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Digital Halal Logistics: The Perspective of Food Delivery Riders

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Abstract. *The growing awareness of Halal compliance in today's community shows the importance of Halal on the quality of products manufactured worldwide. Hence, it is crucial to ensure that the concept of Halal extends to the entire supply chain, from the farm to the consumer. Most research covers manufacturing and procurement, leaving Halal-compliant distribution and logistics open to a number of research opportunities. We conduct an investigation into digital Halal logistics from the perspective of the individual food delivery riders, focusing on the operational level of the supply chain. The extensive reliance on Internet-enabled smart phones and the growing popularity of food delivery have created an increasing number of job opportunities for delivery riders, mainly on motorcycles. However, there is a question around whether or not this delivery process is Halal compliant, given that the riders face many challenges in ensuring an acceptable quality of service. This study investigates how the riders perceive Halal compliance in the food delivery industry, and provides suggestions for the implementation of digital Halal at various operational checkpoints.*

Keywords: *Digital logistics, Halal logistics, supply chain management, delivery riders.*

1. Introduction

As Malaysia envisions itself to be a global halal hub, the awareness of the importance of halal compliance is growing in terms of the quality of products, especially food. This is supported by an increasing demand for halal products, parallel to the trend for healthy living among working adults and the younger generations. Halal status or compliance is not confined to the products manufactured and distributed by and in Islamic countries, but also those from non-Islamic countries. Therefore, it is crucial that the entire supply chain is halal-compliant, from farm to fork.

Most research covers halal manufacturing and procurement, mainly with regard to food handling, leaving the other two vital areas in supply chain relatively unexamined. These other two supply chain areas are distribution, i.e., packaging and containers, and logistics, i.e., segregation. This study investigates the perspective of those working at the operational level of digital halal logistics to understand how operations contribute to the integrity of halal goods throughout the supply chain. The extensive reliance on smartphones and the Internet, and the growing popularity of food delivery worldwide, has created an increasing number of job opportunities for delivery riders, especially those on motorcycles. Despite the convenience of having people riding through traffic to deliver food efficiently and on time, we question how these operations impact the quality of the food, and of the delivery service itself, within the concept of halal.

Our research question is:
"How do delivery riders perceive halal compliance in terms of the quality of the food delivery service?"

In order to answer this question, the objectives of this research are to:
- analyze the food delivery process;
- identify the possible halal checkpoints within the riders' operational process; and
- determine the challenges of implementing

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digital halal logistics at the operational level.

In achieving the said objectives, a qualitative approach was undertaken, in which interviews were conducted to gain insights from the food delivery riders on the food delivery process at the operational level, which further assists this research in identifying the critical checkpoints within the process where the challenges of halal distribution and logistics might occur. Halal status does not only depend on the food preparation process, but also on the environment in which the food product is contained, which includes the packaging and transportation. In this research, we focus specifically on halal distribution, i.e., packaging and containers, and on halal logistics, i.e., segregation.

The remainder of this paper is laid out as follows:

- Section 2 is the literature review
- Section 3 covers the methodology
- Section 4 presents the preliminary findings of this study
- Section 5 is a discussion of the findings
- Section 6 presents the concluding remarks.

2. Literature Review

This section is an overview of the current literature, which justifies the need for conducting this study. It is divided into two sections, namely halal supply chain, distribution and logistics, and the halal status of transportation and logistics service providers (LSPs).

2.1. Halal Supply Chain, Distribution and Logistics

A halal supply chain is conceptually similar to a conventional supply chain, with additional attention and support for halal products and services (Mohamed, Raja Mohd Rasi, Ahmad Mohamad & Wan Yusoff, 2016). Steps are taken from the very beginning of the procurement process to ensure the integrity of halal products and services. Figure 1 shows the distribution of suppliers' products and knowledge to end users, each step of which is effectively a halal checkpoint.

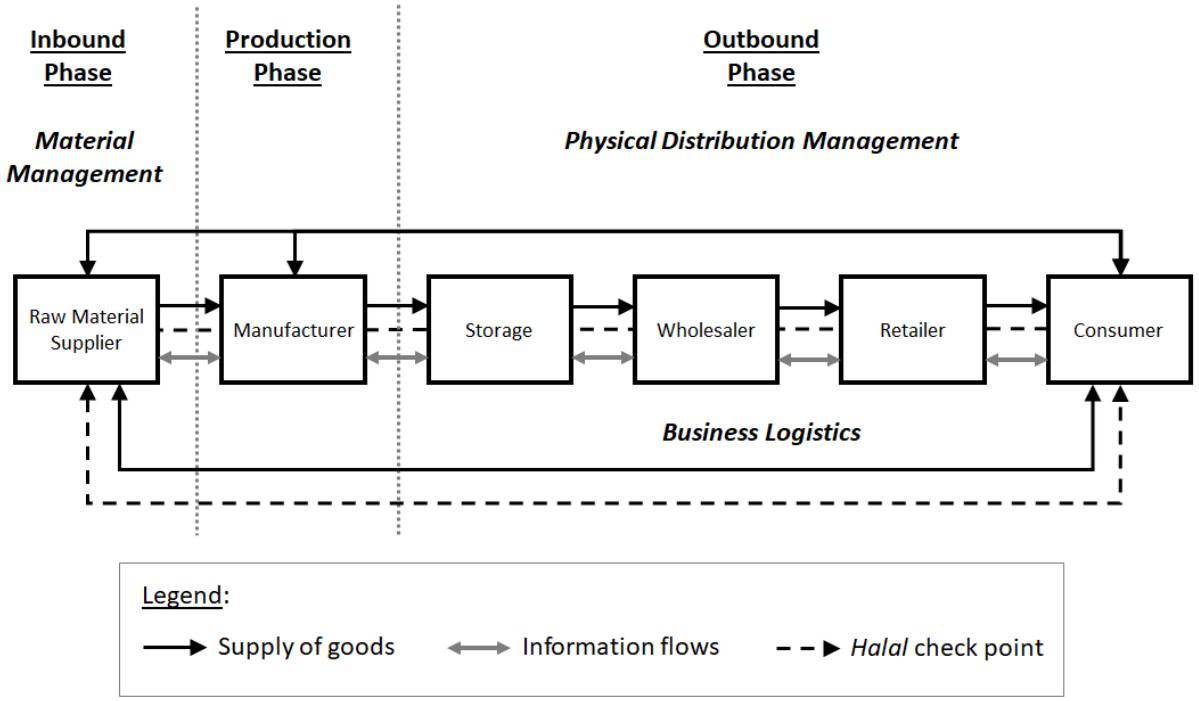

Figure 1.
Conceptual model of halal supply chain management

In general, a Halal Supply Chain consists of four main stages: Halal Procurement; Halal Manufacturing; Halal Distribution; and Halal Logistics. Organizations must at least follow the basic guidelines defined by MS1500 to ensure the halal compliance of a supply chain, in which companies must observe halal procedures in every operation (Rasi, Masrom, Omar, Ahmad Mohamad, & Sham, 2017). This section covers the literature concerning halal distribution and logistics only as the scope of this research.

Packaging impacts the halal state of the products within, and there are strict guidelines covering product handling that also require packaging to be halal-certified and traceable (Ab Talib & Mohd Johan, 2012). Certification requires a list of ingredients used to make the packaging, the origin of the product, and a certification logo (Rezai, Mohamed, & Shamsudin, 2012).

The function of packaging is to contain and protect the goods during delivery and distribution and, in some cases, to protect workers handling hazardous goods such as chemicals and certain liquids and loose products. Packaging protects goods from cross-contamination between halal- and non-halal substances during transport and distribution by separating the two, perhaps by using different carriers, or separate compartments in the same carrier (Ab Talib & Mohd Johan, 2012).

Halal status is not limited to the ingredients of the product, but also extends to the supply chain and the logistical aspects. Logistics, in general, include organizing, protecting, and identifying products and materials before they reach the customer (Omar & Jaafar, 2011). Talib and Johan (2012) state that the role of packaging in logistics is to contain and protect the products during delivery and distribution. This exercise must also ensure that "the delivery system, storage houses, and containers and freezers are all halal certified, which would prevent contamination of halal food from any non-halal elements" (Fathi, Zailani, Iranmanesh, & Kanapathy, 2016). In supporting this, carriers and warehouses must comply with halal guidelines, e.g., sertu cleansing (clean) processes to be performed

on a container if it has been previously used to deliver non-halal products.

Halal logistics capabilities are crucial to maintain the halal quality of a supply chain, from farm to fork (Tieman, 2007). The key element of halal logistics is to maintain the separation of halal and non-halal food items, which includes the use of separate containers to prevent cross-contamination. Sham et al. (2017) suggests that halal authorities should check the halal status of all imported goods at the point of entry, before they are permitted to be distributed across the country. This is a challenge because any halal-certified supply chain status requires the authorized institution to provide halal certificates (Tieman 2011), but the only certificates that are currently available are for products, not for their storage and transportation (Hasan, 2021).

A study was conducted on halal certified logistics providers in Malaysia, which identified the risk categories in halal food transportation (Yaacob, Abd Rahman & Jaafar, 2018). Operational risks to the quality, safety, and halal status of food products have been cited (Al-Mazeedi, Regenstein & Riaz, 2013), which include the risk of contamination of halal food products due to the lack of monitoring procedures during distribution and handling (Yaacob, Abd Rahman & Jaafar, 2018). Previous research tends to cover large-scale food distribution and logistics, involving cargo ships, huge volumes, and teams of people working together through specific procedures to ensure halal status compliance throughout the supply chain (Yaacob, Abd Razak & Ishak, 2021), rather than focusing on individual riders delivering food to the final consumer on a daily basis.

2.2. Halal Status in Transportation and Logistics Service Providers (LSPs)

Halal and non-halal products tend to be mixed together during transport, and cross-contamination may occur if there is no clear segregation, especially if the same container is used for both halal and non-halal products. One basic solution is to have dedicated transport for each type of product, i.e., halal and non-halal. This will not only reduce the risk of cross-contamination, but will also facilitate the delivery process to the customers and clients (Kumar & Shah, 2016). Good transport systems are closely related to supply chain management in building effective and productive logistics systems, as well as minimizing costs and improving the quality of service in terms of performance (Tseng & Yue, 2005).

As part of managing costs and ensuring a focus on quality, it is common for manufacturers and retailers to find ways to outsource their logistics operations to logistics service providers (LSPs) in order to meet the growing demand for logistics services (Lieb & Miller, 2002), as the growth of the supply chain has driven many companies to develop logistics as part of their corporate strategy (Mcginnis & Kohn, 2002). Referring to Figure 1, LSPs sit between the manufacturers/suppliers and the end-users/consumers.

In the Malaysian context, many restaurants do not have their own dedicated transportation in their supply chain, so they tend to outsource their logistics activities to LSPs or third-party logistics (3PL) companies (Zulfakar, Anuar & Talib, 2014). These companies serve the customers' demands by providing their services at the highest level of business efficiency, instead of spending excessively on manpower, transport, and administrative tasks. Therefore, it is the responsibility of the LSP to ensure that the halal status of the products remains unbroken through to the point of final delivery. It is also crucial for LSPs to consider the value of integrity, knowledge, and awareness of halal status while doing business in the supply chain.

Wilding and Juriado (2004) found that the use of LSPs, from the point of view of the customers, generally has a positive impact on the cost efficiency of businesses. Reducing costs can be accomplished by reducing transaction costs, and by integration

that will increase the quality of the exchanged information. In addition, offering a good quality service and being responsive to any of the customer's issues seems helpful to LSPs in improving their results. In other words, it is a win-win situation for both the manufacturers and the LSPs.

In terms of the governance of halal status, the Halal Industry Development Corporation (HDC) launched a variety of halal awareness programs for LSPs in 2010 (Radzman Shah, Muhammad, Mohamad & Jaafar, 2016). The government also provided an investment tax allowance of 100% of eligible capital expenditure incurred for halal-approved LSPs within a period of five years. This is aimed at encouraging new investment in Halal logistics services for the export market, as well as in modern, state-of- the-art machinery, ICT, and equipment to deliver high quality Halal services. Today, there is significant potential in doing business in the halal industry, with the presence of 1.6 billion Muslims and an estimated demand of more than US$600 billion (RM2.1 trillion), making it a great opportunity, not only for manufacturers, but also for those industry players who provide transport services. With the government tax exemptions, more LSP players are willing to invest in halal logistics (Tan, Razali & Husny, 2012). In addition to the support from the Malaysian government, the Department of Islamic Development (JAKIM), as well as international government agencies from other countries, like Majlis Ugama Islam Singapore (MUIS) and Brunei Halal (Brunei Darussalam), suggest that the halal industry is a growing market (Adams, 2011).

Regardless of the advantages discussed above, halal transportation providers still face considerable challenges in terms of halal logistics, including the poor level of cooperation between the halal certification authorities and the LSPs in enforcing regulations (Ab Talib & Abdul Hamid, 2014) Shafie and Othman (2006) support this in their research, saying that the inadequacy of halal compliance officers to fulfil their duties creates risks and vulnerabilities when monitoring the integrity of halal logistics. In addition, some LSPs find it difficult to enforce halal practices due to the lack of information sharing between suppliers and the community. Jaafar et al. (2011) find that this situation is more critical in the retail space, especially for small retailers, due to the lack of control and supervision by the responsible institutions.

Halal logistics practices are new to some LSP players, and a lack of knowledge of Shariah principles with regard to transportation, warehousing, manufacturing, storage, materials handling, and retailing, is a handicap for those exposed to the halal environment. For example, if a container has been previously used for non-halal products, the obligation to do samak (or sertu cleansing) is highly important. Clarity is necessary to ensure that the halal status remains unbroken throughout the supply chain (Ab Talib & Abdul Hamid, 2014).

It is common for some additional management costs to be incurred when conventional transportation providers want to implement halal logistics in their business, and this will likely lead to issues around whether they have sufficient people with the correct training, whether their employees are ready to manage change, and their ability to meet the mandatory requirements set out in MS2400: 2010, Part 1 (Radzman Shah, Muhammad, Mohamad & Jaafar, 2016). These are the items that transportation provider companies are ordered to uphold for halal logistics implementation in their business.

The halal logistics industry in Malaysia is still relatively new, especially with regard to the MS2400: 2010 Part I (transportation requirements). Transportation services providers who are looking to implement halal practices face significant additional responsibilities around inventory policy, fleet scheduling, vehicle routing, consolidation, and warehousing.

3. Methodology

Putting aside the possible actions to be taken by business organizations in implementing halal logistics and distribution, this research examines the perspectives of those involved in the actual halal delivery operations. This is to ensure that the findings in the previous works are supported by the real situation at the operational level.

3.1. Research Settings

There is a growing number of delivery service providers for food in Malaysia. This research takes a sample of two of the most competitive mobile food delivery companies in Malaysia, namely FoodPanda and GrabFood. The delivery riders from these companies are the respondents in this research.

As mentioned in the Introduction, this research takes the qualitative approach of interviewing the riders for insights on the delivery process that involves the distribution of food products from shops and restaurants to the customers. The riders are the best candidates for this study as they are able to share their hands-on experiences of the day-to-day food delivery operations, and their perspectives on halal status checkpoints are valuable to this research. They are also able to provide insights into how digital halal logistics could be implemented at the operational level, given the fact that many are tech-savvy themselves.

This research reports on the preliminary findings from the interviews in terms of the background study of the companies, as explained by the respondents and supported by the literature review. This is followed by an analysis of the interview data, translated into the form of diagrams to help visualize the food delivery process, along with additional important points that could lead to the identification of risks to the halal status of the food being delivered. The final stage of this research is a discussion on the challenges of implementing digital halal logistics at the operational level, based on both the interviews and the analysis of the resulting data.

3.2. Background Study of the Food Delivery Companies

As of early 2020, the mobile food delivery company, FoodPanda, operated in 11 countries, mainly in the Asia Pacific region. Headquartered in Berlin, Germany, FoodPanda employs over 80,000 riders, serving more than 115,000 restaurants in over 246 cities. Their largest competitor in Malaysia is GrabFood, actively operating mostly in the Asia Pacific region with over 15,000 delivery-partners (or GrabBike riders), all earning an income on the platform. FoodPanda was established in Malaysia in 2012, while GrabFood was established in 2018. Both services are available online and via mobile applications (mobile apps).

Interviews were conducted with two respondents, one each from FoodPanda and GrabFood, and we initially discover that their delivery operations are quite different. FoodPanda riders set their own schedule and coverage area one week ahead, after which they start their shift by clocking on through the mobile app at the designated place within their designated area. GrabFood riders, on the other hand, can work anywhere, at any time, and are not required to work within a certain territory.

The payment method used by the two service providers is also slightly different. GrabFood only accept payments from their customers via Grab's very own e-wallet, called GrabPay, while FoodPanda accepts a range of payment methods including credit cards, debit cards, online bank transfers, and cash. FoodPanda riders are required to transfer any cash payments to the company's bank account by midnight, on a daily basis.

There are also differences between the two in terms of the payment of salaries. GrabFood riders are paid according to the length of their journey. For the first 4 kilometers, riders

are paid RM 5.00 and, during peak hours, when demand is high, they receive an additional RM 4.00 per order. FoodPanda rewards their riders at an hourly rate of RM 4.00 per hour. However, if the rider manages to complete two orders or more within the hour, they are paid RM 4.00 per order. The preliminary findings are summarized in Table 1.

Table 1.
Comparison between FoodPanda and GrabFood

Item	FoodPanda	GrabFood
Coverage area	Set/choose coverage area	Anywhere
Working hour / shift	Set/choose own schedule for a week	Any time
Clock-in (via mobile app)	At designated place within the chosen coverage area	Not required
Customer's payment method	Credit cards, debit cards, online bank transfer, cash	GrabPay e-wallet only
Cash handling	Need to transfer the payment to the company's account by midnight on daily basis	Not applicable
Salary payment method	RM 4 per hour during working hours, plus an additional RM 4 per order for every delivery over and above one 1 per hour	RM 5 for the first 4km, plus an additional RM 4 per order during peak hours

4. Data Analysis and Findings

The following diagrams are based on the interview data. Figure 2 shows the first phase of analysis of the food delivery process, in which data from both interviews are summarized, including notes on the worst case scenario that might happen at each stage.

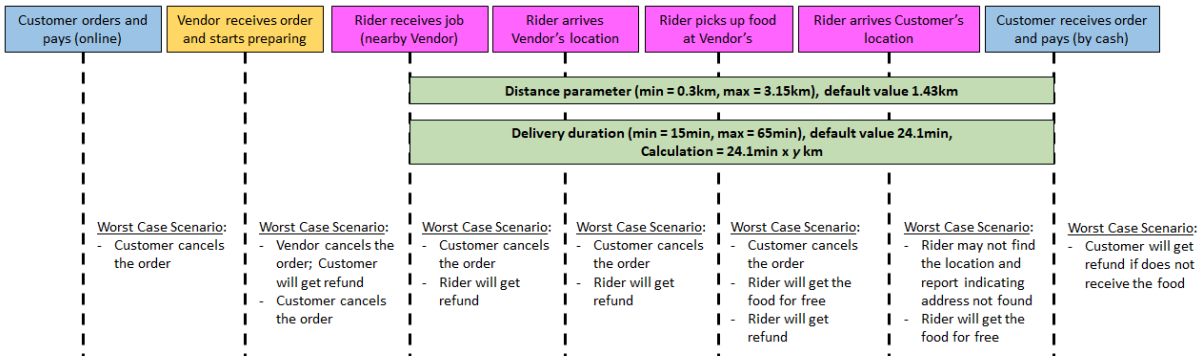

Figure 2.
First phase of analysis of the food delivery process

Figure 3 provides a clearer picture of the rider's delivery process flow from vendor to customer. This figure answers the first objective of this research: analyze the food delivery process carried out by the riders.

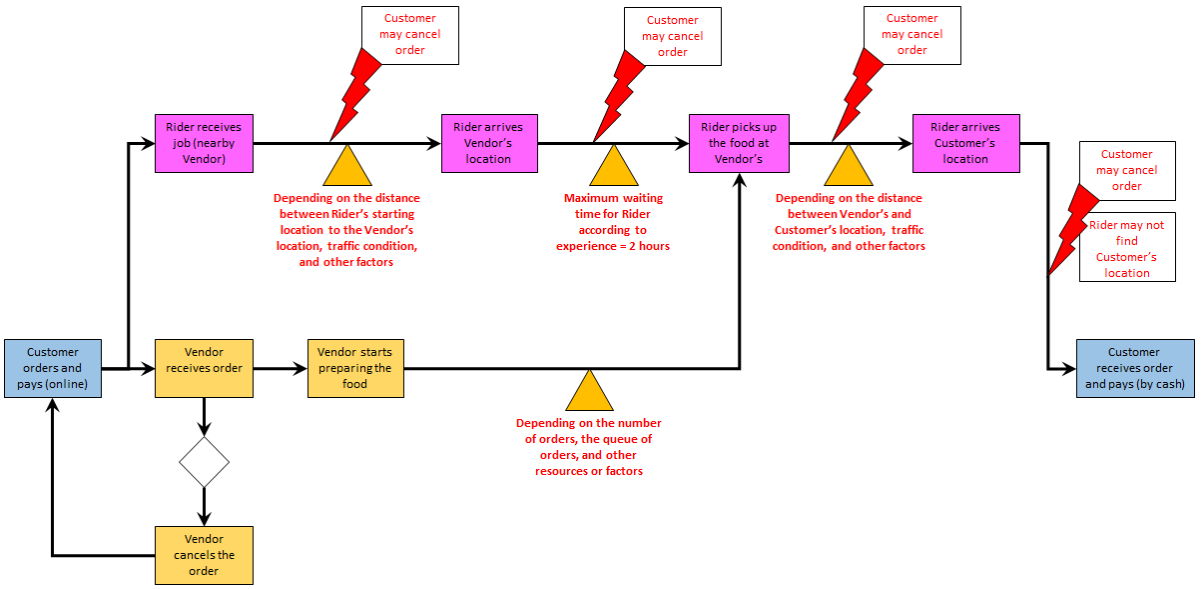

Figure 3.
Analysis of the food delivery process

There are four main activities involving riders (shown as pink boxes), with possible delays between the activities (shown as orange triangles) due to waiting and travelling times.

There are four possible delays:

i. Before the rider arrives at the vendor's location, which depends on the distance between the starting point and the vendor's location, the traffic condition, and other factors;
ii. Before the rider picks up the food which, according to the experience of the two interviewees, can be up to 2 hours;
iii. Before the rider picks up the food, which depends largely on the number of orders in the queue and other factors; and
iv. Before the rider arrives at the customer's location, which depends on the distance between locations, traffic condition, and other factors.

Figure 3 also shows the possible triggers that may interrupt a rider's job and may or may not affect the whole operation. These triggers are shown as red lightning symbols. The five identified triggers, at four positions in the delivery process, are as follows:

i. Customer may cancel the order before the rider arrives at the vendor's location;
ii. Customer may cancel the order before the rider picks up the food;
iii. Customer may cancel the order before the rider arrives at the customer's location;
iv. Customer may cancel the order before the customer receives it and pays by cash; and
v. The rider may not find the customer's location and report as 'address not found'.

The fourth is still possible if the customer is in an apartment or an office where the rider has to go through a guardhouse, a lobby, or similar.

The next step is to achieve the second objective, which is to identify the possible Halal checkpoints within the riders' operational process. Figure 4 shows the possible Halal checkpoints highlighted on top of the food delivery process. This is an improved version of Figure 3.

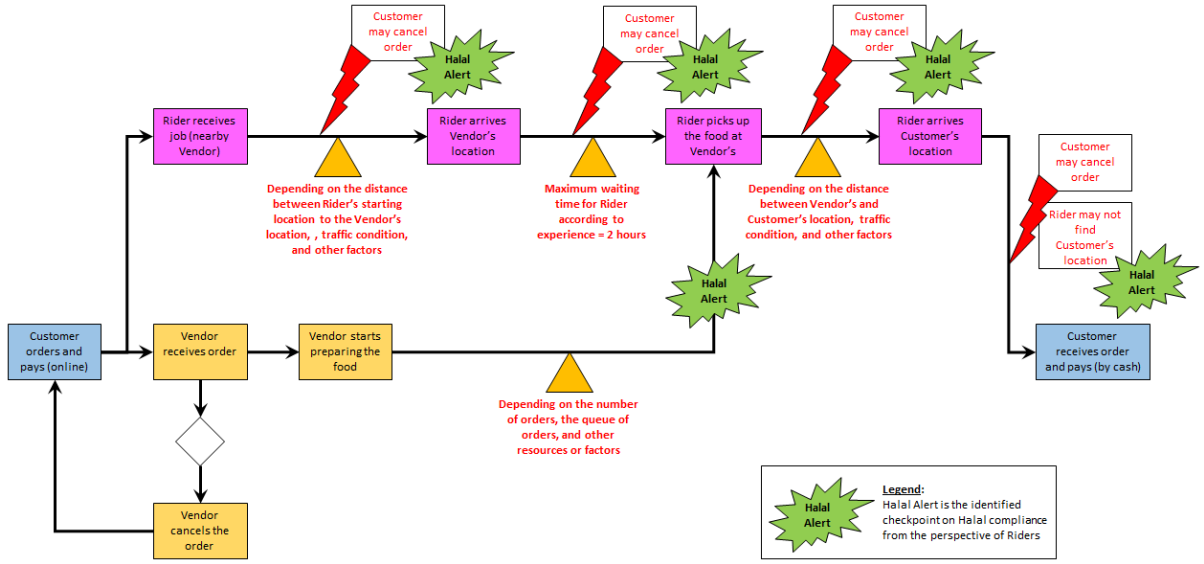

Figure 4.
Identification of possible Halal checkpoints

There are six possible Halal checkpoints identified at six positions within the process flow; five are tied to the afore-mentioned triggers, while one is tied to the third delay, mentioned above. In other words, all triggers and delays are tied to the possible Halal checkpoints within the delivery process flow.

5. Discussions

In the light of determining the challenges of implementing digital Halal logistics at the operational level (i.e., the third research objective), Figure 4 is referred to for further clarification. Table 2 summarizes the challenges and questions on the opportunities for each Halal checkpoint.

Table 2.
Challenges of Implementing Digital Halal Logistics at the Operational Level

Checkpoint	Challenge	Questions on Opportunity
Customer may cancel the order before the rider arrives at the vendor's location.	Rider may still be on the road, and will only get to check the cancellation status after arriving at the vendor's location.	i. Should the rider pick up the food? ii. Would the vendor know that the order has been cancelled when the rider arrives the at the pick-up counter?
Customer may cancel the order before the rider picks up the food.	Rider may have arrived but not yet received the food at the vendor's location. They may check the cancellation status before the food order is handed over.	i. Should the rider pick up the food? ii. If the rider has already taken the food, should they return it in order to save space on the vehicle?
Before the rider picks up the food and while it is being prepared.	Rider may need to wait for the food to be ready. If there is a large backlog, there may be other riders waiting at the same place at the same time.	i. How can the waiting time be estimated? ii. Can the rider do other tasks related to Halal compliance while waiting, e.g., making sure the storage box/bag is clean and in good condition?

		iii. If yes, for question (ii), is the vendor's location far from the parked bike (e.g., is it in a mall, far from the nearest parking)? iv. If yes for question (iii), what other tasks can the rider do that does not require a return to the bike?
Customer may cancel the order before the rider arrives at the customer's location.	Rider may still be on the road, and will only be able to check the cancellation status after arriving at the customer's location.	i. What happens to the food? ii. Even if the disclaimer states that the food belongs to the rider in this situation, will it be halal-compliant for the rider? iii. If the rider has more deliveries to make after this cancelled delivery and has no time to stop and eat, how does storage affect the cleanliness and Halal compliance of the food?
Customer may cancel the order before the customer receives it and pays by cash.	Rider may still be on the way to the customer's front door, and will only be told personally by the customer that the order has been cancelled if the rider does not have an opportunity to check the cancellation status.	i. If the customer takes the order even after it has been cancelled, what is the Halal status, now that each party has received a refund or a penalty?
Rider may not find the customer's location and report as 'address not found'.	Rider may have difficulties finding the customer's location based on the given map and address, and it will take time to reach the customer, who may feel frustrated and angry.	i. If rider purposefully does this in order to take the food home, what is the Halal status?

The challenges listed in Table 2 do not include other factors such as road accidents that cause the food to be ruined. The concerns here are mainly around, three resources deemed important in delivery operations management: equipment (i.e., Halal (or non-Halal) bags and storage boxes, shirts, a backpack, and wet weather gear), space (i.e., the delivery zone), and employees (i.e., riders).

Having laid out the challenges in Table 2, it is clear that the Halal checkpoints within the food delivery service are mainly on material and service management, and in the handling of the ordered food during the delivery process. If digital Halal logistics is to be implemented at this operational level, then the information flow to and from each party (i.e., rider, vendor, customer, and employer) should be in service to Halal compliance. For example, the second question from the second checkpoint in Table 2 asks, "If the rider has already taken the food, should they return it in order to save space on the vehicle?". In this case, digital Halal could include a device to measure the remaining capacity of the storage bag. There may also be a function in the mobile application to alert the rider as to the level of cleanliness and Halal status.

As another example, the second question of the third checkpoint asks, "Can the rider do other tasks related to Halal compliance while waiting, e.g., making sure the storage box/bag is clean and in good condition?". Here, an alert function could be designed to predict when the food will be ready, based on the history of the vendor's capacity in preparing the food and on the current backlog of orders that the vendor is handling. The alert can include some suggestions or guidelines for taking the opportunity to check their equipment for Halal compliance.

The following list summarizes the suggestions of implementing digital Halal logistics at the operational level:

- Tracking and tracing the time and motion of a rider during a shift, to predict their best course of action (based on the checkpoints mentioned above).
- Data integrity checking on top of the tracking application.
- Guidelines-on-the-go as on-the-job training to support the riders' knowledge and practices regarding Halal compliance.
- Alerts and notifications to support the needs at each checkpoint.
- Predictions using data analytics to support the guidelines, alerts, and notifications (as explained in the second example above).
- Internet-of-Things (IoT) devices that support and inform decisions made by the riders (as explained in the first example above).

Suggestions for the implementation of digital Halal logistics are not limited to those listed here. In general, the implementation should take into account ways to support the effective capacity determinants at the operational level, in terms of facilities (which are mainly supported by digital technology), process factors (e.g., speed), human factors (e.g., training, skills), policy factors, operational factors (e.g., scheduling), supply chain factors (e.g., delays), and external factors (e.g., government, pollution, traffic). This is supported by recent research on the governance of halal logistics compliance that stipulates the need to enable digital halal traceability, empower the resources with appropriate technology, and equip the people with knowledge on halal compliance through technology (Ismail, Nazarudin & Muhamad, 2022).

6. Conclusion

This research highlights the activities within the delivery process of two popular food delivery services in Malaysia, and identifies the checkpoints where the challenges of implementing digital Halal logistics can be further analyzed. The results and findings discussed in this paper are derived from the analysis made on the interviews with the two delivery riders, and are illustrated in process flow diagrams that help visualize the operational processes. In short, the first objective is achieved from the interview survey (as presented in Figure 2), the second objective is achieved with the presentation of Figures 3 and 4, and the final objective is achieved in the Discussions section.

This study offers additional (and unexpected) insights into the concept of halal within the supply chain from the perspective of the delivery riders, specifically around the physical condition of the products being delivered and their storage, and whether or not it is permissible to take and eat food that does not originally belong to the rider. Future work is recommended to eventually provide a support and prediction tool for Halal compliance at the operational level of food delivery services.

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