**Al-Muqayyad**
ISSN (print): 2715-3177 | ISSN (online): 2614-8102
Program Studi Ekonomi Syariah, STAI Auliaurrasyidin Tembilahan
Journal Homepage: https://ejournal.stai-tbh.ac.id/index.php/al-muqayyad

# Blockchain as a Reinforcement for Traceability of Indonesian Halal Food Information through the Value Chain Analysis Framework

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**DOI**: https://doi.org/10.46963/jam.v6i1.1031

***Cite this article:***
Mahsun, M., Putra, Y. H. S., Asnawi, N., Djalaluddin, A., & Hasib, N. (2023). Blockchain as a reinforcement for traceability of Indonesian halal food information through the value chain analysis framework. *AL-Muqayyad*, *6*(1), 49-66. https://doi.org/10.46963/jam.v6i1.1031

***Keywords:***
*Value Chain Analysis Framework; Blockchain; Halal food Indonesia*

***Informasi Artikel***:
*Accepted:*
13/06/2023
*Revised:*
09/06/2023
*Published:*
30/06/2023

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**ABSTRACT**

*This research is to offer the use of blockchain for the traceability of information about halal food as a form of developing a traceability system that ensures and maintains the quality of halal food and drinks in Indonesia. This research departs from the rampant counterfeiting of products, which also continues to increase, especially in relation to food and beverages. This causes huge losses from an economic standpoint, both for companies and producers, has an impact on the country's economy, and erodes consumer confidence due to unclear information, especially regarding confusing halal traceability. This research is a literature review developed through the Value Chain Analysis Framework. A value chain analysis framework that supports blockchain in reminding companies to focus on development that will help achieve the Indonesian halal industry supply chain in accordance with government standards engaged in the Indonesian halal industry. This study develops the concept of a halal value chain that strengthens the role of blockchain technology and pays attention to the finances in each block needed by the supply chain.*

## INTRODUCTION

Industrial halal traceability is a solution for monitoring the quality and traceability of supply chain products while maintaining the integrity and security of halal products (Tan, Gligor, & Ngah, 2022; Tieman & Ghazali, 2014; Zhao et al., 2019). Traceability is expected to be able to cover all information starting from the process of procuring Halal raw materials or ingredients, the manufacturing process, packaging, handling, storage, retail sales, and delivery until the product reaches the final customer (Dini & Nurul, 2019; Modgil et al., 2022; Sumarliah, Li, Wang, Fauziyah, & Indriya, 2022; Tan et al., 2022; Zulfakar, Jie, & Chan, 2012). While Hew. *et al*. argue that halal traceability covers materials, production processes, classification, storage, and transportation (Hew, Wong, Tan, Ooi, & Lin, 2020). Pournader *et al*. formulated that information transparency and traceability aim to answer the three questions 'what, when, and where' in the inventory

process in the supply chain, while transparency tries to explain the 'how' aspect of tracing halal products (Pournader, Shi, Seuring, & Koh, 2019).

Meanwhile, the WHO (World Health Organization) reports that product counterfeiting has also continued to increase, especially in relation to food and beverages. This causes huge losses from an economic standpoint, both for companies and producers, has an impact on the country's economy, and erodes consumer confidence (Galvez, Mejuto, & Simal-Gandara, 2018). *Badan Pengawas Obat dan Makanan* (BPOM) RI, indicates that the cause of food counterfeiting occurs when food products begin to circulate (pre-market) and after food products are distributed (post-market). Pre-market needs to be evaluated to check production facilities, such as raw materials, food additives, production codes, and storage of food products. While the post-market is to see the consistency (accordance of information) of what has been claimed from the beginning of the product registration process (Krisda Tiofani, 2021), this process will make it a part of product guarantees, especially from a halal perspective.

While many studies from the halal logistics side have been carried out, halal logistics is a determination of halal control activities and guarantee activities in the field of logistics business processes (infrastructure, special halal warehouses, and transportation). This system has become a guarantee of halal, which can be an important instrument in managing the logistics of the halal food chain in Muslim and non-Muslim countries. It's just that the control of information at each stage still needs to be considered in order to ensure the integrity of halal logistics for consumers and producers (Tieman & Ghazali, 2014). A halal traceability system will increase halal transparency in the supply chain. This can be used to track potentially non-Halal ingredients, validate and authenticate that the product is indeed Halal, and serve as a control for all stakeholders (Dini & Nurul, 2019; Hendayani & Fernando, 2022; Zulfakar et al., 2012).

In the State of the Global Islamic Economy (SGIE) Report 2022 released by the Dinar Standard, Indonesia is still inferior to Malaysia in handling halal food and beverages, and Indonesia is still in second place in the world in terms of world governance. Indonesia is still categorized as weak in terms of awareness and its financial sector when compared to Malaysia (Dinar Standard & Salam Gateway, 2022). However, since the acceleration in the adjustment of Halal Product Assurance regulations, simplifying rules and clarifying processes, speeding up processing time, and facilitating halal certification Indonesia increasingly has very good and promising prospects for halal food investors. This is also felt from the impact of the integration of the information system (technology) on halal products between the Director General of Customs and Excise, *Lembaga National Single Window* (LNSW) of the *Kementerian Keuangan* (Kemenkeu), the *Komite Nasional Ekonomi dan Keuangan Syariah* (KNEKS), and the *Badan Penyelenggara Jaminan Produk Halal* (BPJPH) in data collection on export and import activities of halal products (Kemenag, 2022).

However, the process tracking system must be maintained, bearing in mind that the principle of halal logistics is a halal supply chain process in the form of handling the flow of materials that focuses on separation, not just detection and suspicion. Halal logistics is also promoted to ensure consistency in halal handling and is projected to become increasingly central through technology adoption through Logistics 4.0. Even though Logistics 4.0 is still only a blueprint, with the rapid development of technology, it is projected to be able to help in terms of efficiency and delivery more precisely and quickly in society and become one of the keys to the future development of the logistics industry (INSIGHT:Buletin Ekonomi Syariah, 2020). In addition, an important factor in the halal supply chain is that it helps to improve effectiveness and provides a sustainable conceptual framework (Haleem, Khan, & Khan, 2021; Jha, Jasti, Chaganti, Kota, & Vijayvargy, 2022). And being one of the main factors in the survival of the organization, it becomes an integral part of any business (Rahimi, Raad, Alem Tabriz, & Motameni, 2020).

Malaysia has also adopted a halal supply chain through the first halal blockchain network that only functions as a tracer of the origin of imported beef. This blockchain supports a more stringent tracking system than other food supply chains. This concept is recognized by the OIC Standards and Metrology Institute (Organization of the Islamic Conference) for Islamic Countries as a form of introducing international halal supply chain management system standards. Indonesia is still a food-consuming country that will import the most food in 2021, with a figure of $146.7 billion, followed by Bangladesh, Egypt, Pakistan, and Nigeria. The average meal is imported from China, Brazil, and America. Concern about halal food is still relatively far away when compared to Malaysia. Besides that, the financial factor is also far away, so it has an impact on innovating halal products(Dinar Standard & Salam Gateway, 2022).

While the Indonesian government's policies in developing the blockchain ecosystem are very wide open (Aini et al., 2022; Cahyadi, Irawan, & Ce, 2022), including strengthening the halal supply chain as empowering information technology in Indonesia (Saepudin, 2022) and showing that perceptions of efficiency, transparency, standardization, and development of platforms are positive traceability factors for halal products (Dehghani, Popova, & Gheitanchi, 2022; Mohammed, Potdar, & Quaddus, 2023). However, the potential is still constrained by synchronization between lines, so the blockchain ecosystem in Indonesia has not fully reached its potential. This causes information transformation to be weak in terms of accuracy and data security when realizing a product tracking system (Asnawi, Mahsun, & Danila, 2023). One of the intended data security measures is security, which causes supply and demand to sometimes be unreliable, so that the integrity of halal products cannot be felt (value chain)(Saepudin, 2022). According to Yakoni (2022) offering the blockchain concept as a support for presenting information through the principles of transparency and traceability, reliability and security, automatic contracts and verification, incentives, and

tokenization has proven to have various potential supports for assessing future company or industry performance (Zhao et al., 2019). Although blockchain still has a downside resulting from the negative environmental and social implications of the technology (Spanò, Massaro, Ferri, Dumay, & Schmitz, 2022). This technology also does not mean that there are no obstacles; the obstacles are also felt by the government, employers, and professional employees (Ebekozien, Aigbavboa, & Samsurijan, 2022).

This research offers the use of blockchain as a traceability support developed through halal supply chain management. This is designed through a value chain analysis framework approach to realize optimal and effective halal traceability. As well as the adoption of technology that enables humans and machines to share information effectively and efficiently to respond quickly to market needs (Sánchez, Pérez-Pérez, & Vicente-Oliva, 2019; Zhao et al., 2019) and hopes to realize halal traceability that can adapt well to green technology and provide input to stakeholders, especially the government, shareholders, companies/producers, and consumers themselves.

## METHOD

The value chain analysis framework used in this study was taken from the review literature. As the primary source of information, the last five years' worth of scientific articles published in Scopus-indexed journals were used. Reputable reports, news articles, and regional, national, and worldwide monographs on the same topics were then used as supplementary materials(Dini & Nurul, 2019; Dubey & Gunasekaran, 2015). Literature review is used to explore and develop a theoretical framework with value chain analysis framework (Maxwell, 2010; Modgil et al., 2022).

## RESULT AND DISCUSSION

Halal traceability is such a broad system to study; blockchain-based halal food is oriented towards product information security and traceability systems and food manufacturing sustainability (Zhao et al., 2019). Halal traceability is also intended to strengthen market recognition of Halal logistics branding and logistics operational performance. Halal logistics plays a mediating role in linking the use of Halal traceability technology and logistics performance. This offers a logistics business strategy that is appropriate for targeting Shariah compliance-oriented customers (Fernando, Wahyuni-TD, Zainul Abideen, & Mergeresa, 2022).

Halal traceability provides perceived ease of use, technological aspects, and organizational aspects that synergize with each other (Kamarulzaman, Muhamad, & Mohd Nawi, 2022; Poniman, Purchase, & Sneddon, 2015). Halal traceability can also help understand the importance of environmental factors for the halal industry, improve the integrity of the halal food supply chain, and protect against any risk of cross-contamination (Ab Rashid & Bojei, 2020; Zhao et al., 2019). Technology is also used for traceability and logistics; this gives momentum to developing a tracking system as a form of digitizing retail dining and restaurants. Blockchain has also offered to support tracking

systems to ascertain the origin of food, especially meat, following a number of scandals around the world (Dinar Standard & Salam Gateway, 2022).

While the main concepts of blockchain, making transparency and traceability, reliability and security, automatic contracts/verification, incentives, and tokenization are proven to have various potential supports for assessing company or industry performance going forward (Hendayani & Fernando, 2022; Yarkoni, 2022), data security and accountability (Kiu, Lai, Chia, & Wong, 2022) Including in decision-making and policies in the automation industry (Bajar, Kamat, Shanker, & Barve, 2022). Blockchain technology can assist in product quality management and control (R. W. Ahmad et al., 2022) and blockchain helps in creating competitive advantages and improving organizational and government performance (Sheel & Nath, 2019).

Blockchain has been popular as a tool that can modernize commercial practice soon. Blockchain signifies a statistical configuration of related access information called blocks; a chain is an automatically distributed ledger, typically backed up by multiple indistinguishable hosts throughout the system (Cole, Stevenson, & Aitken, 2019; Hughes et al., 2019; Sheel & Nath, 2019; Q. Wang, Zhu, Ni, Gu, & Zhu, 2020; X. Wang et al., 2019). Adoption of blockchain on halal products will construct the main dimensions (complexity and capability, cost and competitive advantages, adaptive management and external pressures, halal sustainable production, and regulatory errors) that underlie the food challenge(Helmi, Chung, Kumar, Zailani, & Hua, 2021).

**Value chain Analysis Framework**

Value chain analysis is a framework that aims to interpret "value" and relationships along the chain in order to highlight opportunities to create sustainable value chains (Fearne, Garcia Martinez, & Dent, 2012). The term value chain was introduced by Michael Porter through his 1985 book Competitive Advantage: Creating and Sustaining Superior Performance. Michael Porter defines "value chain" as a representation of a company's value-adding activities and as an evaluation of a company's ability to meet customer needs by providing them with efficient ways (Kumar & Rajeev, 2016).

The value chain framework is widely used by the manufacturing industry to implement comprehensive strategies. This framework can be used to formulate and implement a comprehensive strategy depending on the short-term and long-term financial perspective of a product from the company (Knez, Jaklič, & Stare, 2021). Porter's framework covers most of the internal enterprise value chain categories relevant to reverse logistics and recovery, which are added as new categories for key activities. collection and recovery activities at the end of the product life cycle necessary for further provision of the life cycle through re-use (Eisenreich, Füller, Stuchtey, & Gimenez-Jimenez, 2022). The value chain model consists of two activities, namely primary activities and support activities, as shown in Figure 1.

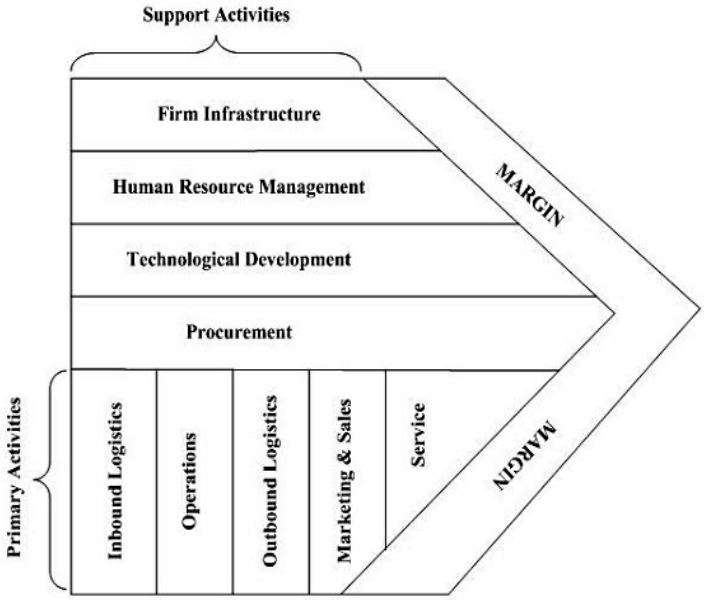


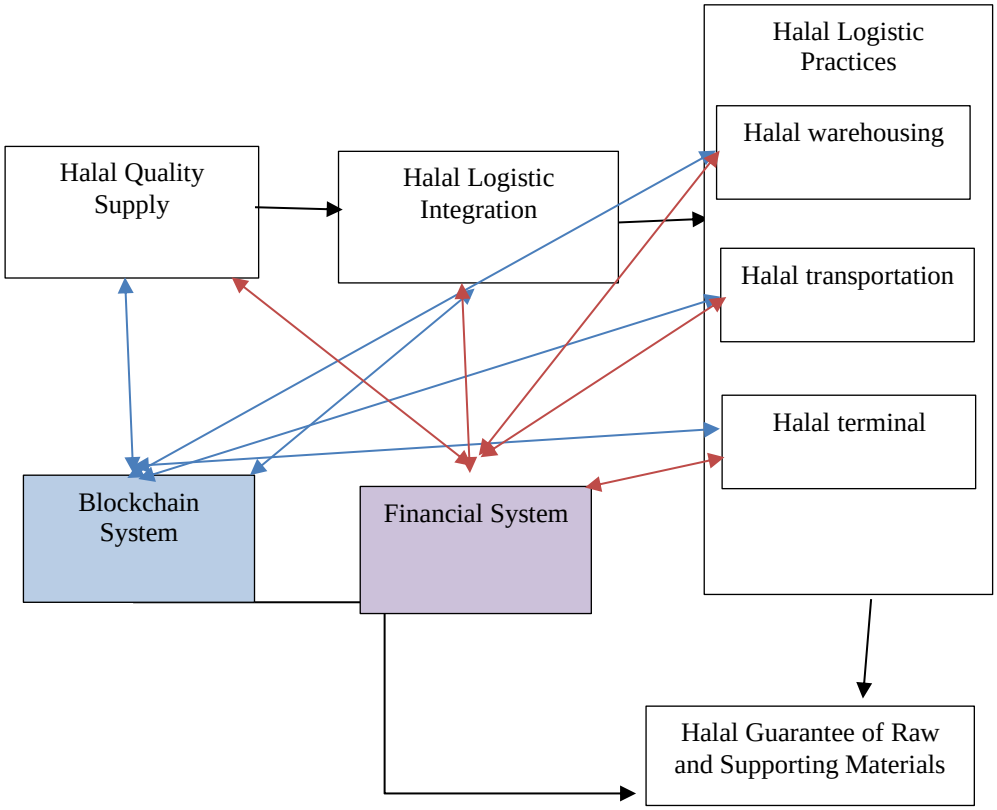

Figure 1: *Michael Porter Value Chain Model/framework* (Eisenreich et al., 2022; Kumar & Rajeev, 2016)

1. Primary Activities
   *a. Halal Inbound Logistics*

The large demand for halal products requires more production. While logistics demands that the supply chain is still lagging behind. Significant investment is needed to increase the capacity and capability of the halal supply chain(Dinar Standard & Salam Gateway, 2022). This shows the more open supply of goods from foreign countries, especially from countries where the population is a Muslim minority. Moreover, product transactions in Indonesia are controlled by non-Muslim countries such as America, Brazil, and China. The existence of halal logistics practices produces a positive effect on logistics performance by increasing the ability of halal product innovation and by increasing the integrity of the halal industry (Azam & Abdullah, 2020) without having to slow down the process of procuring goods, raw materials, or services, including reducing the potential risk of handling materials. This can be helped by the adoption of the blockchain system (Galvez et al., 2018; Gaur, 2020; Pournader et al., 2019; Sheel & Nath, 2019; Tan et al., 2022). This practice is intended to prevent contamination of goods or raw materials from non-halal or non-sharia matters or practices. Logistics in the supply of raw materials must be committed to a consistent halal logistics system in halal transportation, halal warehouses, order processing, inventory, material handling, and packaging (Aziz, Setyorini, & Hasanah, 2021; Dini & Nurul, 2019; Karia, 2022). Through the adoption of blockchain, real-time

information can be presented through an inventory of data from each stage according to the principles of halal and toyyib (Hendayani & Fernando, 2022).

Figure 2. Inbound Logistics Model (Develop by Author) (Karia, 2022)




*b. Halal Integration Standardized Model Operations*

A number of strategic efforts related to the management and development of the BPJPH halal service database. *Badan Penyelenggara Jaminan Produk Halal* (BPJPH). The *Kementerian Agama* continues to make efforts to improve Halal Product Guarantee (JPH) services by utilizing information technology. Apart from continuing to develop the halal service system and strengthening its integration network with service systems for related stakeholders, BPJPH is also exploring the use of Artificial Intelligence (AI) and blockchain to improve its services, both through certification services and providing an accurate traceability system. (BPJPH, 2022). The traceability aspect of material traceability will help determine the critical points of halalness and safety of the materials used. If problems arise, it will be easier to trace them directly to the source (Sukoso, Adam Wiryawan, Joni Kusnadi, 2020). Track and trace systems are being leveraged to strengthen trust. Halal food companies, retailers, and Islamic countries are increasingly using track-and-trace systems, including blockchain, to improve traceability, increase consumer confidence, and monitor halal imports amid rampant fraud(Dinar Standard & Salam Gateway, 2022).

In addition, the standards in the production operation process must certainly meet the criteria determined by LPPOM MUI or those that have collaborated with it. It consists of more than 40 global halal certification bodies. This extensive network strengthens the credibility of the LPPOM MUI certificate. Credibility is also supported by accreditation from the National Accreditation Committee for ISO/IEC 17065:2012 and from ESMA (Emirates Authority for Standardization and Metrology) for GSO 2055-2 (2015). Procedures and decisions on product halalness are handled by LPPOM MUI and the MUI Fatwa Commission. LPPOM MUI handles checking for adequacy of documents, scheduling audits, conducting audits, auditor meetings, issuing audit memoranda, submitting minutes of audit results at MUI Fatwa Commission meetings, making MUI Fatwa Commission decisions regarding product halalness based on audit results, and issuing MUI halal decisions(MUI, 2022). With blockchain technology, all stakeholders can have real-time access to each block, which describes the stages of the production process.

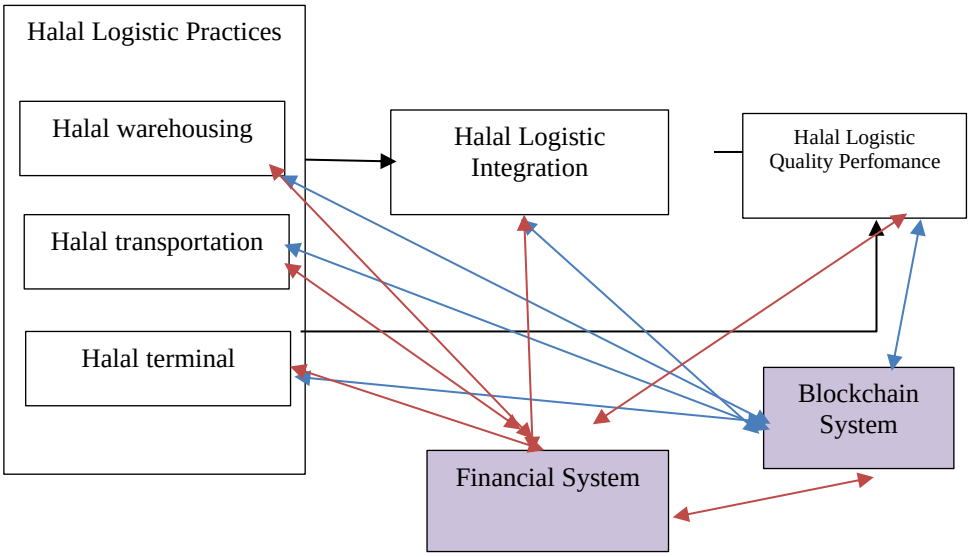
Figure 3: *Halal Certification Procedures For Products Marketed Outside Indonesia* (MUI, 2022)


*c. Balancing Outbound Logistics*

Finished goods must be completely guaranteed to be halal, starting from packaging to the distribution process or migration to the storage warehouse. Each of the stages of the standard process that has been carried out before remains unchanged or guaranteed to be halal (no mixing of non-halal goods, unclean goods, or unclean facilities); of course, the quality of the product is in accordance with the quality expected(BPJPH, 2022).

The integrity of the product quality guarantees the principles of halal and toyyib, and the facilities are also guaranteed from contamination, both in terms of packaging, storage, and delivery or distribution. Everyone ensures that they are always recorded by recording activities at each stage. Halal logistics are not considered an inherent part of halal products. In fact, in HSCM, halal logistics is an integrated part of the halal ecosystem (INSIGHT:Buletin Ekonomi Syariah, 2020).

Figure 4. *Outbound Logistics Model* (Develop by Author) (Karia, 2022)




d. Marketing and Sales

Marketing capability has an impact on increasing the company's competitive advantage and profitability through supply chain management. This is important for creating a competitive advantage and improving firm performance. Therefore, it is important that labeling and sterilization in the distribution process are maintained both from a location perspective and from an Islamic point of view of sales transparency, as priority is given to Islamic marketing, Islamic principles, and determinants of consumer behavior and awareness of Islamic products. Includes labeling and branding, prices, communications and promotions, community needs database, low prices, and monitoring (Irrubai, 2015).

e. Services Adaption

Customer service is one of the organizational processes that companies perform in view of growing competition, to attract entrepreneurial opportunities for increased profitability and better access to markets, and to increase customer satisfaction and loyalty levels (Cicik Harini, 2020). Customer service has an important meaning because, in the end, it will increase product quality, gain

competitive advantages, create profitable opportunities, and, as a result, increase sales and revenue (Ana & Zunaidi, 2022; Rangkuti, 2013).

Customer loyalty is considered one of the key factors in the success of a business to create competitive advantage and company sustainability from time to time. One of the main determinants of creating loyalty is customer satisfaction; besides that, other determinants that can create loyalty other than satisfaction are switching costs. This effort can be made so that customers reuse a product or service, such as by providing continuous promotions in order to lure customers to reuse the product or service (Akhmadi & Martini, 2020).

2. Supporting Activities

| No | Support Activities | |
|---|---|---|
| 1 | Firm Infrasturcture | Islamic financial planning can be defined as the process of achieving goals through financial management in order to increase, create, protect, purify, and distribute wealth or capital in accordance with Islamic Sharia provisions (Lahsasna, 2010). The halal food industry is not only related to the production of halal food but also includes Islamic financial services, which prohibit interest (*riba*), uncertainty (*gharar*), and gambling (*maysir*). Islamic financial planning plays an important role in providing funds and investment opportunities, especially for SMEs (Waharini & Purwantini, 2018). |
| 2 | Human Resource Management | Human resources in Islam are similar to conventional human resources except for their religious, moral, and human roots. Religious and moral fervor (fear and love of God) dominated the leadership during the reign of the Prophet (peace be upon him) and the Four Caliphs (K. Ahmad & Fontaine, 2011) From an Islamic perspective, the roots of Islamic leadership generally exist in the main sources of the Koran and Sunnah, in addition to early Muslim practices (Kosim, 2015). Beekun and Badawiada in Ahmada and Fontaineb also explain in their thought that conventional leadership emphasizes the importance of spirituality, religious values, and human relations. the importance of spirituality, religious values, and human relations (K. Ahmad & Fontaine, 2011). In fact, research has shown that leadership in HR does not appear to have an impact on the organization's internal trust. Due to the traits of Islamic human resources with an emotional and spiritual orientation, they are required in this situation. (Dewie Tri Wijayati, 2022). |

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|---|---|---|
| 3 | IT Development. | One of the principles of the supply chain is to maintain the importance of transparency in the product supply chain. Included in serving halal products. Halal products do not emphasize good products (toyib). It is very possible that blockchain as a digital asset can become an important element for creating justice in the supply chain if it is used according to the right standards (Basyariah, 2021; Hendayani & Fernando, 2022; Mohmood, Halizan, 2021; Sukoso, Adam Wiryawan, Joni Kusnadi, 2020). The supply chain also focuses on the process of handling the transformation of materials from raw to semi-finished or finished products. With the supply chain, each step to another will be guarded, especially from the potential for additional non-halal ingredients. The supply chain will guarantee and maintain the halalness of each product for consumers. While the supply chain management council theory of the logistics sector itself is divided into three, namely transportation, warehousing, and distribution, What distinguishes it from the transportation sector is that distribution has a marketing element. It is these three sectors that are adopted in Indonesia (INSIGHT:Buletin Ekonomi Syariah, 2020). As a supporter of halal traceability from upstream to downstream (Dini Wahyuni & Nurul Arfidhila, 2019). Even now, the term Logistics 4.0 has emerged, which is logistics integration through digital innovation. Blockchain technology will assist in the presentation of information in each of the detailed processes that occur. Blockchain will provide information on each product transfer transaction between one party and the other party through accurate and transparent records recorded through the use of blockchain technology. With a blockchain-based digital system, if a consumer wants to trace the transaction history and product halalness, it can be done in a few seconds. In addition, the blockchain that we use in Indonesia can be connected to blockchain networks in other countries. That way, halal industry transactions around the world can be collected massively on one large platform. With global blockchain networks for the halal industry, it is very easy for the government to guarantee the availability of halal products, both for domestic and foreign consumers (Arkeman, Yandra, 2020). In addition, the principle of digitization in the |

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|---|---|---|
| | | creative industry must also be in line with the principles of maqâsid al-syarî'ah, which is the concept of protecting the religion, soul, mind, lineage, and property of each member of society. From this, Islam also upholds the form of Islamic openness in the development of science and technology (Rachman, 2019). |
| 4 | Procurement | The halal industry is a framework that facilitates and opens opportunities for various stakeholders to synergize with each other to accelerate the development of MSMEs in the halal industry based on digital ecosystems. Digital transformation is needed as an accelerator of national economic recovery and the strengthening of economic foundations to support sustainable development. At least, there are three expected outcomes: increasing efficiency and productivity, creating innovation, and being inclusive. This digital transformation will later be used in three scopes: government (digital government), the business world (digital economy), and society (digital society) (Setyowati, 2020). This is also a form of acceleration in realizing digital transformation, whose agenda is 10 years to 2-3 years and is handed over to the Kementerian komunikasi dan informatika Republik Indonesia (Kemkominfo RI). This effort narrows down into five efforts: preparing a digital transformation roadmap, integrating national data centers, preparing human resources and digital talent needs, and preparing the necessary regulations (Toarik, 2020). |

## CONCLUSION

Blockchain is a big data platform that can accommodate a control value chain analysis framework for Indonesian halal food industry players. Through the principles of supply chain management, the blockchain strengthens the traceability system by maintaining consistency at each block or stage of the supply chain. This is beneficial for companies and consumers in maintaining halal quality, starting from the process of obtaining raw materials to the process of distributing products to consumers directly or to storage warehouses to ensure product maintenance. In addition to the results of the analysis of the value chain framework, this research also contributes to the role of blockchain as an amplifier in maintaining the consistency of the quality of halal products according to what is desired by Islamic sharia and the halal standardization of halal product guarantee institutions. This is a guarantee of effectiveness and efficiency because the financial role can also maintain stability. Of course, the intended finance follows

financial principles that follow sharia. Of course, this must also be supported by adequate human resources who also adhere to sharia principles.

This research is still limited to a review of literature that focuses on blockchain studies, but researchers hope that it can be developed into empirical research, both qualitative and quantitative. Both from a blockchain, financial, or human resource perspective, which are closely related to the implementation of the halal industry, especially in Indonesia.

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