Risk Categories in Halal Food Transportation: A Preliminary Findings

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***Abstract*— The issue of halal food has attracted public attention and the Malaysia's local authority especially on the issues of halal food status and the risk of contamination along the halal food supply chain. The risks of contamination will affect the halal food products safety and quality. Therefore, this study seeks to identify risk categories that lead to contamination risk of halal food products during the transportation, storage, and distribution process in halal food supply chain. Using a qualitative approach, an in-depth interview was carried out with the management committee from the halal certified logistics providers in Malaysia. The recorded interviews were transcribed, translated, coded, and reconciled. Atlas.ti software (version 7) assisted in data coding to identify themes and subthemes for this study. The findings suggested that delay risk, natural hazard, and operational risk are the category of risks that would affect the halal food products safety and quality and halal status during the transportation process. Similarly, technology adoption risk and halal integrity risk are also important risk factors towards the process of risk categorization in halal food transportation and distribution process.**

***Keywords*—** *Contamination risk, halal food transportation, halal meat supply, halal food, halal supply chain*

1. Introduction

The integrity of halal food supply chain has become an increasing concern in the market [1]. Consumers are concerned and aware of the food products that reach them. A key aspect of halal food is related to the safety and quality of the food products and free from any element of najs and hazardous element. Hence, it has been argued that the halal food production and the distribution processes must comply with the halal food supply chain standards and requirements. In view of that, to achieve the standard of the halal food supply chain, the halal food products need to be handled by logistics service companies or halal transporter that have been certified halal by The Department of Islamic Development of Malaysia (JAKIM) through certification of Malaysia Standard of Halal Logistics [2]. Although, some logistics activities are handled in-house, but still the logistics activities must fulfil the halal regulation and procedure specifically on the segregation element in the transportation and distribution process. Currently, there are 34 logistics companies in Malaysia that have been certified as halal logistics by.

Malaysia Standard of Halal Logistics. The numbers of logistics companies with Halal logistics certification will increase due to the increase of awareness on the importance of halal logistics standard in the company services and the willingness of the companies to practice halal logistics [3]. By implementing halal compliance, the halal transportation services will be improved and the probability of contamination risks to the food products will be minimized. Henceforth, the aim of this study is to identify the risk categories involved during transportation that may increase the probability of contamination risks to the halal food products during transportation process. The identification of the contamination risk is a primary concern in halal food safety and quality compliance. Identifying the risk categories will improve the halal food transportation operations and help to develop risk preventive approach in halal logistics operation. The study will help the halal transporter to prevent the risk of contaminants to the halal food products during transportation.

2. Literature Review

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Halal logistics is basically the process of managing the procurement, movement, storage and handling of materials, part of livestock and semi-finished inventory both food and non-food, and related information and documentation flows by companies based on Sharia' law [4]. Halal food transportation is one part of halal logistics that provides the transportation services of outbound food products collection, consolidation, storage handling, value added services and traceability system to control the movement and storage of halal food products. The operation and the services offered by the halal transportation company must comply with Sharia' requirements and standards set by the relevant government agencies involved. The main differences between the halal logistics operation and the conventional logistics operation are the segregation process of food handling with non-halal and hazardous element [5]. The segregation process in halal logistics are involving the dedicated assets of the companies such as trucks, fleet, spaces and equipment that solely being used only for halal food transportation and distribution. Previous studies have reported that halal logistics plays an important role to ensure the halal food status of the food products through the collaboration and integration of the entities in the halal food supply chain [4]. In Malaysia, halal logistics services are bound by the requirements outlined by The Department of Islamic Development of Malaysia (JAKIM) and other relevant halal regulations by Malaysia regulatory bodies. It has been discussed that, halal integrity among the parties involved in halal food supply chain is very important [6] . Halal integrity can be defined as the right attitude, behavior, and ethics in conducting a business and towards maintaining a good relationship among all the parties involved in the halal food supply chain [7]. Industry player especially the halal transporters need to develop and maintain good business ethics and integrity within the halal food business. Recent evidence reported on the importance of the major roles of halal food transporter in protecting the halal status of food products throughout the entire chain. The authenticity of halal food products is not only halal at the manufacturing process and packaging, but it must be certified halal along the supply chain process until the point of end consumption [8]. [1] stated that the consumers are not only concerned with the manufacturing process but also the activities along the supply chain including transportation, warehousing, and retailing. Hence, the success of the Halal industry depends on the logistics service management in ensuring the integrity of Halal food products throughout the supply chain process. To achieve the objective, halal food transportation companies need to comply with the policy as part of their daily operating process and activities. The guidelines in the policy provide an interrelated standard in term of handling, transportation, storage, and personnel with specific emphasis on quality, standards and compliance control [9] [13].

2.1 Halal Transportation Services

The main element of services offered by the halal food transportation is the segregation of halal and non-halal or hazardous materials during the transportation, storage, and distribution process. The segregation process reduces the risks of contamination of the halal food product with non-halal products. Segregation during delivery and storage are the main elements in protecting the Halal status of food products throughout the supply chain process [10]. Nevertheless, controls and monitoring in transportation activities is considered as critical and dedicated tasks in maintaining the capabilities of the company's dedicated assets used in halal food transportation. This is because the logistics activities and the movements of any transportation mode must comply with the principles of Sharia' law and halal procedure [11]. A study conducted by [12] stated that the risk factors of contamination to the halal food products during transportation may happen if the logistics activities and segregation process is not monitored effectively. Henceforth, to avoid the risks, halal transportation companies need to monitor and audit the transportation operation continuously by referring to the halal policy established by JAKIM and standard of MS2400:2010. The standard of MS2400:2010 of Halal Logistics provide assurance that the food products are transported and distributed from one custodian to another in accordance to Sharia' requirement and halal procedure [13]. Nevertheless, by implementing the halal procedure in company's daily logistics operation will enhance the business strategy and market competitiveness.

2.2 Risks in Halal Food Transportation

A. Risk is defined as damages, injury, liability, loss or any other negative occurrence caused by external or internal factor [11]. In the supply chain management, risks can be classified into operational risks, supply and demand risks, products contamination risk and technology risks. As described by [14] the operational risk is the most important factor that would increase the probability of risk happened throughout the supply chain process. The operational risk defined as any probability of unexpected event or action that would interrupt the operational flow of the daily work process in an organization [15]. Indeed, the effect of operational risk will also give an impact to the food product distribution process and affect the quality, safety and halal status of the food products [16]. Nevertheless, the risk of contamination to the halal food products might also happen if there is lack of monitoring procedure to the operational activities during the halal food handling and distribution of the halal food products from one point to another. In addition, the other risk factor of natural hazard such as the biological, physical and chemical risk will also increase the risk of contamination to the food products [17]. Hence, to manage food product contamination risk and to control the food safety and quality issues, a standard of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Point (HACCP) systems have been introduced in food supply chain and have been recognized worldwide [18]. [12] and [19] mentioned that the risks along the halal food supply chain will affect the food products quality and the halal food products distribution process. Halal food products may be recalled in any case of contamination and thus affect the good reputation of the halal food manufacturing company. Consequently, customers will lose trust of the halal food producer and thus affect sales and profits of the company [20] [21]. Contamination risk may occur when the halal food product is being exposed alongside haram operation and other hazardous products during the transportation, storage and handling process. This situation may occur if the logistics companies do not practice segregation of halal and haram products as well as hazardous and non-hazardous cargo. Ensuring a hygienic and clean environment is also important in daily transportation operations [22]. If this aspect is not being monitored the food products would be contaminated causing halal products to be consider as haram product before it reaches the end user. Beside the major issues of food contamination, food manufacturers and logistics companies may be exposed to other operational risk in the supply chain stages that would affect their company performances and reputation. Past studies stated that the risk of contamination to the food products might happened due to improper food production practices, sub-standard equipment used, improper handling and temperature abuse during food production [23]. From the Islamic perspective, it is emphasized that in all stages of transportation, the halal food products shall be physically segregated from any non-halal elements considered as Najs in Islamic law [24]. Moreover, the equipment used in all unit operations should be solely dedicated only for halal food handling. Halal food transportation is based on the "Thoyibban" concept that encompasses quality, nutrition, hygiene, and ethically delivery practices of the food products to the consumer needs to be implemented [25] [24]. Furthermore, regulations in the standard of halal logistics stipulate that food products should be protected against physical, chemical, and microbial contamination during production, transportation, and distribution process.

3. Research Methodology

Literature searches were conducted at the beginning to develop a better understanding of the issue of contamination in halal food supply chain. Then, the literature searches continue with the topic of halal procedure, standards, certification and legislation related to halal logistics operation. In addition, a research was conducted on the related topics of food safety management systems in Malaysia using the HACCP system and Halal Assurance System as the guidelines. It is indicated that the research objective of this study is to identify the risk categories in halal food transportation that would lead to contamination of halal food products during transportation. In addition, the study also explores the perspectives of halal logistics services companies on the risks involved in the halal transportation daily operation and activities. The literature research was conducted by using various databases such as Science Direct, Springer Link, EBSCO, IEEE Xplore, Scientific Journal, Conference Proceeding, reports, books and guidelines. Apart from that, a thorough review of halal legislation and standards

was done through the open access governmental websites and standards compliance. The literature research was very important to guide the researcher to develop the framework of research question for this study. The research question will be used during the interview session with the key informant and help to achieve the research objective of the study. It is clearly understood that this research is an exploratory and descriptive study [26]. Therefore, the purpose of this exploratory study is to seek insight into the contamination risk factors related to halal food products during transportation. According to [27] "an exploratory study is a valuable means of finding out what is happening; to seek new insights; to ask questions and to assess phenomena in a new light" . Thus, a qualitative approach was used as it allows the exploration of a subject with limited previous research [28] (Mcvilly & Burton-Smith, 2008). An in-depth interview format is chosen as it provides informants with some guidance on what to talk about, while also allows for the discovery or elaboration of information that is important but may not have previously been thought of as pertinent by the research theme. According to [26] an in-depth interview is an effective tool to obtain a rich understanding and information of a new phenomenon in specific area.

3.1 Data Collection

This study focuses on risk categories that would lead to contamination risks to the halal food products during transportation. Purposive sampling was carried out in the study to achieve the purpose of the study [27]. The key informants identified are those with expertise in the company's transportation and distribution activities. The expertise and knowledge on halal logistics operation from the key informants helps the researcher to get the accurate information on the issues discussed. Sampling is done based on the numbers of halal logistics services providers involved in halal food transportation services. Six transportation companies listed by JAKIM as halal certified logistics companies were identified and chosen as respondents. The logistics companies were certified by JAKIM as halal logistics company according to the Malaysia Standard of MS 2400: 2010 Part 1 (Transportation) and MS 2400: 2010 Part 2 (Warehousing). Feedback from six key informants which fell within the suggested sample size of four to ten cases for qualitative data analysis. Based on sampling, in-depth interviews with the key informants were conducted. The interview questions were adopted from existing literature related to the halal food supply chain perspective and cross contamination issues. The interviews were done in English and Bahasa Malaysia. Approximately 45 minutes to 2 hours were spent on each interview session. Some of the informant allowed the researchers to observe their premises and review their operational documentations. The interviews were recorded and accompanied with comprehensive note taking and transcribed afterwards. The key informants from industry were selected based on their company criteria (i.e. product risk and duration of halal certification) and their personal profile (education background and number of years of experience in logistics field).

Table 3.1 Respondent Profile

Position	**Company**	**Working Experience**
Assistant Vice President	A	17
Logistics Manager	B	8
Compliance Manager	C	8
Halal Executive	D	3
Compliance Executive	E	7

3.2 Data Analysis

All interviews recorded were transcribed verbatim and verified to ensure the reliability of the data. The interview transcripts in Malay were translated into English and verified by the researcher. Data analysis was performed using Atlas.ti 7 qualitative software to identify themes and sub themes of the data. The data were collected using specific questions based on previous literature, thus, some themes were pre-determined. New themes and sub-themes emerged from the data were added. Thus, the analysis was both deductive and inductive. The first stage of the interviews was to identify the

current issues and contamination risk factors in halal food transportation. When the existing processes were identified, the second stage of interviews were conducted to reconfirm whether the existing operation in halal food transportation is following the *Syariah* compliance and regulation related to the contamination risk factors in halal food transportation.

4. Result and Findings

From the interviews conducted, five risk categories were identified related to the halal food transportation. The risks factors in halal food transportation lead to a high possibility of contamination risk in halal food products. The theme highlights the five main risk categories of contamination risks of the halal food products during transportation. The risk identified comprised of delay risks, operational risks, natural hazard, technology adoption risk, and halal integrity risks. Risk categories identified in the halal food transportation operation were based from the interviews conducted with the five major halal certified transportation companies. The major findings of this study are based on the qualitative evidence gathered from the interview with halal logistics companies that provide transportation services to the halal food manufacturers in the context of Malaysia halal food supply chain. The findings might be limited since the risks categories concluded in the study are based on halal food contamination risk from the transporter's perspective only. Thus, the contamination risk identified is only during the logistics process whereby the halal food products are under the custody and liability of the transporter. Based on the interview, the respondents faced similar risks in their daily operation issues and perspective on contamination risk in halal food supply chain. The study categorized the risks into five major sections based on the factors that lead to every single category of risk identified during halal food products distribution process. The respondents agree that the probability from the impact of the element in the risk categories will increase the likelihood of the contamination risk to the halal food products during transportation. Table 4.1 shows the risk categories of halal food transportation that may lead to a high possibility of contamination risk to the halal food products during transportation.

Table 4.1 Risk Categories in Halal Food Transportation

Risk Categories	Risk Factors
Delay Risk	Excessive handling due to border crossing Other Government Agencies Issues Containerization Troubleshoot Transportation/Forwarder Breakdown Traffic Congestion
Operational Risk	The need of dedicated assets for halal operation Training to the operational staff Improvement of facilities and equipment Transportation temperature monitoring Improper loading and unloading procedure
Natural Hazard	Physical, Chemical and Biological Hazard Natural Disaster Housekeeping and material handling Temperature abuse during production and logistics
Technology Adoption Risk	Investment on the halal transportation (GPS Trackers) Product Recall Issues Government Regulation Handling for Different Food Products Specification Social Factors
Halal Integrity Risk	Logistics Operation Retail Operations Awareness and Readiness Knowledge, Attitude and Behavior Structured Distribution Process

5. Discussion

5.1 Delay Risk

Delay risk means a slow progress or development that can lead to a high possibility of loss or interference in the food supply chain operations. Delay risks will affect the whole company operations especially if the company provides services to other parties. In halal food transportation, delay in business transaction at ports, such as excessive handling at cross border

will affect the lead-time of the distribution process of halal food and ingredient. It is being highlighted that, the issues of delay at port happened due to pending of approval and documentation from the government agencies. Based from the interview, most of the informants agreed that, the delay at port will affect the whole operation in halal food supply chain. The delay will increase the lead time for the food products or food ingredients to be transport from the port to the next destination. As a result, the delay in movement of food products will affects the quality of the halal food products. The finding was also supported by a research done by [13] [1] stated that delay risks happened due to governance procedure during distribution process, variability in weather condition, poor quality services and maintenance of the transportation that would lead to delay risk of the food distribution process. These factors will increase the lead time delivery of the halal food products and reduce the quality and freshness of the halal food. The other delay risks are delay in transportation lead-time delivery due to transportation breakdown and congested travelling time and conditions. A study done by [9] on supply chain management risk management agreed that the factors of delay risk will affect the quality of the food distribution process. When delay risk takes place, the whole supply chain is affected, and thus, increases the contamination risks to the halal food products. This is because halal food products have limited shelf life and the quality of halal food products will be affected if the distribution time exceeded the life span of the halal food products.

5.2 Operational Risk

The main operational issues among the halal transporters are lack of infrastructure and dedicated personnel to handle the halal supply chain transactions. Therefore, to implement halal logistics, the company's management and the operators must understand the halal operational procedures thoroughly. The company's infrastructure, equipment, warehouse, facilities, and containers need to be segregated accordingly and handled by trained Muslim staffs. Training of halal procedures to the operational workers especially for the drivers needs to be conducted continuously to enhance their knowledge and practices in halal product handling in the company premises. Furthermore, to maintain the integrity of the halal product there must be a guarantee that the product is not being mixed in one load carrier, trolley and bulk shipment and there is proper control of temperature. Therefore, to maintain the halal and risks of food contamination, halal supply chain process must be handled by trained workers and at the right time using the right process and at the right time. Most of the informant agreed that the temperature monitoring of food products during distribution process is very crucial in the daily operation. A study by [23] [8] also support the findings by emphasize on the temperature monitoring of the food product during transportation in company's daily operation. Thus, the factor of temperature monitoring is essential to avoid risks of food products contamination during transportation. Food products particularly frozen food and perishable goods rely heavily on temperature control to maintain the quality, safety, and hygiene of the food product during transportation. Operational risk in the company daily operation will increase the food product contamination as the distribution process will take longer time than the normal actual time [5]. Furthermore, the factors of operational risks in logistics activities will increase the exposure to the natural hazards of biological, chemical, physical, human, environment. The finding from the study by [18] [21] in line with the research done by that stated that the long-term implication of operational risk in company's operation will affect the connectivity and integration process in halal food supply chain.

5.3 Natural Hazard

Natural hazards are considered as disruptive risk that increases the risks of food contamination along the lead-time delivery of the food products. Example of natural hazards are disruption along the journey such as flood, traffic congestion, climate changes, weather changes, fire and other natural disasters that could affect the food supply chain process. Disruption risks may cause a delay of the food products lead-time delivery and increase the food product contamination risk as the transportation process will take a longer time. As an outcome, the possibility of food contamination may increase as the hazards of biological, chemical, physical, human, environment, and equipment are not well monitored during the transportation process. Thus, it is important to understand the sensitive characteristics of halal food products to avoid the effect of natural hazard risk. A study conducted by [13] [19] supported the

finding of the study and emphasize that the halal transportation companies to invest more on the equipment, facilities and handling procedure of the food products. A study by [40] (Aung and Chang 2014) agreed that temperature monitoring is the key essential to maintain the quality and safety of the food product during transportation. Keeping products at a certain temperature throughout the supply chain is a complex task, as the various materials and the airflow of the trucks need to be monitored. It is clearly that, the natural hazards risks need to be monitored frequently and effectively especially when dealing with frozen food products and perishable goods. Indeed, a study by [20] supported the finding of the study whereby the effect of natural hazards related with "manmade" risks, whereby the risk occurs due to ignorance or lack of awareness of the risks among the operators in the halal food transportation

5.4 Technology Adoption Risk

The halal identification and monitoring system adopted by the manufacturers and logistics service providers can assist to tracing any potential non-halal ingredients as well as to validate and verify the authenticity of the halal products. Most of the informants agreed that halal traceability system could help eliminate the risk of contamination to the halal food products. The current implementation of traceability system among halal food transporter in Malaysia is Radio Frequency Identification Device (RFID), barcode, GSM and application of web server and internet technology. The adoption of the traceability system would help to identify the occurrence of cross contamination along the supply chain process. Hence, proper risk mitigation and techniques could be planned to mitigate the impact of loss from the food products contamination risks. Based from the study, the informants agreed that the halal transporters still lack in a meticulous traceability system installation in the transportation process. This situation may increase the potential loss as an effect of the cross contamination of halal food products during the manufacturing and supply chain process. [24] also agreed on the findings and mentioned that without a proper traceability system, it will be very hard for a company to detect and to trace the lifespan and movement of the products. The traceability system will help to avoid the problem of products recall, as it will help to trace back the history of the product starting from inbound stock to outbound material. A study conducted by [16] [18] also agreed that the factors of contamination risks to the products handling happened because of a lack of awareness and readiness of the manufacturers and logistics company regarding technology implementation for daily operation. Therefore, there is a need to include a traceability system as a mandatory requirement in a company's operation to control product cross contamination risks.

5.5 Halal Integrity Risk

The integration between halal transportation companies and halal authorities is very important to ensure the smooth flow of business integrity and compliance in the halal transportation operations. The importance of Halal integrity is to ensure that the food products remain Halal throughout the whole supply chain process in the present food trade scenario. To maintain good business relationship, manufacturers and transport services need to be sincere and responsible in the production process and handling procedures. Halal integrity can be achieved in halal food industry if the food products are being sourced, produced, processed, stored, and distributed in a manner coherent with the Islamic values. Therefore, the integration and halal integrity among the food manufacturers and halal transportation companies can be further improved throughout the establishment with standard operation procedures based on risk management framework. The findings were relevant with a study done by [21] [24] confirmed that the Halal authorities such as JAKIM, Halal Development Corporation (HDC) and other authorities need to improve the auditing and the compliance development to improve the ethics and integrity of halal operations among the industry players. Halal knowledge on standard operation and compliances among the industry players must be developed and improved continuously as to improve the structure in the halal food supply chain. Past finding by [5] and [45] also agreed on the findings and commented that the awareness and understanding of the halal food transportation procedure is very important to ensure the smooth process of halal food transportation among the stakeholders. From the study, it has been observed that one of the factors towards a company's failure in the supply chain process that leads to contamination risk are the reluctance of the companies to invest and improve their facilities, equipment and continuous training the staff

involved in halal food transportation. The upgraded of the facilities and knowledge enhancement among the workers will improve the business ethic and integrity among the halal transporter when dealing with the logistics business and activities.

6. Conclusion

This study shows that delay risk, operational risk, natural hazard, technology adoption risk, and halal integrity risks are factors that increase the contamination risk of the halal food transportation. By identifying the risk categories, will reduce the possibility of contamination risks to the halal food production during transportation. Therefore, it is emphasized that government rules and regulations, compliances and company SOP's on risk control are very important in monitoring the issues of food products contamination faced by halal food transportation companies. The collaboration and integration among the government agencies and the stakeholders in the entire chain is very important especially on the issues involving the delay risk at the port. There must be a solution and agreement between the government agencies and the industry on the issue of delay risk Transportation creates time utility, which means when the halal food products are transported, transportation will determine the urgency and the consistency of the product movement from one point to another. The use of transportation to carry or to bring halal food cannot be mixed with non-halal food to avoid contamination during storage, handling, and transportation process.

Another important factor to control the food product contamination risks are the readiness of the logistics companies to invest in their facilities, spacing capacity, transportation technology, and maintenance. The improvement of the main halal dedicated asset such as the operational facilities and transportation maintenance will help minimize the risks of food product contamination during transportation. In addition, the establishment of the Halal Committee in the company is vital to monitor the Halal procedure and compliances for the company daily operations. Halal logistics players should also have a team ready to manage the halal logistics operations and changes related to business compliances and environmental issues. The appointment of halal advisors or halal internal auditors is required as part of the company internal audit monitoring and risk management program. The committee must be knowledgeable, on the procedures of halal compliances based on The Department of Islamic Development of Malaysia (JAKIM) requirements and training development from Halal Development Corporation (HDC). In conclusion, the company's initiatives and risk management measures must be undertaken effectively by the halal logistics companies to control the risks of food product contamination during the transportation process. Future research needs to be conducted on the area of risk management in halal food supply after risk identification has been identified and reviewed.

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