Halal Traceability Model Using Cld Approach To Supply Chain Management Of Food And Beverage Packaging For Msme Products In Serang City Using Blockchain Technology

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ABSTRACT
This study aims to develop a halal tracking model with a Causal Loop Diagram (CLD) approach in supply chain management of food and beverage product packaging for Micro, Small, and Medium Enterprises (MSMEs) in Serang City. This study identifies the role of stakeholders and business processes in tracking halal food commodities in Indonesia through CLD analysis. In addition, this study proposes the use of blockchain technology as a solution to increase transparency and consumer trust in the halal supply chain. By combining the CLD approach, dynamic system analysis, and blockchain technology, this model is expected to be able to provide practical guidance for MSMEs in ensuring product halalness, supporting the Indonesian Government's efforts in the global halal industry, and facing challenges in supply chain management for halal food and beverage packaging.

Keywords: *Causal Loop Diagram (CLD), Blockchain Technology, Supply Chain Management, Halal Integrity*

1. INTRODUCTION

In the era of globalization and rapid technological development, the packaged food and beverage sector of Micro, Small, and Medium Enterprises (MSMEs) has experienced significant growth in various aspects, including production, distribution, and consumption [1]. The potential has become an important center of economic activity in the region. However, the growth of the packaged food and beverage industry also needs to improve in terms of product safety and halalness [2].

Product halalness is a critical issue that needs attention in the packaged food and beverage industry. For consumers, halal is a crucial factor in selecting and consuming products [3]. They want to ensure that the products they buy and consume comply with halal principles that conform to religious beliefs and demands. Therefore, we need a system that can provide transparent and accurate product halalness from upstream to downstream in the supply chain [4].

Blockchain technology is essential as an innovative solution to overcome this problem. Blockchain is a technology that allows the recording of transactions in the form of cryptographically linked and transparent blocks [5]. This technology has proven effective in various areas, including the supply chain because it ensures data authenticity, integrity, and transparency. In the context of product halalness, Blockchain technology can be used to record every stage of production, distribution, and consumption in transparent and irreversible details, thereby enabling more efficient tracking and verification of halal [6]. However, implementing Blockchain technology in managing the MSME packaged food and beverage supply chain is complex. Multiple complexities must be addressed, including technical, regulatory, and appropriate management approaches. Therefore, a comprehensive and integrated approach is needed to develop a halal traceability model in the MSME supply chain management in Serang City [7].

B. Setiawan and N. M. Indraswari (eds.), *Proceedings of the 2nd International Conference on Management and Business (ICOMB 2023)*,
Advances in Economics, Business and Management Research 278,
https://doi.org/10.2991/978-94-6463-402-0_10

The Causal Loop Diagram (CLD) approach is one of the tools that can be used in designing the model. CLD enables in-depth analysis of cause-and-effect relationships in complex systems, such as supply chain management [8]. By designing CLD, various factors that influence product halalness, such as government policies, producer awareness, production processes, distribution, and consumer perceptions, can be identified and analyzed holistically [9].

This study aims to develop a halal traceability model with a CLD approach in managing food and beverage supply chain packaging for MSME products in Serang City. This model is expected to significantly improve the safety and legality of MSME products and optimize overall supply chain operations [10]. In addition, this research will also provide practical guidance for MSMEs in adopting Blockchain technology and the CLD approach to meet higher halal standards to increase the competitiveness of MSME products in an increasingly competitive global market [11].

2. LITERATURE REVIEW

2.1. Causal Loop Diagram (CLD)

Causal Loop Diagram (CLD) is a visual tool used in system dynamics to depict cause-and-effect relationships between various variables in a system [12]. CLD helps understand how changes in one variable can affect other variables in the system. These diagrams help system modelers to explain, understand, and design complex interactions in a system [13].

Causal Loop Diagrams (CLD) can be used to describe cause-and-effect relationships in the context of food and beverage packaging for MSME (Micro, Small, and Medium Enterprises) products[14]. There is a positive relationship between MSME Packaging Product Production and Sales. The more products produced, the higher the probability of sales. High product quality can positively contribute to marketing and sales[15].

By using CLD, MSMEs in the packaged food and beverage industry can better understand how these variables are interrelated and how changes in one area can impact the entire system. This can help MSMEs plan more effective production, marketing, and sales strategies and increase the competitiveness of their products in the market[16].

2.2. Blockchain Technology

While there are significant benefits in implementing blockchain technology in agribusiness tracking, implementation still needs to be improved. Another study explores blockchain integration into the halal food tracking system through a model that combines halal orientation strategy, institutional theory, and innovation diffusion theory[17]. The findings from this study indicate that producers go through a series of stages before deciding to engage in a halal tracking system. With the participation of all parties involved in the halal supply chain, a blockchain-based tracking system allows end consumers to access information about the entire supply chain from the product's origin. Therefore, blockchain-based halal tracking solutions are not just a trend but a reality that can have a real impact [18].

Standardizing processes and tracking interfaces is critical before implementing blockchain technology[19]. Halal supply chain systems must be adapted appropriately and regulated before blockchain can be successfully implemented [20]. This research introduces a blockchain-based halal logistics tracking model that has never been studied in Indonesia. This initiative is part of the Indonesian government's efforts to become a leader in the halal industry at the global level.

Product packaging utilizing blockchain technology is an innovation that allows MSMEs (Micro, Small, and Medium Enterprises) to strengthen their supply chains' transparency, security, and reliability. Here's an overview of how this can happen:

1. Supply Chain Management and Tracking (Supply Chain Management):

Description: Blockchain technology allows every stage of production and distribution in the supply chain to be openly recorded and verified. Every time a product moves from one location to the next, this information is recorded in a new block in the blockchain chain.

Benefits: MSMEs can accurately track the product journey from raw materials to final product. This increases transparency and allows for fast traceback in the event of quality or safety issues.

2. Product Authentication and Authenticity:

Description: Through QR codes or RFID technology, consumers can verify product authenticity and access detailed information about the product's origin and journey.

Benefits: This helps eliminate counterfeit products and provides additional confidence to consumers. They can be confident that their products are genuine and match the manufacturer's claims.

3. Product Warranty:

Description: Product warranty information can be encrypted in blockchain. It enables automatic tracking of warranties and warranty status updates and allows users to submit warranty claims easily.

Benefits: It provides a better customer experience and strengthens their trust in the MSME brand or product.

4. Stock Availability Tracking:

Description: Using blockchain, business owners can monitor product stock in real-time. This can trigger automatic orders or provide alerts when inventory is nearing exhaustion.

Benefits: It helps optimize stock management, avoids stockouts, and allows business owners to respond quickly to fluctuations in demand.

5. Certification and Compliance Verification:

Description: Halal certification information or other certifications can be imported and verified via blockchain, ensuring that products meet specific standards and regulations.

Benefits: This helps ensure product compliance with halal or other quality standards and builds consumer trust.

Implementing blockchain in MSME product packaging requires collaboration with blockchain solution providers or technology companies. However, this can open up new opportunities in terms of transparency, security, and improved customer experience.

2.3. Supply Chain Management

SCM Refers to managing all activities involved in producing, distributing, and delivering products or services from producers to final consumers. SCM is essential in halal food and beverages to ensure product sustainability, safety, and halalness.

The halal supply chain is crucial in maintaining the integrity of halal food and beverage products [11]. However, there are reports of fraud worldwide, even for food and beverage products that already have a halal certificate and follow the halal supply chain. Therefore, consumers, especially Muslim ones, increasingly demand transparent tracking solutions to ensure halal integrity[7]. The benefits of traceability and traceability are expected to be felt at both the company and farmer levels, throughout the supply chain, and in the marketplace as a whole. Implementation of tracking can reduce the cost of product withdrawal from the market. Food manufacturers can implement effective product recall management to ensure food products' safety and halal status according to their own approach. Preventing the creation of recalls, especially in terms of halal compliance, will help build consumer confidence in the integrity of the Halal industry [2].

2.4. Halal Integrity

Halal integrity is an essential foundation in the halal food industry. Precautions and protection must be implemented to maintain the status of halal food products, even though they have gone through a long journey and various stages in the supply chain [3]. All elements in the supply chain, from the source to the final consumer, have individual and collective responsibilities to maintain the authenticity of halal food products, avoiding intentional or unintentional contamination [21].

One party alone can't assume this great responsibility. Given that the demand for Halal food products is expected to grow shortly, factors such as Halal certification, standards, and tracking are becoming increasingly important [11]. In a study on halal hunts in food companies that have been certified halal, the company's initiatives in terms of tracking halal food production were studied. From experience in various cases, a framework has been generated that can be used by halal food producers as a guide to ensure halal compliance throughout the production, transportation, and distribution processes [22].

3. RESEARCH METHOD

The research method used in this study is a descriptive analysis approach using secondary data from relevant scientific literature. This research will collect information and concepts related to halal tracking in the MSME packaged food and beverage supply chain and the application of blockchain technology in that context. The data will be analyzed qualitatively to identify the challenges, benefits, and implications of using blockchain technology to ensure products' halal integrity. Furthermore, the Causal Loop Diagram (CLD) approach will be applied to design a halal traceability model in MSME supply chain management in Serang City, taking into account factors such as halal certification, halal standards, government policies, producer awareness, production processes, distribution, and perceptions. Consumer. With a combination of descriptive analysis methods and the CLD approach, this study aims to provide in-depth insight

into the potential and constraints of implementing blockchain technology in ensuring the halalness of packaged food and beverage products for SMEs in Serang City.

4. RESULTS AND DISCUSSION

In Indonesia, halal product development is still focused on the certification stage and giving halal labels to products[11]. Although there has been an increase in this regard, there is no comprehensive strategy for developing halal logistics as a master plan for creating a halal supply chain in Indonesia. Clear operational standards and procedures (SOP) to regulate the distribution of halal products still need to be fully defined in Indonesia [23].

The tracking system in the context of halal logistics ensures product quality in the supply chain. It has a vital role in product authentication and identification, which will protect consumer confidence in food safety [24]. The tracking system in the context of halal logistics ensures product quality in the supply chain. It has a vital role in product authentication and identification, which will protect consumer confidence in food safety [25].

By involving all actors in the halal supply chain, a tracking system based on blockchain technology allows end consumers to obtain detailed information about the entire product journey from start to finish. Implementing a halal tracking system also has the potential to reduce the costs incurred to take products from the market. Blockchain technology is essential in ensuring transparency and consensus in halal logistics [26].

This research focuses on developing a halal tracking model using the Causal Loop Diagram (CLD) approach in managing the packaged food and beverage supply chain for MSMEs in Serang City. Utilizing blockchain technology is one of the main components of this model. This model is an innovative step that has never been explored in Indonesia, in line with the Indonesian Government's efforts to strengthen the country's position as a globally competitive producer of the halal industry. Thus, this research has theoretical relevance and substantially contributes to the challenges of developing and managing the supply chain of halal food and beverages [27].

The system identification process has the goal of illustrating an overall picture of the system being investigated through the use of diagrams. This study generated a causal diagram in the form of a Circular Loop Diagram (CLD) from an in-depth needs analysis. This CLD diagram is intended to represent cause-and-effect relationships in the studied system. An overview of the Causal Loop diagram in this study can be found in the following illustration:

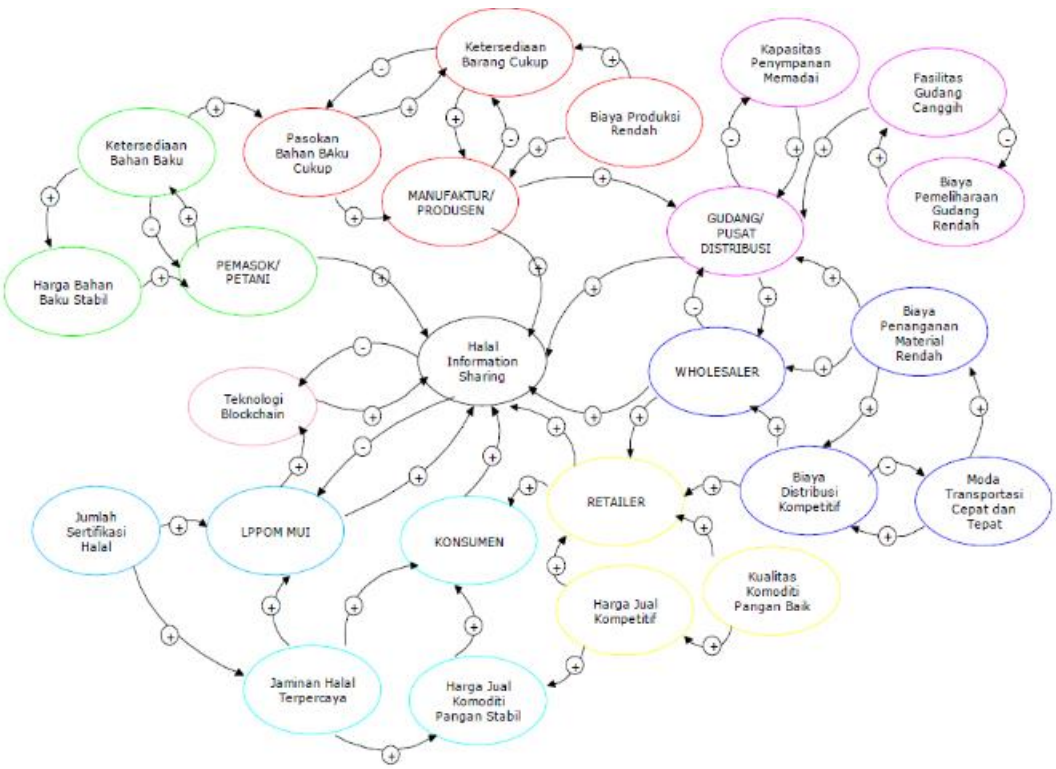

Figure 1. Causal Loop Diagram

The Halal Traceability Model is a system designed to ensure that products or materials consumed or used by Muslims meet Islamic halal standards. The CLD (Causal Loop Diagram) approach is a visual method for modeling and analyzing cause-and-effect relationships in a system.

The following is an example of the CLD approach to the Halal Traceability Model:

Main Variables:

Consumer Trust (Trust of Consumers): The level of consumer confidence in the halalness of the products they consume.

Supply Chain Transparency: The level of openness and clarity of information regarding the entire product supply chain.

Halal Certification: The existence of official certification that shows that the product meets Islamic halal standards.

Inspection and Audit: Inspection and audit process carried out by halal authorities or related parties.

Manufacturer Compliance: The level of manufacturer compliance with halal guidelines and regulations.

Causality:

Increase in Consumer Confidence → Increase in Demand for Halal Products → Increase in Production and Supply of Halal Products → Increase in Supply Chain Transparency.

Increased Supply Chain Transparency → Increased Product Tracking and Tracking → Increased Consumer Confidence.

Increased Inspections and Audits → Increased Manufacturer Compliance → Increased Consumer Confidence.

Increase in Demand for Halal Products → Increase in Demand for Halal Certification → Increase in Consumer Confidence.

Increase in Consumer Confidence → Increase in Manufacturer Compliance → Increase in Demand for Halal Certification.

Increased Demand for Halal Certification → Increased Inspections and Audits → Increased Supply Chain Transparency.

Increase in Supply Chain Transparency → Increase in Product Tracking and Tracking → Increase in Demand for Halal Certification.

Feedback Cycle:

Increase in Consumer Confidence → Increase in Demand for Halal Products → Increase in Production and Supply of Halal Products → Increase in Supply Chain Transparency → Increase in Consumer Confidence (Positive Cycle).

Increase in Inspections and Audits → Increase in Manufacturer Compliance → Increase in Consumer Confidence → Increase in Demand for Halal Products → Increase in Inspections and Audits (Positive Cycle).

This modeling provides a visual representation of how the main elements in the Halal Traceability Model can interact and influence each other. CLD helps analyze the impact of changes in one variable on another variable and vice versa. This can help identify effective strategies and policies to strengthen the halal system.

From understanding the results of identifying the Causal Loop Diagram (CLD) System Model, it is clear that stakeholders and business processes have a crucial role in tracking halal food commodities in Indonesia. This system approach also makes it possible to determine the actions that need to be taken and the starting point in implementing a halal tracking system for food commodities, especially with the help of blockchain technology, according to the findings of system identification [28].

Although the Causal Loop Diagram (CLD) Model approach has succeeded in identifying systemic aspects, another approach is needed to analyze system synergies that are more comprehensive to overcome the problems that arise. For example, an analysis with a dynamic system approach can be carried out to design scenarios for decisions to be taken to find the right solution Applying blockchain technology to food commodity tracking systems in Indonesia can be a practical approach to overcoming these challenges [28].

Thus, this study proposes that apart from the CLD Model approach, analysis with a dynamic system approach and blockchain technology can significantly contribute to the halal tracking model in the supply chain management of food and beverage packaging for MSME products in Serang City. Integrating these approaches, a holistic and practical model is hoped to ensure product halalness and improve quality and transparency in the halal supply chain.

Addressing Technical and Data Management Challenges in Implementing Blockchain Technology

Implementing blockchain technology within supply chains confronts many technical complexities and data management intricacies. Acknowledging these hurdles more comprehensively is crucial to understanding their depth and impact. Delving deeper into the technical challenges, such as scalability, interoperability, and security concerns, will provide a more precise roadmap for mitigating these obstacles. Moreover, elucidating the intricacies of data management issues—such as data privacy, integrity, and standardization—will fortify the study's foundation and contribute significantly to its academic rigor.

While stakeholders are recognized as pivotal in the halal supply chain, the study's current scope needs more insight into their active involvement in shaping and executing the proposed model. Expanding upon how these stakeholders will be engaged throughout the developmental and implementation phases is paramount. Detailing strategies for stakeholder engagement, including collaboration frameworks, participatory approaches, and feedback mechanisms, will infuse the proposed model with practical applicability and real-world relevance. This augmentation will elevate the study's credibility and amplify its potential for seamless integration within the halal supply chain ecosystem.

These proposed improvements augment the study's academic credibility and practical applicability. By addressing technical complexities, diving deeper into data management challenges, and elucidating stakeholder engagement strategies, this study transforms into a more robust, insightful, and actionable piece of research. This enhanced version not only contributes to the new body of knowledge but also stands as an innovative blueprint poised to impact and revolutionize the integration of blockchain technology within the halal supply chain domain.

Stakeholders, often crucial players in any system, must be explicitly detailed regarding their involvement. There's a significant gap in explaining how these stakeholders—government bodies, halal authorities, businesses, or consumers—will actively participate in shaping and executing the proposed model.

In essence, the research focuses on constructing the theoretical and systemic aspects of the Halal Traceability Model, illustrating how different variables interact within the supply chain. However, it fails to elucidate the need to include more practical steps or strategies for engaging stakeholders. For instance, it doesn't detail how these stakeholders will collaborate, provide feedback, or participate in the implementation phases.

In addressing this gap, the research could detail specific strategies for stakeholder engagement. These strategies include collaboration frameworks, participatory approaches like workshops or focus groups involving stakeholders, feedback mechanisms to incorporate their insights, or even training programs to familiarize stakeholders with the proposed model and its implications.

By enhancing the research with a clear roadmap for stakeholder involvement, the proposed model can become more actionable, relevant, and adaptable within the real-world context of the halal supply chain. This inclusion would bolster the study's credibility and practical applicability, ensuring that the proposed model aligns with the needs and perspectives of the stakeholders involved.

5. CONCLUSION

This research underscores the importance of developing a halal traceability model using the Causal Loop Diagram (CLD) approach in the supply chain management of packaged food and beverage products for SMEs in Serang City. Through system identification using CLD, it was found that stakeholders and business processes have a central role in tracking halal food commodities in Indonesia. Although the CLD Model has helped identify systemic aspects, additional approaches are needed to realize a comprehensive solution, such as dynamic system analysis and application of blockchain technology.

The application of blockchain technology has the potential to overcome challenges in ensuring product halalness and increase transparency and consumer confidence in the halal supply chain. By integrating these various approaches, it is hoped that a robust and effective model will be created to ensure the safety and halalness of MSME products, supporting the Indonesian Government's efforts to strengthen its position in the global halal industry, and making a real contribution in dealing with problems and opportunities in food and beverage supply chain management. legal packaging.

6. AUTHORS' CONTRIBUTIONS

a. Kiki Trisna Mukti: Research conception and design, data analysis, article writing.

b. Wiwik Novianawati: Data acquisition, data analysis and interpretation, critical revision of articles.

c. Aramiko Kayanie Nenden Atryana: Project supervision, expert consultation in research methodology, critical revision of articles.

d. Handy Satiayadi: Data acquisition, data analysis and interpretation, article compilation and editing.

e. Basrowi: Project supervision, financial resources, critical revision of articles.

7. ACKNOWLEDGMENTS

We thank the Master of Management Study Program at Bina Bangsa University for their support during this research. We also thank our supervisors for their technical assistance and valuable suggestions. The campus partly funded this research, which significantly contributed to its progress.

We also thank all the research subjects who participated voluntarily; this research would not have been possible without their contributions.

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