less than 25.5% by the year 2025. This makes it a suitable platform for the adoption of emerging technologies in the different sectors of the country's economy, especially the halal sector.

Notwithstanding, digitalisation, global sourcing, and decentralised information systems continue to be some of the factors increasing halal integrity risks in supply chains. According to Ali et al. (2021) and Tieman (2017), MYeHALAL plays a halal certification and governance role that is operated by JAKIM, but it does not have full risk visibility. Blockchain technology is identified as an enabler for halal

processes according to the latest measures by the government. Starting in 2024, the Deputy Prime Minister of Malaysia said including blockchain in the halal certification process will leverage the benefits of improving halal processes, reducing the barriers to trade, and meeting international standards in order to gain more consumers' confidence.

The launch of Malaysia Blockchain Infrastructure, expected to take place in July 2025, is one of the most important initiatives in regard to adopting blockchain within the country. First, it primarily aimed at consolidating the fragmented nature of the blockchain environment in Malaysia. This, it is seeking to accomplish through the application of blockchain interoperability between the different public blockchain platforms and the various private blockchains already targeting the improvement of the halal certification system, among others. The issue of integration is addressed in this paper through the proposal for the application of a blockchain technology-based digitally enabled HSCRM framework within Malaysia's national digital infrastructure.

2. LITERATURE REVIEW

2.1 Halal Supply Chain Integrity and Traceability

Integrity, traceability, and halal requirements are always identified as basic requirements in halal chain literature for the preservation of consumer confidence (Khan et al., 2022; Zailani et al., 2017). With an estimated value of roughly USD 1.4 trillion in 2017, the international halal food market will continue to grow to USD 2.6 trillion by 2023 (PIHH, 2019). Yet the complexity of the halal chain as well as the lack of halal traceability lead to violations of halal integrity (Soon et al., 2017).

However, recent academic literature stresses the transformative capability of blockchain technology in improving the halal supply chains of food products in terms of increased transparency and tamper-resistance (Ali et al., 2021; Susanty et al., 2024). Systematic reviews regarding the use of blockchain technology in food supply chains prove the fact that 31% of the implementation of innovative digital technologies in food supply chains is related to the use of blockchain technology for the halal supply of food products (Harsanto & Firmansyah, 2024).

2.2 Risk Governance Theory and Institutional Framework

Risk governance theory explains how halal risks arise from a lack of coordination, transparency, and poor control systems at organisational boundaries (Renn & Klinke, 2020). Additionally, the risk governance framework from the International Risk Governance Council emphasises the need to implement adaptive learning processes in institutions and integrative approaches that integrate basic scientific knowledge with economic and social considerations (Renn et al., 2011). The risk governance framework applies in the context of halal supply chains, which demand coordination between various stakeholders, such as producers, certifiers, regulators, and consumers. Institutional theory proposes that regulatory coercion, normative expectations, and legitimacy pressures have an impact on organisational halal compliance actions (Scott, 2014). Organisations practice halal certification not only to secure regulatory compliance but also to gain support in their institutional environments (Jabbour & Abdel-Kader, 2016). Most of the current research focusing on the phenomenon of enterprise risk management and institutional forces has confirmed that forces of institutional pressures have a significant impact on the integration of risk management processes within the value chains (Crawford et al., 2024; Moreira, 2023).

2.3 Malaysia's Digital Ecosystem and MyDigital Initiative

MyDigital is an initiative of Malaysia's overall plan to position the country as a master in the field of the digital economy with six strategic thrusts consisting of 22 strategies and 48 and 28 initiatives, respectively (MDEC, 2022). This plan aims to produce 500,000 new job opportunities, raise the level of

digital literacy for civil servants to 100%, and attract two unicorn companies by 2030 (EPU, 2021). A vital key enabler of this agenda is the National 4IR Policy that highlights balanced and responsible growth through the adoption of technology and was launched in July 2021.

In this environment, the use of blockchain technology was identified as an emerging digital platform with particular use scenarios in government administration and supply chain management, as well as certification services (MITI, 2024). MIMOS successfully developed the Malaysia Blockchain Infrastructure in partnership with selected partners, including Zetrix AI (formerly MyEG Services), to create a platform that supports interoperability between different implementations of blockchain technology (MIMOS, 2025). Furthermore, this infrastructure supports the use of My Digital ID for credentials, as well as decentralised applications to facilitate an innovative halal certification environment (Digital News Asia, 2025).

2.4. Blockchain Integration with National Halal Governance

Although there is a growing body of literature analysing blockchain technology as a halal traceability solution, the use of national governance platforms like MYeHALAL in conjunction with blockchain technology remains uncharted territory. The JAKIM has launched the Halal Digital Chain (HADIC), which will provide a digital halal environment through the use of the blockchain platform. The project has the potential to make the compliance process for halal products more traceable, whereby the fraud will become obsolete (Serunai Commerce, 2024). There has been a gap in the studies that test the integration among the HADIC, MYeHALAL, and the Malaysia Blockchain Infrastructure.

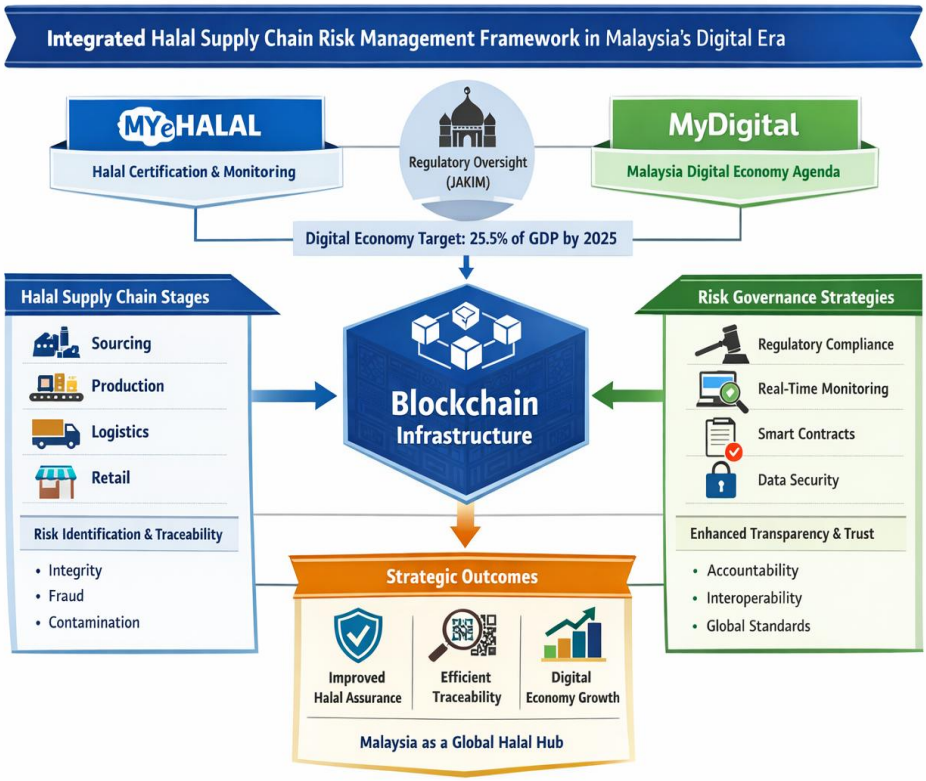

Figure 1. Integrated Halal Supply Chain Risk Management Framework in Malaysia's Digital Era

3. METHODOLOGY

This paper uses a systematic literature review approach (SLR) that is PRISMA-compliant, ensuring methodical rigour. This particular approach to literature analysis used in the study makes it sufficient to compile a macroscopic overview of the existing body of knowledge on halal supply chains and the use of blockchain techniques and governance models.

3.1 Search Strategy and Data Sources

The Scopus and Web of Science databases were systematically searched for peer-reviewed articles that were published between the years 2010 and 2024. The extended search period reflects the development of halal supply chain studies over the years and the recent trends and advances regarding the applications and uses of blockchain and digital governance. The search terms used were combined to search for information on: (1) halal supply chain studies ("halal supply chain" OR "halal traceability" OR "halal certification"), (2) risk management ("risk management" OR "risk governance" OR "supply chain risk"), (3) blockchain ("blockchain" OR "distributed ledger" OR "smart contracts"), and (4) digital governance ("digital transformation" OR "MyDigital" OR "digital governance").

3.2 Inclusion and Exclusion Criteria

Inclusion criteria were (1) articles published in English, (2) studies that were empirical or conceptual related to one of the themes of interest: halal supply chains, risk management, or blockchain applications, (3) articles that should be either peer-reviewed journal articles or conference proceedings, and (4) articles that should contribute meaningfully to the themes of interest through at least one of the dimensions: governance, certification, or digital transformation. Exclusion criteria included (1) non-academic publications, such as white papers and newspaper articles; (2) studies with insights not transferable to the study's context because they focus outside the halal or food safety area; (3) duplicate publications; and (4) articles unavailable in full text.

3.3 Screening and Quality Assessment

The first level of screening involved title and abstract screening to review relevance, and subsequently full-paper screening for articles that passed the title and abstract screening. A quality assessment was conducted using adapted criteria from existing review protocols that focused on methodology intensity, grounding in theory, and conceptual advancement. The extraction of the data involved characteristics, frameworks, risk factors, governance proposals, and tested online facilitators of risk concentration zones, governance gaps, and tech fixes.

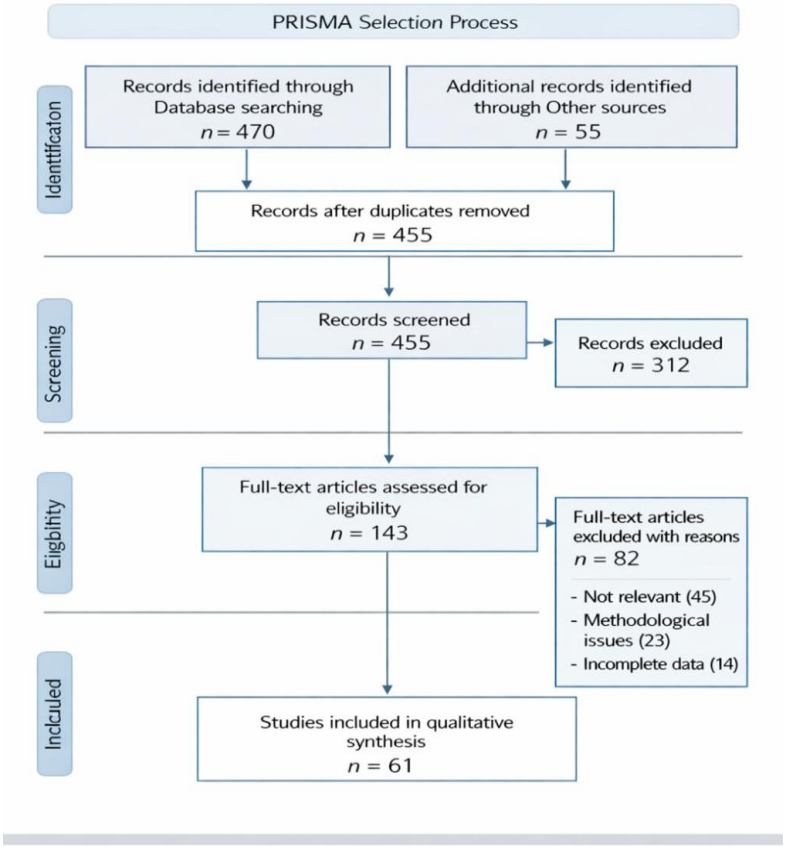

Figure 2. PRISMA Selection Process

4. FINDINGS

The concentrations of halal risk exist around organisational interfaces, largely reliant on manual processes for verification and information systems in a siloed manner. The concentration points exist at the following: (1) raw material sourcing and supplier halal verification, (2) halal processing and manufacturing, (3) halal logistics and warehousing, and (4) halal retailing and consuming interfaces. Masudin et al. (2022) noted that the MYeHALAL system currently supports better governance of halal certification instead of supporting real-time intelligence in proactive risk management practices.

MYeHALAL functions with the blockchain technology that provides unalterable ledger formation, decentralised verification, and smart contracts for the application of halal compliance rules. Studies also refer to the application of blockchain to halal logistics as successful in overcoming five major issues, and they include (1) integration of technology, (2) collaboration between different stakeholders, (3) low-cost operation among the small and medium-sized enterprises, (4) compatibility between regulations, as well as establishing (5) trust or reliance among all the stakeholders upon each other (Ali et al., 2021; Mohaiyadin et al., 2024). The government's trust in Malaysia regarding blockchain technology offers a solution to these issues.

4.1 Integrated HSCRM Framework

The MYeHALAL system thus has the following positions in the regulatory kernel: a permissioned blockchain residing on top of the Malaysian Blockchain Infrastructure in the downstream and upstream processes of the supply chain. Furthermore, the strategic position has been integrated in a manner friendly to the vision of the digital economy and has leveraged the MyDigital strategic drivers of transformation, secure infrastructure, and inclusion.

Architecture:

Level One (1) – Regulatory Governance & Administration: This involves the role of the MYeHALAL in relation to the regulatory framework, whereby the same is included in the halal certification standards that are maintained by JAKIM. This is the level that interacts with the blockchain system created by the Malaysian government for the recording of approved parties and laws in relation to the regulatory governance in Malaysia.

Level Two (2) – Blockchain Infrastructure:

The level is based on the national blockchain infrastructure in Malaysia.

The level provides a secure common record system with smart contracts for halal needs as determined by halal requirements.

The level enables the integration with MyDigital ID to allow users to validly view their credentials for each individual within the network to ensure network members are safe.

Level Three (3) - Halal Control Points (HCPs): In the event that this is needed, the IoT sensors will record electronically the most important Halal Control Points involving the acquisition, processing, logistics, and ultimately, the retailing phase. Each Halal Control Point has been designed to ensure a permanent record exists in terms of halal transaction verification involving dates and parties.

Level Four (4) - Real-Time Monitoring and Analytics: The application of analytics is utilized for the purpose of scrutinizing the data on the blockchain to detect risk patterns. This also encompasses the creation of alerts on compliance issues as well as the creation of audit reports for the purpose of audit purposes. It is also enabled for the purpose of interaction with the government's administrative system to enable interaction between JAKIM, MOSTI, and the Ministry of Digital.

The multilevel system adopted ensures that the halal standard conditions are left open but at the same time ensures that the Malaysian institutions are enabled to regulate. The system implements the vision brought forth by MyDigital on the effective use of the blockchain technology for productive purposes.

5. DISCUSSION

The new framework could enhance both the technology innovation and institutional regulation of halal risk administration and governance in consideration of the adaptive principles of risk governance. It was cited by Renn & Klinke (2020) that integrating the concept of MYeHALAL with the applications of blockchain technology could likely achieve three goals at the same time: improvement of food safety, nurturing the digital economy, and international competitiveness of Malaysia in the halal industry.

5.1 Implications for Regulators

This technology helps regulators, especially JAKIM and the halal regulatory authorities in each state, as it gives real-time information in the supply chain so they can act before a violation of halal laws happens, rather than just correcting them after. This would render collaboration between different arms of the government quite effortless, which falls in line with the visions of MyDigital to make government services even more effective. This initiative proves that Malaysia is a technology leader on the international arena by setting itself up as a global halal hub. The initiative has resulted in foreign direct

investment, including the RM4 billion pledge from the Chinese government in response to the Malaysia-China Halal Business Forum.

5.2 Implications for Industry

The framework may reduce compliance ambiguity and operational uncertainty for businesses, particularly SMEs, which are a critical segment of the Malaysian halal industry. The framework possibly boosts market credibility by making halal status verifiable. The outcome could lead to higher prices and easier access to export markets. The proposed framework, connected with the interoperability features of the Malaysia Blockchain Infrastructure, helps small and medium-sized enterprises (SMEs) work with bigger supply chain partners without needing to invest in their systems.

5.3 Alignment with National Digital Strategy

The framework directly supports the national goal of the digital economy as outlined by the MyDigital blueprint. The National 4IR Policy also endorses the responsible use of technology. It achieves the stated objective by promoting halal ethics within the digital framework. It also indicates the government's willingness to collaborate with other bodies, as influenced by the Minister of Science, Technology, and Innovation's MIMOS (2025).

5.4 Empirical Validation Agenda

To ascertain the claimed benefits of the proposed framework, future testing using an empirical method should employ a convergent approach to assess how well this framework works as well as identify what is causing difficulties in implementation. A quantitative approach, which involves survey research using partial least squares structural equation modelling, would help in testing hypotheses relating to: 1) the integration of blockchains and effective risk mitigation; 2) the pressures of institutions and technological implementation; 3) digital infrastructure and its effectiveness in integrity; and 4) stakeholder coordination and supply management. In addition to that, a qualitative phase of the study via expert interviews or a Delphi study would confirm framework elements, obstacles to implementation, and cost-benefit analysis implications for a range of halal industry sectors. The specific interest would focus on understanding the sector's prevalence in the Malaysian halal environment. This research focuses on SMEs. The findings from the case study analysis of the implementation of the blockchain system in pilot halal supply chains would provide rich data regarding the management of the transition process and performance implications.

6. CONCLUSION

This research hopes to make a significant contribution to the body of knowledge on HSCRM in a more theoretical, technology-driven sense by providing an HSCRM construct that is suited to the Malaysian institutional setting within the MyDigital vision. The integration of MYeHALAL with blockchain technology under Malaysia Blockchain Infrastructure seeks to enhance traceability, accountability, and integrity of halal in line with the MyDigital vision of developing a responsible digital economy. The contribution of this framework is threefold. Theoretically, this framework assembles multiple concepts from risk governance theory and institutional theory to discuss Halal. This paper explores the risks brought about by a digital environment and provides ways of mitigating such risks effectively. This framework is also practical since it functions as a guide for regulators and industries on how to leverage national blockchain infrastructure in managing halal. The strategic aspects are to place Malaysia at the hub of maintaining its dominance in the international halal sector using technological innovation to become the leader of a digital economy in 2030. Malaysia is celebrating 50 years of leading halal industry development and is on the path to achieving full implementation of the National Blockchain Roadmap 2021–2025 (having achieved 60% of their goal as of 2025). As such, the above-proposed framework may stand as a guideline of how to integrate the

integrity of halal and digital transformation. Further research may opt for empirical validation and implementations, especially regional ones in ASEAN or via the Malaysia-China Halal Trade Corridor.

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