



# RFID Technology to Improve Integrity of Halal Fashion Supply Chain Management: A Systematic Literature Review

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**Abstract.** The halal industry is presently in great demand utilizing the Indonesian people considering that most of the Indonesian population is Muslim. As Muslims are required to determine Halal products for daily use. (gap) This paper is a literature study that examines preceding research related to halal supply chain management (SCM), traceability, and tracking systems. This study illustrates halal supply chains within the fashion industry make contributions to the development of halal SCM by offering a framework that uses tracing and tracking technology to keep the integrity of the halal product. The solution to this problem is adopting Radio Frequency Identification (RFID) technology within the halal SCM technique. RFID technology is a technology for automated identification systems the usage of wireless technology to become aware of uniquely marked objects or people. Radiofrequency identification is primarily based on wireless communication in radio frequencies. The system includes readers and tags that react to electromagnetic fields or impulses emitted through the reader. The use of RFID technology inside the supply chain technology in the fashion industry can do tracking and tracing to make certain that each level is usually maintained in keeping with Islamic law.

**Keywords:** Halal Fashion · Halal Supply Chain Management · Tracking · Tracing · RFID

## 1 Introduction

The global halal industry is a market segment with rapid growth of trillions of dollars. The halal industry has increased beyond the food area to encompass pharmaceuticals, cosmetics, health products, toiletries, medical devices, and service sector components such as logistics, marketing, print and electronic media, packaging, branding, and financing [1]. Lately, with the expansion in the quantity of well-to-do Muslims, the halal business has extended further into the way of life, including halal travel, accommodation administration, and fashion [1]. One segment of the halal industry is fashion targeting Muslims. The clothing market is growing slowly, offering trendy and modest athletic apparel, headscarves, designer brand and boutique, and seasonal collection [2]. Dubai Islamic Economic Development Center's report estimates that Muslim consumers spent

US\$ 270 billion on fashion [3]. With RFID technology to detect halal products, it will increase business and help organizations to increase revenue.

The State of Global Islamic Economic Report 2019/2020 showed that Indonesia is ranked third for modest fashion [4]. The halal fashion will continue to grow considering the Muslim population is increasing rapidly, approaching two billion people globally. Indonesia is a Muslim majority country with 86.7% of Indonesians identifying themselves as Muslim [5]. This shows that Indonesia's halal fashion products have great potential as a commodity to enter the international market and make Indonesia the center of the global halal industry. This is in line with the target set by the government to make Indonesia the center of halal fashion in the world [6].

Halal comes from the Arabic world, meaning legitimate or permissible [7]. The halal practice applies to all activities of Muslims, but it is more than just an obligation. Al-Jallad [8] explained that halal is the Islamic way of life, including behavior, speech, and clothing. On the other hand, Haram is punishable and forbidden in Islam [7, 8].

The integrity of the whole Halal SCM is a critical aspect of the Halal industry. The powerful management of the Halal SCM is more complex than conventional logistics operations. Certainly, Muslim markets around the world require specific tastes, packaging, distribution, and certification. Therefore, introducing religious requirements to these types of items in the halal environmental supply chain is becoming more and more viable [2]. The halal SCM approach is critical to ensure halal integrity on the brink of consumption [9]. If you do not implement the halal SCM, there is no guarantee that the product is halal when used. According to Tieman (2011) and Baharudin (2011), manufacturers need to maintain halal integrity at all stages of the supply chain to avoid fraud regarding the high-quality of halal products [10]. The halal concept also includes handling such products' packaging, storage, and transportation.

In line with law No. 33 of 2014 on Halal Product assure, the reason for the halal industry is that the country is obliged to provide safety and ensures approximately the idolatry of a product. In this case, the decision maker's job is to enforce these standards and prevent activities contrary to government laws [9]. According to [11], concerns about halal products are growing among Muslim consumers, so consumers care and are willing to pay more for halal products. Consumers focus on the results of all activities in each supply chain process for halal products. Although there have been provisions governing the production process, preparation, handling, and storage up to a certain point, this does not ensure that the product is halal when it reaches the hands of consumers if the process does not implement the halal SCM. Thus, providing this standard requires a system that can monitor whether it complies with halal standards [10].

One of the prominent tracking technologies is RFID. In the last decade, RFID has attracted industry attention. This is because the cost of RFID tags comes down, and their advantages are identified. RFID identifies objects using radio waves, which means the product can be identified, recognized, tracked & traced. Thus, RFID can help the industry to place products in the supply chain process whether they comply with Islamic law [12]. With the use of RFID, halal integrity can be maintained in each supply chain actor.

Previous research [13] confirmed that the use of RFID on halal SCM on food has effective effects. RFID makes use of traditional tracking tools consisting of barcodes

with an excessive degree of data protection, improved operational visibility on SCM techniques, and a quicker and extra reliable product identity. Then Muhammad [14] proved that RFID could consistently monitor the temperature in meat containers to remain compliant with halal standards, which then provides notification if there is an increase or decrease in temperature. As such, the study proposes using RFID to create halal fashion supporting activities of the halal industry.

Research focusing on halal SCM has had only a small number of academic publications so far, but previous research has focused on halal food. Meanwhile, halal fashion currently has considerable market interest and demand. The halal industry is in need by the Indonesian citizens since most of the Indonesian population is Muslim. Halal is no longer barely essential for Muslims but has become a global trend [6]. As a result, it can be assumed that if the client is aware of halal practices in storage and handling as an assurance of clean, secure, and unpolluted goods, it can increase buy intentions for halal fashion.

The paper proceeds as follows; the research begins with an outline of the methodology used to collect and evaluate the literature. The study as a result reveals a system able to track halal SCM processes focusing on the fashion enterprise. The paper concludes with a summary of the findings, studies' contributions, limitations, and proposed areas for future studies.

## **2 Literature Review**

### **2.1 Halal Fashion**

Halal fashion products are clothes that meet Islamic law. Halal fashion should incorporate dimensions of sophistication and fairness as part of their brand development strategy to create a competitive advantage for their business [15]. Islamic law has established that production is halal if it meets Islamic law criteria ranging from materials, tools, processes, and results. To decide the validity of fashion products, the raw materials used need to be halal, the manufacturing and storage procedure isn't combined with unclean materials, and the distribution method needs to comply with the welfare of the people and the precept of justice. The stages from upstream to downstream of the production process of goodwill assure consumers that the reliability of fashion products is under certification standards in Indonesia regulated by Islamic certification [6].

Indonesian Muslim fashion has represented the halal lifestyle in the world [16]. Muslim clothing today has a large fan and market interest. According to The Royal Islamic Strategic Studies Center (RISSC), the sharia-based (halal) industry is currently in great demand, especially by the Indonesians because 86.7% of its population is Muslim. Halal is no longer just a necessity for Muslims but has become a global trend, with leading fashion and cosmetics brands having halal-certified products [17]. Some Muslim women also wear headscarves as an identity that is often known as the hijab (Arabic word means headscarves) community [6].

### **2.2 Halal Supply Chain Management**

An SCM is a global community of companies working together to improve the flow of materials and information between suppliers and customers at the lowest cost and

with maximum speed to achieve customer satisfaction. A supply chain is also known as a material movement, flowing from its delivery to the end customer. A well-known supply chain consists of purchasing, production, warehousing, transportation, customer service, demand planning, and SCM. Includes people, activities, information, and assets associated with moving products from supplier to customer [18].

Halal SCM conforms to the precise definition however with the addition of Islamic laws. Islamic regulation is a law in Islam's religion that gives suggestions to use the right halal standards in supply chains. Halal SCM may be described as the combination of business processes and activities within the supply chains from the point of starting place to the end of consumption abiding through Islamic law [19]. A halal SCM covers everything from procuring and preparing genuine halal ingredients to manufacture and delivering final products to customers [20]. That is to make sure that halal applies not only to products or foods but additionally to all activities inside the supply chain that include product managing and management (such as inventory management and ingredient handling) [18]. The difference between a conventional supply chain and a Halal SCM is that the conventional supply chain specializes in cost reduction. In comparison, the Halal SCM makes a specialty of maintaining halal product idolatry. The activities of those two supply chains can also look the same, however, they may be specific in reason [10].

Halal SCM refers to the enterprise of halal concepts to increase halal integrity from the supply side to the point of customer purchase [22]. It includes method-orientated techniques that suggest that any halal SCM activity, i.e., material resources, product manufacturing, handling, storage, transportation, and retail, have to be properly recorded and provided consistent with reliable halal criteria. This process has to be supposed to put off cross-pollutants and hold product idolatry status [22]. Halal status is a joint obligation that specializes in safe consumption. It combines every element of consumption and is difficult for the daily lifestyle of Muslim customers [23]. Halal fashion is clothing that follows Islamic standards of safety, modesty, cleanliness, and comfort [24].

### 2.3 RFID

RFID is a technology for computerized identification systems that use wireless technology to stumble on objects or people uniquely. It is based on wireless communication in radio frequencies. The system includes readers and tags that react to electromagnetic fields or impulses emitted through the reader [25]. RFID makes use of radio waves to wirelessly put out an object's identity (in a unique serial number). RFID data may be acquired thru clothing, the human body, and nonmetallic materials [26].

## 3 Research Methods

This paper is literature have a look at that examines previous studies associated with halal SCM, traceability, and tracking systems. The usage of an RFID-based tracking system, the studies propose a conceptual framework for the halal fashion supply chain.

A systematic literature review (SRL), in line with Stapic [30], became carried out to analyze contemporary literature on the use of RFID in Halal SCM. SLR is a method for

research used to assess and translate research applicable to research questions, topics, or specific standards. The reason for an SLR is to gather applicable studies, synthesize the findings, and verify the kingdom of educational understanding regarding a particular studies query or topic.

In this study, the guidelines used for systematic literature review were based on Kitchenham and Charters [29]. Researchers use search terms derived from the powerful words in our main research question. To assure data relevance and consistency across the chosen publications, the choice of search key phrases changed into pushed thru the study’s aim. (“RFID”) AND (“Halal Supply Chain”). We used five electronic database resources to find research articles: Scopus, Taylor Francis, Science Direct, Emerald, and IEEE. The literature search resulted in 122 articles.

### 4 Result and Discussion

Figure shows a process cited from [30] leading supply chain processes ranging from manufacturing, shipping, distribution centers, retailers, and customers. This supply chain flow applies RFID technology to integrate each supply chain process.

Figure 2 depicts the modification of the framework proposed by [30]. Islamic laws apply at every stage to following the customer’s needs. To standardize the halal process using appropriate technology, this study used RFID.

*Halal Manufacturing* Inside the first section of the supply chain, Islam has unique requirements related to halal fashion. In line with Islamic principles of clothing, the raw materials (i.e., fabric, cotton, and leather-based) of fashion products (i.e., clothing, shoes, belts, bags, and accessories) ought to be of good quality, clean, permissible, and legal to supply halal clothing. Halal products have to moreover no longer comprise unlawful

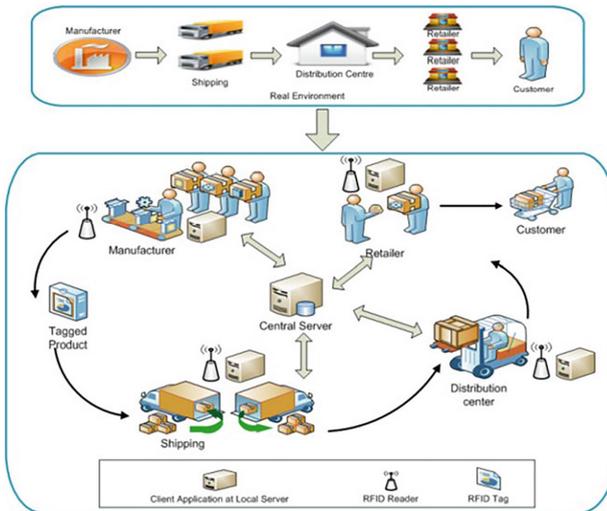


Fig. 1. Supply Chain Framework by [30]

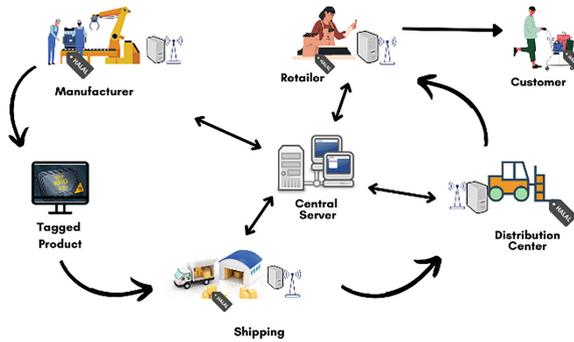


Fig. 2. Modified Technological Halal Supply Chain Framework using RFID

animal parts. The skin to make fashion products have to be artificial (i.e., synthetic) and now not encompass animal fur (i.e., pigs) or unlawful animals. As an example, cowhide may be used as a supply of clothing if slaughtered under Islamic concepts; in any other case, clothing is haram due to the fact Islam requires that the product's ingredients be good items earlier than being used for consumption.

Islam has specific requirements for fashion production and design, and every Muslim must pay special attention to the specific conditions of this leg of the supply chain. Women's clothing should be thick and not show their skin, and men's clothing should be above the ankle bone. Logically, Muslim customers who roughly recognize Halal practices in the production and design of fashion products might be more inspired to buy Halal fashion [21, 31].

The usefulness of RFID in manufacturing processes can help companies track assets and more accurately monitor common KPIs, provide more visibility into manufacturing operations, and enable time-based selections [12].

*Halal Shipping* Logistics management offers with meeting customer demand via making plans and controlling the motion of goods from supplier to consumer and information from end-user to supplier. Logistics management is part of SCM, at the same time the latter is a broader term that refers to all activities from the procurement of raw materials to the delivery of finished products to customers. Logistics management specializes in maximizing customer satisfaction, while SCM strives for an overall competitive advantage [28].

Logistics can use diverse transports which include land, sea, and air. Inside the transportation of halal products, halal and non-halal goods need to use unconnected vessels to prevent cross-pollutants. Moreover, Islam requires routine cleaning for packing containers and locations of halal products. If packing containers or trucks previously shipped non-halal products, they have to be often cleaned before sending halal products to make sure no impurities or pollution [21].

Inventory management may be effortlessly monitored through the use of RFID sensors. Cars can be prepared with sensors to obtain real-time temperatures and food humidity at some stage in delivery. Moreover, the delivery time may be calculated correctly using GPS. To make sure the integrity of halal fashion, logistics companies provide facilities to control halal products. as example, PT Nittsu Lemo Indonesia Logistics (NLIL)

and PT NEX Logistics Indonesia (NEX LI) provide outstanding logistics services, namely halal delivery of halal transportation, unique packing containers for halal products, and cleaning of container facilities. Each is the earliest company to achieve halal certification from Indonesia's halal certification body, the Indonesian Ulama Council (LPPOM-MUI) [31].

*Halal Distribution Center* Inventory management allows companies to keep track of raw materials and work in processing finished goods and products. Inventory management can more effectively help monitor the availability of the right amount of physical inventory in the warehouse. In evaluation, warehousing includes all actions from the raw materials to the finished goods of the product [28].

The main problem in this part of the supply chain is to verify the segregation of halal and illegal products [32]. Fashion manufacturers are not allowed to have devices related to impure and forbidden items. Sewing machines used to make leather jackets, which can be haram for example, are not safe for making a halal jacket due to the possibility of cross-contamination. The aim is to prevent contamination that may violate Halal principles. It is essential to ensure that Halal products are not mixed with non-Halal products at storage locations [21]. In warehouses, products need to be stored at one point of handling, i.e. Collection, delivery, warehousing, cross-docking, picking and transport, are segregated from illegal products [31, 32]. Therefore, it can be assumed that if the customer is aware of Halal practices in storage and handling as a guarantee of clean, safe and uncontaminated goods, they will have a greater intention to purchase Halal fashion.

*Halal Retailer* Halal fashion retail check is important. Products may be contaminated at the same time as shipped to sellers or displayed in shops. as a consequence, when bought at shops, halal products are often separated from non-halal ones [33] to keep away from cross-contamination and make it easier for customers to become aware of halal products in shops. [34] find that halal and non-halal products must be on separate shelves, as the shop's retail layout highly affects customers' shopping intentions. With the implementation of RFID in the retail process, a dynamic RFID-based framework can realize the presence of each item on a shelf. Simultaneously with the picking of an item, the system recognizes the item picked by the customer, marks and reports the problem picked, so that the inventory can be carried out in real time. Then preserve the freshness, cleanliness and safety of the product to be purchased [27].

## 5 Conclusion

Maintaining the Halal integrity of fashion items could be important at all levels of the supply chain, from point of source to end of consumption. Contemporary problems of using halal mode supply chains can be precisely addressed and solved thanks to the improvement of RFID technology. Information sharing, traceability and transparency can be done effortlessly throughout the supply chain to ensure quality. A Halal SCM is a new way of managing Halal products.

This technique was developed to meet the demand of the Halal industry, which is at the heart of Islamic law requirements. Halal SCM adoption rate remains relatively low

among Halal manufacturers due to some restrictions preventing them from adopting it. In addition, some variables can facilitate their adoption. With the increasing number of companies taking the lead in RFID and making the technology more user-friendly within the Halal SCM, it is also essential for the manufacture and operation of management, information technology and information systems researchers to ensure the direction of future research useful for management, with an emphasis on studies related to the design, implementation and use of RFID technology. The results of this study can serve as a basis for other researchers to better understand the Halal SCM industry. It can be useful to conduct more empirical research that adopts a particular theory. The focus on halal SCM currently only gets attention among academics and decision-makers. Given the significance of this market segment, the halal market segment, decision-makers need to understand its concept, potential, and limitations. This shows how the chain of the halal fashion industry can be achieved. This research is an effort to contribute to RFID literature in SCM halal context in the fashion industry.

However, this research is limited by the selection of databases. Consequently, it could not completely cover all existing literature related to RFID technology, especially in halal fashion enterprise research. Further research can make bigger search terms and survey additional scientific databases. This research may be developed by thinking about specific types of halal products such as cosmetics, food, and medicines. The sustainable performance of the halal SCM may be summed up in another way by considering certain measurement items. Tayyib aspects of halal consumption demand the combination of sustainable practices with halal SCM. Researchers argue that halal may be taken as a high-quality and safety standard.

## 6 Related Works

Fashion is inseparable from human life. As Muslims, it is required to use those with halal guarantees. Research [31] proves an impact on the intention to buy from customers halal fashion products. Current technological developments can help maintain halal integrity in the supply chain process of these products, namely with RFID technology. In the [27] study, researchers used RFID technology in the supply chain of halal food. In this study, the adoption of the concept was carried out in the halal RFID process, with the update made to halal SCM fashion.

**Acknowledgments.** Are addressed to Mrs. Imairi Eitiveni, S.Kom., M.Kom., Ph.D. as a guide in completing this article and all colleagues who have given support to complete this article.

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