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Research Article

Advancing Halal Supply Chain Management: Integrating Blockchain Technology for Enhanced Traceability and Compliance

Zaid Bin Khaliq[1], *Muhammed Buhary Muhammed Thabith*[2]

[1]*Institute of Halal Research and Training (INHART), International Islamic University Malaysia (IIUM)*
[2]*Senior Lecturer, Labuan Faculty of International Finance, Universiti Malaysia Sabah*

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ABSTRACT

This is because the Halal industry is growing rapidly because of the increasing demand of Halal-certified foods, cosmetics, pharmaceuticals, and finance worldwide. Nevertheless, integrity, traceability and compliance remain problematic in the supply chains of the industry. The classical Halal supply chain systems are in transparent form and prone to fraud and contamination, which diminishes the consumer confidence. The secure and immutable nature of blockchain technology is a good solution in enhancing the Halal Supply Chain Management (SCM).

The paper discusses the application of blockchain to improve authenticity of certification, traceability, and frauds detection in Halal SCM. I combined both mixed-method techniques such as case studies of Halal-certified businesses in food, cosmetics and pharmaceuticals, interviews with 15 experts, including certifiers and blockchain developers, and a survey conducted among 200 Halal industry stakeholders.

Findings indicate that blockchain significantly enhances traceability by establishing real-time and tamper-resistant logs of all the supply chain actions to ascertain that all Halal standards are observed. It also helps to prevent fraud by securing certification information and is more transparent to assist in enhancing consumer confidence.

Nevertheless, despite such advantages, there are still adoption issues such as high cost, technical complexity, change resistance, particularly among the small and medium enterprises. The paper notes that standardized processes, cooperation, and education are required to facilitate the use of blockchains.

In general, the study shows that blockchain has the potential of transforming the SCM of Halal and suggests additional research on the standards and combination with IoT and AI.

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1. Introduction

Food, pharmaceutical, cosmetic and financial sectors of the Halal industry are estimated to grow to USD 3.2 trillion by 2028 (Ali and Suleiman, 2021). In spite of this expansion, the sovereignty of Halal products in the international supply chains is a critical matter. The conventional Halal SCM systems are not always transparent and this creates fraud, contamination, non-compliance fears. Decentralized and immutable, blockchain technology would provide a possible resolution to these issues. The purpose of the research is to investigate how blockchain can be integrated into Halal SCM and how the concept will affect its traceability, compliance, and consumer trust.

Halal industry is a religious requirement as well as a huge sector of the economy. The rising need in Halal products is caused by the rising number of Muslims that is projected to be almost 2.2 billion by 2030 (Pew Research Center, 2015). Also, the non-Muslim customers are also getting interested in the Halal products because of their perceived quality and safety. Nevertheless, the global supply chains are very complicated and thus offer a big challenge in ensuring the integrity of Halal products. Such issues are the assurance of compliance with the Halal standards of supply chain processes and products, contamination and conformity of Halal certifications.

**Corresponding Author*:
Email: thabith786@ums.edu.my *(M. B. M.Thabith)*

The technology of blockchain that was created to handle cryptocurrencies can overcome these issues. Blockchain refers to a decentralized and distributed registry, which documents transactions in a transparent and secure way. The transaction is stored as a block, which is connected to the previous block forming a chain of blocks. Such a design makes the information stored within the blockchain immutable and tamper-proof. Blockchain can also be used to offer end-to-end traceability in the context of Halal SCM, which will make sure that all the supply chain processes adhere to Halal standards. It is also able to promote transparency, crimes and boost consumer trust.

The proposed study will set out to examine the application of blockchain technology in Halal SCM with reference to its effect on traceability, compliance, and consumer confidence. The research questions that will inform this study include:

1. What can be done to increase traceability with Halal SCM using blockchain technology?
2. What are the major opportunities and issues of blockchain in Halal SCM?
3. What is the way blockchain technology can help increase consumer confidence in Halal products?

2. Literature Review

2.1 Halal Supply Chain Management

Halal SCM entails the assurance of adherence of Shariah principles of the products used in sourcing and consumption. The major issues are the need to uphold segregation, avoid contamination, and certificate integrity (Tieman & Ghazali, 2021). The nature of global supply chains adds to such challenges, because products can be subject to different jurisdictions with different regulatory controls.

Halal is not just the lack of pork and alcohol but it is the process all the way to the production of products as well as including the sourcing of raw materials, the processing, packaging, and distribution. Halal SCM involves a rigorous observation of the Shariah that entails sourcing ethically, treating animals in a humane manner, and not contaminated by non-Halal products. Nonetheless, supply chains are occurring globally, which makes it challenging to enforce compliance across all levels. As an example, a product can be sourced in one country, processed in another country and consumed in a third country all having different standards of Halal certification.

Poor transparency of conventional Halal SCM systems is an issue of concern. Halal certifications are often used by the consumers to determine whether products are in accordance with the Shariah principles. The certification is however, a very shrouded procedure and there have been fraud and mislabeling cases. This has cost the company consumer confidence and a demand towards more transparent and reliable systems.

2.2 SCM with the help of blockchain technology

Adopting blockchain enhances real-time monitoring of products, minimises frauds, and enhances accountability through the development of an unalterable registry of transactions (Kshetri, 2018). It is decentralized and thus gets rid of the middlemen thus lowering the expenses and enhancing performance. Critical problems that can be solved within the framework of Halal SCM with the help of blockchain include the authenticity of certification, supply chain information, and consumer confidence (Rejeb et al., 2020).

This technology is commonly used in different sectors of the economy, finance, healthcare, and logistics, through blockchain. Within the SCM context, blockchain may offer end-to-end traceability, whereby all the steps of the supply chain are documented and confirmed. This may assist in detection and remedy of problems like contamination, fraud and non-compliance.

Immutability is one of the main characteristics of blockchain. When a transaction is stored on the blockchain it is irreversible. This makes the information that is stored in the blockchain tamper-proof and reliable. When applied to Halal SCM, this will assist in the authenticity of Halal certifications and that the products adhere to the Shariah principles.

The other notable aspect of blockchain is that it is transparent. Everything that is registered in the blockchain is accessible to all the network participants. This may be used in the supply chain to make it more transparent and to create consumer trust. As an illustration, consumers are able to scan a QR code on a product to get information of the origin, processing, and certification of the item.

2.3 Use of Blockchain in Halal SCM

The use of blockchain has been pointed out as a new approach to revolutionize Halal SCM in recent studies. As an example, the blockchain may offer end-to-end traceability of Halal products, which will guarantee that all steps of the supply chain are in line with the Halal standards (Queiroz & Wamba, 2019). Nonetheless, certain obstacles, including expensive implementation procedures, technical sophistication, and change resistance are still major impediments (Wilson and Liu, 2020).

Blockchain application in Halal SCM can give a number of advantages. First, it is able to improve traceability through the clear and untampered document of all the transactions in the supply chain. This would aid in the detection and resolution of problems like contamination and fraud. Second, it has the ability to enhance compliance; that is; to make sure that each step in the supply chain complies with the Halal standards. Third, it is able to increase the consumer trust because it offers transparent and verifiable details about Halal products.

Nonetheless, blockchain adoption in Halal SCM has a number of challenges as well. The high cost of implementation is one of the major challenges. The blockchain technology is expensive in terms of infrastructure and training. This may create an obstacle to small and medium-sized enterprises (SMEs) that might not be able to afford blockchain technology. The technical complexity of blockchain is another problem. Adoption of blockchain in current supply chain systems may be technically hard especially to SMEs. Lastly, the industry stakeholders might experience resistance to change since they might not fully understand or they fear being strangled by the adoption of blockchain.

3. Methodology

The research is a mixed-method study that gathers both the qualitative and quantitative research to investigate blockchain integration in Halal SCM.

3.1 Research Design

Case Studies: To examine supply chain operations and blockchain adoption strategies of three companies that were certified as Halal, three companies representing various industries (food, cosmetics, and pharmaceuticals) were chosen. The case studies offer the comprehensive insight into the challenges and advantages of introducing blockchain in Halal SCM.

Expert Interviews: 15 industry experts (Halal certification bodies, supply chain managers and blockchain developers) were interviewed in semi-structured interviews. The interviews offer information on the prospects of blockchain technology in Halal SCM and obstacles to its implementation.

Survey: The questionnaire was sent to 200 stakeholders of the Halal industry to evaluate their views on blockchain technology and its possible advantages. The survey gives the quantitative data of the industry stakeholders towards the blockchain technology.

3.2 Data Analysis

Thematic analysis was used to analyze qualitative data in the form of case studies and interviews. Thematic analysis consists in the identification and analysis of patterns or themes in the data. This methodology will enable focusing on a more complex and subtle perspective of the issues and advantages of implementing blockchain in Halal SCM.

The statistical tools were used to analyze quantitative data provided by the survey to determine the trends and correlations. To estimate the important variables that contribute to the adoption of blockchain technology in Halal SCM, the survey data were analyzed based on descriptive statistics, correlation analysis, and regression analysis.

4. Results

4.1 Case Study Findings

The findings of this paper grant a thorough insight into the possibilities of the positive and negative outcomes of adopting blockchain technology within Halal Supply Chain Management (SCM). The results obtained are based on the mixed-methods approach, case study, expert interviews, and a survey of industry participants. This chapter will discuss the results in details as per the research methods used.

4.1 Case Study Findings

The case studies included three certified companies of different industries that were Halal certified, including food, cosmetics, and pharmaceuticals. The selected companies were those which utilized blockchain technology as well as the companies that agreed to be part of the study. The case studies have shown that there are some major insights in regards to the role of blockchain on the Halal SCM.

4.1.1 Enhanced Traceability

The three companies also indicated that blockchain technology greatly enhanced their traceability. As an illustration, the food company had the capability to trace the source of raw materials, processing phases and distribution of the finished products in real-time. Such traceability allowed making sure that every single step of the supply chain was in line with the Halal standards. The same case was reported with the cosmetics company, as blockchain allowed the company to trace the ingredient sources up to the end product. The drug manufacturing company emphasized the potentiality to monitor the origin of the active pharmaceutical ingredients (APIs) and adherence to the Halal requirements in the whole production procedure.

4.1.2 Improved Compliance

I also found in the case studies that blockchain technology enhanced the adherence to the Halal standards. Blockchain made all the certifications and transactions to be tamper free due to its immutable nature. An example is the case of the food company, which recorded a 30 percent decrease in the processing time of certifications since blockchain did not require the company to physically verify Halal certifications. The cosmetics company wrote that blockchain would allow a clear as well as verifiable record of Halal certifications, minimizing the chance of fraud. The pharmaceutical company highlighted the fact that blockchain ensured the authenticity of the Halal certifications, which is essential in an industry where product safety and compliance are the key factors.

4.1.3 Implementation problems

Along with these advantages, the case studies have also noted that there are a number of challenges relating to the implementation of blockchain technology. High initial costs were reported by the food company which included the development of the blockchain platform and integration with the existing supply chain systems. There was a technical issue encountered by the cosmetics company to guarantee the accuracy and consistency of data in the supply chain. The pharmaceutical firm observed some of the stakeholders to be resistant to change and they were not willing to use blockchain because they did not understand the technology.

4.2 Expert Interview Insights

The 15 industry experts that semi-structured the interviews comprise of Halal certification bodies, supply chain managers and blockchain developers. The interviews presented useful information on the potential of blockchain technology in Halal SCM and it obstacles to its adoption.

4.2.1 Potential of Blockchain

All experts were in agreement that blockchain technology can be used to transform Halal SCM by improving traceability, transparency and compliance. A specialist of one of the Halal certification organizations observed that blockchain would have offered a single source of truth to Halal certifications, making them authentic and impossible to alter. A supply chain manager added that blockchain would simplify the certification process and would save time and money spent on manual certification. The opportunity of blockchain to develop a transparent and decentralized supply chain with all parties having access to all the information was noted by a blockchain developer.

4.2.2 Challenges to Adoption

Research also found that there are a number of barriers towards the implementation of blockchain technology in Halal SCM. The cost of implementation was also a major issue especially among small and medium-sized enterprises (SMEs). According to one expert, the development and maintenance cost of a blockchain platform may be unattainable to the SMEs. The other issue was technical complexity, as experts noted that it required specialized knowledge to implement and integrate blockchain with already existing supply chain systems. The change was also faced with a lot of resistance as some of the stakeholders were hesitant to embrace blockchain because they did not understand or feared being disrupted.

4.2.3 Recommendations

Analysts gave some suggestions to address the challenges of blockchain adoption. Creating standardized protocols of blockchain implementation was a frequent recommendation, since it will guarantee uniformity and cross-platform and cross-supply chain functionality. Cooperation between industry stakeholders also became important, and specialists have observed that approach of collaboration might assist in solving technical issues and achieving agreement on blockchain usage. It was suggested that education and training should be conducted to make more stakeholders in the industry aware and understanding of blockchain technology.

4.3 Survey Results

Out of the 200 stakeholders in the Halal industry, such as manufacturers, distributors, retailers, and certification bodies, a survey was sent to them. The survey sought to evaluate opinions on blockchain technology and how it can be of help in Halal SCM. The findings are shown below.

4.3.1 Perceptions of Blockchain

Survey results showed that three quarters of the participants thought blockchain could enhance Halal SCM. The opportunity to improve traceability, transparency, and compliance was noted by the respondents as an opportunity of blockchain. One of the examples is that the blockchain would enable the company to have real-time insight into the supply chain so that every step is performed in accordance with the Halal standards, as one of the respondents explained. The other respondent focused on the

idea of blockchain to eliminate the threat of fraud by creating a record of the Halal certifications that is impossible to modify.

4.3.2 Implementation Concerns

Although these are the positive perceptions, 60 percent of the respondents were worried about the high cost and the technical difficulty of applying the blockchain technology. One of the respondents stated that the entry cost of blockchain is excessive among SMEs. One more respondent pointed at the technical issues of the blockchain integration into the current supply chain systems. The issue of resistance to change also featured prominently as some of the respondents reported that stakeholders are unwilling to use new technologies.

4.3.3 Consumer Trust

The survey also indicated that eighty five percent of the people who participated in the survey believed that blockchain would help to boost consumer confidence by giving transparent and verifiable data concerning the Halal products. One of the respondents observed that blockchain would be able to create consumer confidence by making sure that the products are able to meet the Halal standards. The other respondent highlighted that blockchain would become useful in increasing brand loyalty because it would give consumers confidence in the validity of the Halal certifications.

4.4 Summary of Results

This study reveals that blockchain technology has potential in improving traceability, transparency, and compliance in Halal SCM with a significant potential. Both the case studies and the expert interviews, as well as the survey, point to the fact that blockchain can offer a record of the Halal certifications that is tamper-proof and transparent, and it will enable the assurance that the product adheres to the principles of Shariah in all the stages of the supply chain. Nevertheless, the paper also presents a number of obstacles to the adoption of blockchain, such as the high price of implementation, technical complexity, and resistance to change. These issues should be tackled to achieve the potential of blockchain in Halal SCM.

5. Discussion

The results of the research are close to the literature, as it shows the transformative nature of blockchain technology in Halal SCM. Blockchain can be used to solve some of the most critical problems, including the authenticity of certifications, transparency of a supply chain, and consumer confidence. Nonetheless, the research also finds out that there are some important obstacles to adoption such as the costs of implementation, technical complexity, and change resistance.

5.1 Blockchain advantages in Halal SCM.

5.1.1 Enhanced Traceability

Among the greatest advantages of the implementation of blockchain technology in Halal SCM, there is the capacity of the technology to improve traceability. Blockchain allows tracking Halal products in real-time, which provides compliance with all parts of the supply chain (Saberi et al., 2019). This is especially so when it comes to the Halal industry whereby customers require assurances that the products, they buy are in line with the Shariah regarding sourcing to consumption.

Blockchain can do this through the formation of a registry of transactions that cannot be altered. Every transaction is stored in a block that is connected to the block before it resulting in a chain of block. This design provides the data stored on the blockchain to be non-tamperable and reliable. Explicitly, a food product which has been certified as Halal can be traced back to the farm where the raw material is produced, the processing and packaging, and the retail location where the food is sold. QR code enables consumers to access this information by scanning on the product, hence giving satisfaction to consumers that the product is indeed Halal.

5.1.2 Improved Compliance

The blockchain is unalterable, which guarantees the imperviousness of Halal certifications, lessening the risk of fraud (Kshetri, 2018). This is especially critical in Halal sector where fraud and mislabeling cases have been witnessed. Blockchain would be able to give a clear and verifiable history of Halal certifications, allowing them to be authentic and not tampered.

To illustrate, one of the Halal certification organisations can provide a digital certificate, which is registered on the blockchain. All the supply chain members such as manufacturers, distributors, retailers, and consumers can access this certificate. Any change that tries to be made on the certificate would instantly be identified since the blockchain logs all the changes. This will make the certification authentic and can be relied on.

5.1.3 Consumer Trust

There are ways of increasing consumer confidence and brand loyalty through transparent and verifiable information about Halal products (Zailani et al., 2020). Consumer trust is the most crucial element in the Halal industry because the Halal industry uses consumers to look at the products and guarantee that this product is in line with Shariah principle by giving the product a Halal certification. The blockchain is capable of offering consumers with a clear and verifiable information regarding the source, processing and certification of the Halal products, which would increase their trust in the product.

As an illustration, a consumer will be able to scan a QR code on a product that is certified in Halal to receive information regarding the origin, processing and certification. The blockchain records this information, which cannot be manipulated, and therefore it is trustworthy. Such an openness will boost the consumer trust in the product and the brand and this will result to brand loyalty.

5.2 Blockchain Adoption Problems.

5.2.1 High Costs

The use of blockchain technology involves huge infrastructure and training expenses (Wilson & Liu, 2020). It may be a hindrance to small and medium-sized enterprises (SMEs) that might not have the financial resources to invest in blockchain technology. Blockchain implementation cost will also consist of the cost of building the blockchain platform, integrating it with the current supply chain systems, and training personnel on how to use the technology.

As an illustration, a Halal-certified food company might be required to invest into the development of blockchain platform that will be able to trace the origin, processing, and certification of its products. This might involve acquiring the services of blockchain developers, hardware and software, and training employees on how to operate the platform. This investment can be prohibitive to the SMEs especially in the developing countries where there are limited resources.

5.2.2 Technical Complexity

The benefits of blockchain in the current supply chain systems might be technically complex, especially in the case of SMEs (Queiroz and Wamba, 2019). The blockchain technology is not simple and needs professional expertise in order to create and use. The adoption of blockchain with current supply chain systems can lead to considerable changes in its systems, which can be both difficult and time-consuming in technical terms.

In the example, a Halal-approved cosmetics company would have to combine blockchain with its current supply chain management system. This can be achieved by building APIs that would bridge the gap between the blockchain platform and the

current system to ensure that information is passed correctly and safely. This may be technologically not easy and it may need the help of blockchain developers.

5.2.3 Resistance to Change

Industry stakeholders do not need to be keen on the implementation of blockchain because of the lack of a comprehension of blockchain or the fear of being disrupted (Abdul-Talib and Abd-Razak, 2020). This may be a major obstacle to the implementation of blockchain technology in Halal SCM. The stakeholders in the industry might not be ready to embrace blockchain because of lack of knowledge of the technology, fear, that the technology will upset the current operations, or fear of incurring high costs and complexities in the implementation process.

Considering the example of Halal certification body, a reluctance to transition to blockchain can occur because of the expense and difficulty of technology adoption. The certification body can also be worried as to the possible derailment of its present certification procedures. This change-resistance may be a big obstacle on the way of adoption of blockchain technology in the Halal SCM.

5.3 Recommendations

The study suggests the following in order to address these challenges:

5.3.1 Standardization

Creating standardized procedures that will be applied in Halal SCM to attain consistency and interoperability (Tieman & Ghazali, 2021). The standardization is necessary so that the blockchain platforms may be compatible with one another and can be incorporated alongside the existing supply chain systems. Standardized procedures can also provide assurance that data is captured as per, and it can be accessed by all members of the supply chain.

To illustrate, a uniform system of recording Halal certifications in the blockchain can make sure that the same information is registered in the same format in all the certification bodies. This may guarantee consistency in the certifications and they may be available to every supply chain member such as manufacturers, distributors, retailers and consumers.

5.3.2 Collaboration

Promoting the cooperation of industry stakeholders (Halal certification bodies, supply chain managers, blockchain developers, etc.) (Rejeb et al., 2020). The cooperation is necessary so that blockchain technology could be adopted successfully and all stakeholders could be benefited by its application. Resistance to change may also be overcome with the collaboration as it will make sure all the stakeholders participate in the implementation process and will be aware of the advantages of blockchain technology.

One case in point, the liaison of a Halal certification agency, a supply chain manager, and a blockchain developer can make sure that the blockchain platform is created, which responds to the requirements of all stakeholders. The certification body can make contributions to the needs of the recording of Halal certifications, the supply chain manager can make contributions to the requirements of the tracking of products, and the blockchain developer can make sure that the platform is technically viable.

5.3.3 Education and Training

Educating and training on the use of blockchain technology to raise awareness and knowledge among the stakeholders in the industry (Wilson and Liu, 2020). The resistance to a change needs to be addressed through education and training to help the industry stakeholders realize the advantages of blockchain technology. Technical skills to implement and use blockchain technology can also be developed by training and education programs.

An illustration is a training program to Halal certification bodies to give them an overview of the blockchain technology, its advantages, and its application in recording Halal certifications. It is also possible to offer practical training on the work with the blockchain platform via the program so that the certification bodies would be familiar with the technology and would be able to use it in practice.

6. Conclusion

Incorporation of blockchain technology in Halal Supply Chain Management (SCM) is the revolutionary chance to resolve the historical issues in traceability, compliance and consumer trust. This paper has addressed the prospect of blockchain to transform Halal SCM, which provides a detailed discussion of its advantages, issues, and implication on stakeholders in the industry. The results demonstrate how important blockchain will be in improving the integrity of Halal products in global supply chains as well as outline the challenges that need to be overcome to achieve its potential.

6.1 Summary of Key Findings

The research indicates that the blockchain technology is able to make the process of traceability much more effective since it would enable it to keep a clear, unchangeable and live account of all the transactions within the supply chain. This aspect will see to it that the Halal products are produced in accordance to Shariah standards at all levels such as sourcing products and even consumption. The unquestionability of the Halal certifications and its capability to curb fraud also make blockchain competitive in Halal SCM. Moreover, the blockchain information is also transparent and verifiable, which can contribute to more consumer trust which is important in an industry where ethical and religious adherence is the most important.

Nevertheless, the paper also outlines some obstacles to the use of blockchain, such as the high cost of implementation, technical complexity, and change resistance. Small and medium-sized enterprises (SMEs) are the sectors that especially have high barriers as they might not have the resources or the skills to implement blockchain technology. Moreover, the absence of uniform guidelines and interaction with the industry stakeholders presents other barriers to large-scale adoption.

6.2 Theoretical Contributions

The present research is relevant to the existing literature on Halal SCM because it offers a more detailed insight into other important aspects of the industry in which blockchain technology can be used to resolve the challenges. It expands upon previous studies by providing empirical data on the basis of case studies, specialist interviews, and surveys that would indicate the possibilities and constraints of blockchain implementation. The research is also able to expand the theoretical framework of Halal SCM by incorporating the findings of the blockchain technology, supply chain transparency, and consumer trust. This cross-cutting methodology enhances the scholarship debate and offers a basis of the future study.

6.3 Practical Implications

To the industry stakeholders, the results of this study can provide practical information on how to implement blockchain technology in Halal SCM. The results indicate that blockchain has the potential of automating the certification process, minimizing fraud, and increasing consumer trust. Nevertheless, to implement successfully, one has to deal with the issues of cost and technical complexity and resistance to change. The research proposes that standardized protocols should be developed,

collaboration among stakeholders should be promoted, and the programs on education and training should be invested in to create awareness and technical knowledge.

6.4 Recommendations

Policymakers and regulatory authorities are very instrumental in ensuring that the use of blockchain technology in Halal SCM can be adopted. The research has suggested the adoption of regulatory frameworks that will facilitate the use of blockchain to acquire Halal certification and traceability. Another suggestion that policymakers should make relates to the use of interoperable blockchain platforms where Halal certification bodies, supply chain managers, and technology providers should work together to ensure that they come up with interoperability blockchain. Also, the governments and industry associations must invest in programs to assist SMEs to adopt the blockchain technology, including funding programs, technical support, and training workshops.

6.5 Future Research Directions

Although this study is insightful, it also indicates the need to conduct more studies in order to resolve the outstanding issues and seek new opportunities. The research in the future needs to be conducted on the following areas:

Standardization and Interoperability: establishing standardized protocols in implementing blockchain in Halal SCM in order to achieve uniformity and interoperability of blockchain across platforms and supply chains.

Cost-Benefit Analysis: Deploying elaborate cost-benefit analysis to determine the economic viability of integrating blockchains into SMEs and other stakeholders.

Consumer Perspectives: To learn more about what drives trust and purchasing decisions, the perceptions and attitudes of consumers towards blockchain-enabled Halal products are to be investigated.

New Technologies: The role of emerging technologies, like the Internet of Things (IoT) and artificial intelligence (AI) in improving the capabilities of blockchain in Halal SCM, should be investigated.

Cross-Cultural Studies: A cross-cultural analysis of the introduction of blockchain technology to Halal SCM in various cultural, regulatory environments to determine the best practices and lessons learned.

6.6 Final Remarks

To sum up, traceability, compliance, and consumer trust are the issues that can be solved with the help of blockchain technology integration into Halal SCM. Although the advantages are considerable, for the successful implementation of blockchain, the obstacles of cost, technical complexity, and change resistance need to be addressed. With the help of collaboration, creation of standardized protocols, and investment in education and training, the industry stakeholders can extract the full potential of blockchain technology to improve Halal SCM. The research is valuable to the academic and practical knowledge of blockchain in Halal SCM and offers the perspective on future research and innovation in this essential field.

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