Factors Influencing ICT Adoption in Halal Transportations: A Case Study of Malaysian Halal Logistics Service Providers

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Abstract

The purpose of this study is i) to investigate the factors that influence the adoption of Information and Communication Technology (ICT) in Halal transportations and logistics and ii) to develop an ICT adoption framework for Halal logistic service providers (LSPs). The Halal LSPs selected for the study currently used ICT service platforms, such as accounting and management system for Halal logistic business. The study categorizes the factors influencing the adoption decision and process by LSPs into four groups: technological related factors, Halal assurance related factors, organizational and environmental related factors. The major contribution in this study is the discovery that technological related factors (ICT compatibility with Halal requirement) and Halal assurance related factors are the most affecting factors among the Halal LSPs applying ICT for Halal performances control in transportation's operation. Among the environmental related factors, ICT requirement for monitoring Halal included in Halal Logistic Standard on Transportation (MS2400:2010) are the most influencing factors in the adoption of ICT with the support of the government. In addition, the government related factors are very important in the reducing the main barriers and the creation of the atmosphere of ICT adoption in Halal LSP sector.

Keywords: Information Communication Technology (ICT), Halal logistic standard, Halal transportation, ICT Adoption

1. Introduction

Logistics plays a key role in protecting the Halal status of any given product through proper transportation, storage and handling within the supply chain, until it reaches its final destination [1]. The main success of the Halal industry relies heavily on logistics service management capabilities in ensuring the integrity of Halal products. The logistic service management involves the collection, consolidation, storage handling, value added, track and trace and controls of the movement and storage of Halal products. For these purposes, LSPs play a crucial role in realizing this goal for the Halal industry. Segregation goods from Halal and non-Halal goods for cross-contamination avoidance are the main element of protecting the Halal status. Among the elements of controlling 'Halal' in logistic activities are monitoring Halal performances controls in transportations activities and the movements by any type of transportation mode must comply with the principle of Shariah [2]. There is a risk of cross contamination of Halal product with Non-Halal during transportation operations. Among the issues are sharing containers, poor visibility into what inventory is in which containers, where the container is transit, history of immediate suppliers, history of immediate maintenance and segregation allocation space between Halal and non-Halal goods in same containers increased the risk towards Halal integrity being compromised.

While concerning on this main issues, maintaining the Halal performance responsibility during transportation process also a big challenge. Jaafar, et al. [3] argued that to achieve a Halal supply chain compliance product is almost unattainable. This is because the Halal supply chain service offered by the LSP is guaranteed only when the products are in their custody. But, once the products are transferred to the custody of the other party, the chances of breakage in chain is higher when the other party is not practicing Halal supply chain. The lack of information sharing among suppliers and community is possible caused of these issues. Jaafar et al adds, this situation is more critical at the retail level especially the small retailers due to lack of control and monitoring by the responsible institution at their level.

Monitoring Halal integrity of product is very crucial; many researchers see the potential of ICT to improve the Halal services in logistic activities. According to Tierman [4], the use of ICT may increase the effectiveness and organization of the Halal supply chain. However the adoption of ICT in Halal industry is fairly new. According to Malaysia logistic Directory [5], a study by Frost & Sullivan also showed that the concept of adopting visibility technologies for security management purposes such as radio-frequency identification (RFID) and global positioning systems (GPS) is still fairly new despite the fact that the demand by logistics end-users who expressed their interest in the use of RFID and GPS as forms of logistics security management is high. The use of technology in logistics is currently focused on warehousing, bar coding and transportation management systems. At present, it is estimated that only 35% of logistics service providers are using the technologies. The low adoption of RFID system is due to the high initial set up cost and less mature of such technology across the ASEAN region [5].

Thus, the purpose of this study is to investigate the factors that influence the Halal LSPs in applying ICT for Halal controls transportations. To gain in-depth understanding, the contributing factors such as environment, organizational, government's responsibility and the Halal assurance element factors that contribute confidence and positive attitude towards Halal are being focused. Based on the analysis of the cases of Halal LSPs adopting ICT, the second purpose of this study is to propose a framework of ICT adoption for Halal LSPs. The proposed ICT adoption framework consists of four dimensions (technological related factors, Halal assurance related factors, organizational and environmental factors), which are partially based on some ICT adoption frameworks used in [6] [7] and [8] . Finally, this paper discusses the importance of government's role and the cooperation work between Halal industries and ICT industries and how to effectively provide initiatives to the LSPs to adopt and to retain ICT through bridging the findings in the study.

2. Literature Review: Factors Influencing of ICT Adoption of Malaysian Halal LSP's

In this literature review we highlight the factors affecting the ICT adoption process and their impact on Halal LSPs performance. As our study is focusing on Halal transportation's operation in Halal logistic, the impact of ICT on Halal performance efficiencies also being explored.

2.1 Technological Related Factors - *portions of Roger's (1995) model innovation diffusion*

In recent years, there have been many research efforts aimed at identifying factors and practices indicating how technological innovation may support company in practicing Halal controls and management in their logistics services. Malisa Mazlan [9] used Roger's theory to investigate the factors that may affect the ICT adoption process among JAKIM Halal certified company in Malaysia. They found that the companies have a high degree of adoption in the variables of relative advantage, compatibility, trialability, observability, image and complexity. The study highlighted a high degree of adoption in complexity variable indicates that they have a difficult and hard to adopting ICT in their business.

Despite the growing interest about ICT in Halal logistic [10] [9] and Halal transportations performances control [11] [12] [4] the field of ICT is relatively new and research on ICT towards Halal controls in transportations chain and logistic activities is limited [13]. Research on the importance of ICT for Malaysian Halal SMEs applied Rogers's theory [9] successfully discussed but little research is available regarding ICT adoption by Malaysian Halal LSPs. According to Tierman [10], LSPs play important roles to develop and ultimately controls the entire Halal logistical concept by mean conducting organization with a specialized and advanced ICT to make logistic operations transparent and controllable. Therefore, the study that discussed factors influences the adoption of ICT by LSPs is needed to determine the current status of ICT adoption level and to what extent the ICT has been applied in monitoring the Halal integrity.

2.2 Organizational Relate Factors

Besides focusing on particular ICT factors, the organizational and environmental factors also may impact on the process of ICT adoption in an organization. According to Rashid and Al-Qirim [6], the organizational factors collectively impact on the resources of the business in relation to adoption of ICT innovation [14]. However, the process of ICT adoption could be quite difficult for a firm because of its requirements. The willingness for adoption of ICT is, usually, associated with organizational readiness where organization must adapt with a large investment and firms may not have sufficient financial resources to support the high investment in hardware and software technology that is required [15, 16]. Therefore we would expect that organizational awareness, encouragement and readiness might influence technological innovation.

2.3   Environmental Related Factors

In addition to technological and organizational factors, the external environment in which a firm conducts its business will also influence the innovative capability [17]. Environmental factors provide significant forces for adoption where the issues relating to market climate and the firm's standing in the market directly influence the uptake of technology. Damanpour [18] found that environments with high uncertainties would have positive influence on the relationship between organizational structures and organizational innovation. Apart from that, competitor also could be one of the important external factors considered in ICT adoption. ICT adoption decision would influenced by the relative advantage gained by LSPs compared to their competitors. If there is no relative advantage gained by LSPs, ICT might not be adopted [19].

Governmental support is another important environmental characteristic for technological innovation. The government roles are importance in putting to order the local Halal industry to ensure Halal integrity. In 2010, the Halal Development Centre (HDC), as the Halal authority on behalf of Malaysian government, has launched many Halal programs for LSPs. The government also offering the investment tax allowance of 100% of qualifying capital expenditure incurred within a period of 5 years for Halal certified LSPs. In June 2010, the government announced the launching of Standards on Halal Logistics, MS 2400: 2010 that covers the Halal transportation aspects and the requirement of ICT for Halal controls. The standard stated, an organization shall establish and apply a traceability system that enables the identification of the inbound goods and/or cargo for the processing stages in the transportation chain services, history of immediate suppliers and the details of distribution routes for delivering Halal goods must be recorded [20]. These incentives have been seen to encourage new investments in 'Halal' logistics services for the export market and to increase the use of modern and state-of-the-art machinery, ICT and equipment in producing high quality 'Halal' services that also comply with the international standards.

2.4   Halal Assurance Related Factors

Shariah law is the fundamental guide in developing the Halal standard. The only different between conventional transportation and Halal transportations system is where the principle of the Shariah is being applied to the transportation chain. With the Halal certification and Halal standard established by government, LSPs and manufacturers are obliged to act responsibly to maintain the *halal* status of the Halal

services they offered. To avoid the risk towards Halal being compromised, effective control measures, providing Halal assurance system need to be implemented by LSPs [1] [21]. In this way, it encourages confidence in the safety also the Halal integrity of products and thus promotes both confidence in the Halal industry and stability of Halal businesses [21]. In literature, Azah et al [22] discovered that there is no real time Halal tracking implemented by Halal LSPs. Azah adds that the issue of applying ICT towards Halal is still in early stage. According to Zailani [19], there is no method to determine whether the food product come from the country which is stated on its packaging. This finding has created opportunities to other Halal LSPs to encourage in developing an ICT solution and adoption for tracking purposes.

2.5 The ICT Adoption Framework

Based on review of the literature on factors that impact the adoption process, a conceptual framework was developed as shown in Figure 1. The study explored IS/IT adoption and diffusion models for LSPs and identified the essential factors that may impact the ICT adoption process by Halal LSPs. As this study focusing on Halal, we identify the Halal assurance related factors are among the factors that influence the adoption process. Four attributes from Roger's model [23] are relative advantage, compatibility, complexity, image and cost which will be adapted in this framework to test the impacts on ICT adoption process. This theory will be used to analyze technology factor. In the case of Halal study, we categorized the compatibility and relative advantage variables of ICT as the degree to which the adoption is perceived as benefits and compatible with Halal requirement jobs responsibilities and value system. While an image variable is the degree to which adopting ICT is perceived to enhance Halal LSPs image or status. Based on the literature, we categorize the factors influencing the adoption decision of Halal LSPs into four dimensions: technology, Halal assurance related issues, organizational and environmental related factors.

The framework was developed after undertaking an in-depth review of literature relating to ICT innovation diffusion, competitive advantage and also Halal factors itself. This review gave us an indication of the important questions that should be asked to LSPs to better understand the factors of ICT adoption. We developed a questionnaire consists of 8 questions that sought general information such as company name, size etc as well as 18 specific questions about ICT adoption issues. We tested this adoption framework on three case studies of Malaysian Halal LSPs.
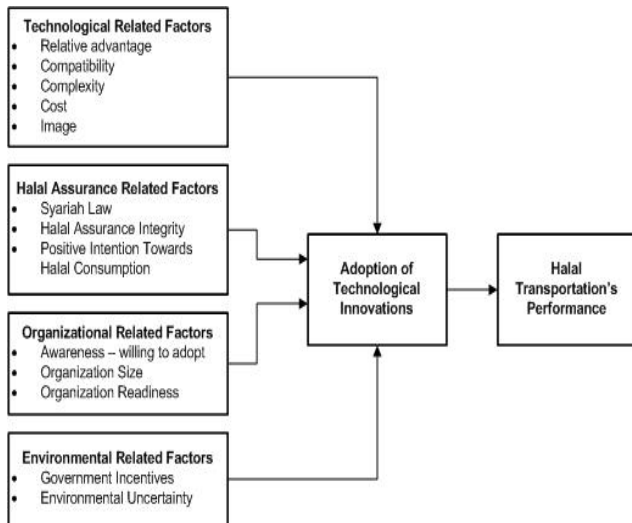
Figure 1: Research Framework – *Factors Influencing ICT Adoption in Halal Transportation by Malaysian Halal LSPs*

3. Research Methodology

3.1 Data collection

This research applies a case study methodology for data collection and analysis. The reason for choosing this methodology was to provide qualitative data that can help us better understand how ICT is initiated within the Malaysian Halal LSPs organizations and to expose factors that supported ICT diffusion. In addition, case studies help us understand the details of the cases from the participant's viewpoint by using multiple sources of data [24]. As this research focused on understanding how diffusion occurs, an exploratory case study approach was adopted. For research that was an exploratory in nature, qualitative methods were deemed more appropriate [24]. This multiple case study explores the factors that may impact the ICT adoption process and also explores the ICT application used to monitor Halal performances control in transportation's operation.

Among the research questions are;

- What are the driving factors that best support the implementation of ICT initiatives in Malaysian Halal LSP?
- What ICT characteristic suit for Halal transportation requirement that can be identified for Malaysian Halal LSP?
- What are the factors that may impact on the process of ICT adoption in Halal transportation for Halal LSP?

3.2 Case Study Criteria

Malaysian Halal LSPs were selected from a benchmark list in Malaysian Halal logistic industry as potential case candidates. All Halal LSPs had used ICT systems that supported communication and document management within their logistic activities and supply chain management. High-level managers (vice presidents or other high level managers) were interviewed to provided related data experience for the study. The case study interviews were conducted from April 2011 until September 2011. Case data were collected primarily through structured face-to-face interviews with managers of these Halal LSPs companies. However, when necessary, telephone interview with other executives in the firms were conducted to supplement the information gathered during the personal interviews. To enhance answer validity, participants verified the summaries of major findings of each interview after the end of each interview session. Furthermore, to ensure consistency and reliability, structured guidelines were used for all interviews.

4. Case Study: Finding and Data Analysis

The results were analyzed using QSR NVivo 9 software analysis. NVIVO is one of CAQDAS (computer-assisted qualitative data analysis) that can enhance the qualitative research process, quickly process queries, and expand analytical avenues [25]. Even though the individual had different software application experience from each organization, they did share over 70% of a common ICT experience in conducting Halal transportations operation.

The findings from the case studies confirmed the four main factors of ICT diffusion within Halal LSPs companies. Before discussing these factors, the findings of each case study background are described below.

Table 1: Company characteristics

| Malaysian Halal LSPs	Case A	Case B	Case C
Context of operation			
Halal transportation activities	The services offered include Halal transportation, Halal distribution, Halal shipping, Halal freighting for sea and air cargo, samak service for containers, customs facilities and other Halal value-added services.	IT system has been enhanced with the critical check point list and traceability functions at the receiving process (verification of Halal status of cargo and labeling). No specific Halal transportation and distribution services yet.	Halal product handling - Halal product. Non-halal product at different space allocation.
Outsourcing Halal services	Outsource other 3PL for managing non-Halal item.	Samak services to other samak's contractor	Samak services to other company
Technology and co-ordination			
Existing ICT used to monitor Halal controls	RFID, bar coding, Internet real time tracking and tracing using GPS, TMS,WMS, EDI, CCTV	Bar-coding, Transportation Management System (TMS), Warehouse Management System (WMS), EDI	Bar-coding, Transportation Management System (TMS), Warehouse Management System (WMS), EDI
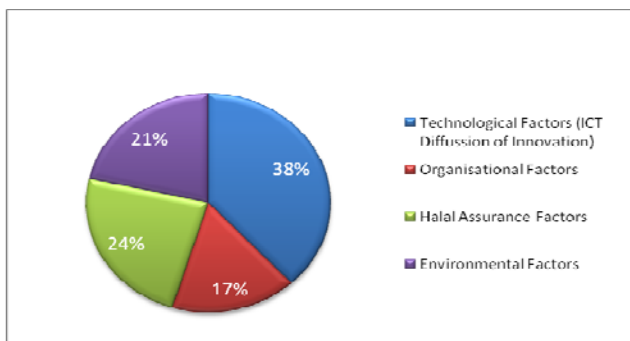
Figure 2: Influencing Factors in ICT adoption Process among Malaysian Halal LSPs

According to the framework of Halal transportation technology adoption (Figure 1), we evaluate the assent degree by interviewer on the adoption and utilization of ICT that complies with Halal standard in their organizations. We interviewed three Halal LSPs which have technology adoption experience for monitoring Halal in transportation and logistics. We score on the adopting factors under this framework according to factors that more explicitly expressed by interviewer in the case. Figure 2 shows the result in percent while Table 2 demonstrates the result of the study in brief.

Table 2: Influencing factors in the study

Dimension	Factors found in the study	CsA	CsB	CsC
Technological Innovation Factor	Relative Advantage	●	●	●
	Compatibility	●	●	●
	Complexity		●	
	Cost	●	●	●
	Image	●		
Halal Assurance Related Factor	Syariah Law	●	●	●
	Halal Assurance Integrity	●	●	●
	Positive Intention Towards Halal Consumption	●	●	
Organizational Related Factor	Awareness - willing to adopt	●	●	●
	Organization Size	●		●
	Organization Readiness	●		●
Environmental Related Factors	Halal Logistic Standard on Transportation MS2400	●	●	
	Relative Incentive offered for Halal Business	●	●	●
	Halal Program Initiatives	●	●	
	Environment Uncertainty		●	●

Note: ● shows that the factor is explicitly expressed in the case.

Technological Related Factors

The usage of the existing ICT that the LSPs have used to monitor Halal control in transportation's operation can be categorized into three areas: data communication technologies, identification technologies and, data acquisition technologies. All Halal LSPs have chosen data communication technologies and identification technologies as an ICT application for monitoring Halal. On the other hand, only CsA has applied data acquisition technologies that are CCTV to keep track the movement of product in their warehouse. Besides, all cases also have used the Internet based service platforms to extend their Halal market as a core business activity.

Relative advantage: Depending on the goal and the capability of LSPs, the ICT choice and its usage are depending on the compatibility of ICT characteristic with

the Halal requirement and guideline. For example, the RFID characteristic is tracking and tracing are seen as compatible with the Halal transportation guideline- track and trace goods along the supply chain. Besides that, the study regards the expectation of benefits of new ICT that Halal LSPs try to adopt as the perceived benefit. Many Halal LSPs (CsA, CsB, and CsC) have known the benefit of ICT adoption through previous experience – customer are more confident when they see some ICT investment applied as value added service to their product handling. From the result, all the Halal LSPs agree that relative advantage of ICT is the main contributing factor to adopt ICT.

Compatibility: All three cases applied management system that helps them to interact with immediate supplier or customers. For example, CsA said that an issue about container is very crucial. *"We wouldn't know what types of products that the container has carried because the container travels around the world. It could be anything that is non-Halal "*. Besides, all Halal LSPs (CsA,CsB,CsC) does not invest new technology just to cater Halal requirement. They use existing technology whereby the characteristic of these technologies is compatible and suitable for Halal requirement. For example, the characteristic of RFID is tracking and tracing. As stated in Halal logistic standard on transportation, the traceability system applied shall enables the identification of goods identification of the inbound goods and/or cargo for the processing stages from the immediate suppliers and the distribution routes at destination of the goods and/or cargo. This requirement is suitable with RFID characteristic. CsA, CsB addressed the main criteria of Halal controls in transportation are the information of location of goods being transported along the supply chain can be traced and the identification of product (information and specifics details). On the other hand, CsC explains system that suitable for product handling in ports is logistic system that based on segregation instead of detection. CsC also adds that ICT that can access and deliver the information faster are compliments. For example the information of goods and/or cargo (route) in the transportation chain services can be accessed efficiently.

Cost: Even in the Halal LSPs already using existing ICT for Halal control, cost is still a critical barrier. Even the adopter of ICT (CsB and CsC) is unwilling to upgrade the information systems or to adopt other advanced ICT service applications because of the high adoption cost. Due to limitations of capability or time, (CsB) outsourced a part of their business to private consultant. However, CsA explains that the cost for using ICT does not seem to be a barrier because they believe that it is a kind of

investment. This thought seems to come from the higher awareness of improvement services after they achieved the benefit and the satisfaction of the ICT usage.

Complexity: The technological together with Halal knowledge of employees and their management capability can be a barrier to the adoption and extension of the information systems. Some CEOs (CsC and CsB) are worried about the introduction of new advanced ICT (just to cater Halal controls) because of the fear that their employees might be not familiar with it. Nonetheless, this factor does not seems to be a critical factor to adopt new ICT because they can ask the ICT service providers what they want and request an expert to train their employees.

No real time Halal tracking and tracing: Some Halal LSPs (CsB and CsC) addressed that all the monitoring Halal controls is still in manual. There is no real time Halal tracking and tracing. However all Halal LSPs (CsA, CsB and CsC) apply existing ICT to cater tracking and tracing issues.

Halal Assurance Related Factors

These factors can be critical factors to directly or indirectly adopting and extending implementation of new ICT service applications for Halal. These factors are actually differentiating the study from other LSP adoption ICT studies. CsA and CsB agreed the changing business model to Halal business is because of their responsibility and the positive intention (towards Halal) as Muslims, providing Halal assurance in logistics services to customers from farm to fork. Manager of Halal in CsA answered, '*We believe that there are many customers in Halal market. Nowadays peoples are starting to be concerned with Halal issue and the demand for Halal is also increasing. Therefore, it is better for us to start now. It is our responsibility as a Syariah compliant company*'. However, CsC believed that the concerned of Halal or non-Halal issues is a small matter but the way companies handle the product in a good system and follow the Halal standard are the vital issues.

According to Tierman [10], for an effective logistics management of a Halal supply chain it is important to have Halal assurance system into the logistics strategy. Tierman said that, the company should have a solid visibility of its supply chain, supported by key performance indicators and finally, regular Halal logistics audits should take place to ensure that the Halal logistics performance is under control. All Halal LSPs (CsA, CsB and CsC) bear with this Halal integrated strategy therefore trying to achieve it with ICT assistance and implementation especially to cater visibility of its Halal

supply chain. They realized that information visibility is crucial between suppliers and within the company also. This is particularly important as poor performance on Halal has shown to have major implications for the image of the company and its brand, which can take years to recover. Halal logistics and Halal transportation guidelines are therefore important to be addressed in the contract between shipper and logistics service provider.

Organizational Related Factors

Awareness – willing to adopt: This study estimates the awareness by using the intention of ICT adoption and of Halal business extension via ICT. Therefore, it is possible to assume that the Halal LSPs (CsA, CsB, and CsC) in the study have the positive awareness of ICT adoption in the light of their intention and efforts to adopt ICT for Halal monitoring. They also invest in technology, which plays an important role in providing product traceability through the storage of data such as product designated code, batch manufacturing number, expiry date, etc. The result shows that higher Halal awareness and awareness about ICT has played a very important role in ICT adoption and extension.

Organizational Readiness: This factor is the existence of external and internal information system that provides the development of customer and partner relationship management mechanism for Halal. CsA and CsC also felt IT maturity and organizations readiness is the major affecting factor when planning to adopt an ICT.

Environmental Related Factors

Government Incentives and Support

a) Halal logistic standard on transportation MS2400 (2010):

All Halal LSPs in the study are Malaysia's Halal Jakim-certified logistics provider and also apply for Halal logistic standard that covers on transportation, warehouse and retailing. This is a driving factor as to comply with the standard; the organization must establish and apply a traceability system that enables the identification of goods and/or cargo in the transportation chain services, the identification of the inbound goods and/or cargo for the processing stages from the immediate suppliers and distribution routes at destination of the goods and/or cargo. [20]. Some Halal LSPs (CsA, CsB) already apply the traceability system for fulfilling the standard

requirement. This can be seen as influencing factors that impact the process of ICT adoption.

b) Relative Incentive offered for Halal Business and ICT application

In this study, there is not enough mention about the government support toward ICT application. However, most Halal LSPs desire various and appropriate support from the government. Some of Halal LSPs (CsA and CsC) have used one of the ICT service platforms developed by the support of the government According to Malayisan Logistic Directory [5], in terms of government support, attractive tax incentives are offered for businesses involved in Halal products and services. Under the incentives, Halal logistics operators are eligible for: (i) Full income tax exemption for a period of five years; OR 100% income tax exemption on qualifying capital expenditure for a period of 5 years. AND (ii) Exemption on import duty and sales tax on equipment, components and machinery used directly in the Cold Room operations subject to current policies. Realizing these benefits, most Halal LSPs (CsA, CsB and CsC) take these incentives as to encourage new investments in their Halal business. Besides, Halal LSPs also gains some benefit if use modern and state-of-the-art machinery, ICT and equipment in producing high quality 'Halal' in their logistic activities that comply with the Halal standard. Halal LSPs (CsA) spending RM7 million to RM10 million in 2011 as part of its expansion plan to meet rising Halal logistics demand nationwide. So, positive government supports and roles are among factors that may impact the ICT adoption process.

c) Halal Program Initiatives

All Halal LSPs (CsA, CsB and CsC) in the study have used an ICT service platform provided by Halal Development Centre (HDC), which have played an important role in providing many programs and training related to ICT adoption in Halal sector. The training helped Halal LSPs on how to comply with the Halal logistic standard. They were organized in 2006 by the enforcement of government legislation to promote ICT adoption among LSPs. To continuously ensure Halal integrity in its service, (CsA, CsB, CsC) has increased efforts and resources in facility maintenance and training for its employees. This initiative is to create awareness and knowledge amongst its employees in managing halal products as well as ensure its effectiveness in terms of application. The CsB and CsA will send their Halal officer to join the Halal training course once a year to master in Halal transportation's issues for example sharing container, lack of visibility across an entire supply chain

includes poor container identification, segregating allocation between Halal and non-Halal product in same container (for contamination avoidance).

Environment Uncertainty: As local Halal food industry was worth RM45 billion while the global Halal market was valued at about RM2 trillion, the competition between Halal LSPs leading in Halal business are some of the contributing factors. During the interview CsB stated that some Halal LSPs (CsA, CsC) are one of their competitor are moving forward in applying modern ICT to monitor their Halal transportations operation and logistics activities. They (CsB) see this as a new challenge for them to beat their competitors.

5. Discussion

The Halal LSPs in Malaysia have experienced various benefits from the usage of the ICT in their Halal logistic activities. There are two main reasons why the Malaysian Halal LSP's wants to adopt ICT in monitoring Halal integrity; first, to assist assurance of Halal integrity throughout the supply chain, and second, to increase efficiency of the logistics performance. These are very similar to the benefits found in other literature which include the increase in Halal transparency during food production, increase in consumer trust on the Halalness due to the increase in the amount of information about the production process, food-safety control [26], and making information available along the supply chain [13]. Better organization of supply chains increased the Halal performance at the destination [10] and ease of access to know Halal status in a few second without cost. Moreover, the adoption of ICT among the Halal LSPs is positive if the characteristic of ICT are compatible with the Halal requirement.

Among technology related factors, the cost for using ICT currently in most Halal LSPs think that it is a kind of investment. This thought seems to come from the higher awareness of improvement services after they achieved the benefit and the satisfaction of the ICT usage. In addition, they are willing to adopt other ICT to extend the market and to pursue the efficacy of their Halal business. In this case, however, cost is still a crucial barrier to adopt ICT even in the LSPs that are already adopting the ICT service platforms and where their awareness and the intention of ICT adoption are increasing. It also shows that the cost of ICT adoption could be decreased gradually, depending on the level of ICT development and the degree of the assistance of the external environment.

Of environmental related factors, it can be seen that the more the provision of government support, the more positively that Malaysian Halal LSP will adopt innovation in Halal logistic technology. The relative incentives from government encourage Halal LSPs to invest in Halal market. Also for organizational factors, the higher the awareness of the top managements and their readiness to adopt ICT in their organization will influence the ICT diffusion in Halal operation.

As an indirect factor impacting ICT adoption in the Halal LSPs, all Halal related factors shows the motivation of Halal LSPs to adopt ICT for monitoring Halal. In the analysis of data obtained from interviews, three technological components can be identified that suit and compatible for Halal transportation:

a) Location tracking – system to determine location of Halal goods being delivered to customer
b) Identification of product – system to identify the information of goods (i.e history from immediate supplier), which in the basic form, automatic identification technologies help to collect the shipment identification number and information, and provide this information as an input to the rest of the system.
c) Data Communication - technologies to access and deliver the information

In the case of Halal transportation's operation (HTO), information could mean the Halal goods location, point of origin and destination, the content, the inspection results, etc. These traceability systems can be used to provide real time global Halal information for internal use in terminal operation or in transportations chains. For instance client may want to have accurate Halal information on where their containers are and when they arrive, and the governments may desire to ensure that cargo arriving on land is properly taxed or dangerous goods are not smuggled.

Based on the above discussion and the research framework as shown in Figure 2 and Table 2, we propose the propositions as follow:

Proposition 1:
The implementation of HTO is positively related to Halal transportation standard (MS2400l:2010)

Proposition 2:
The more explicit the technology towards HTO requirement, the more likely that Malaysian Halal LSP will adopt innovation in Halal logistic technology / ICT

Proposition 3:
The more the organizational encouragement, the more likely that Malaysian Halal LSP will adopt innovation in Halal logistic technology / ICT

Proposition 4:

The more the environment uncertainty, the more likely that Malaysian Halal LSP will adopt innovation in Halal logistic technology /ICT

Proposition 5:

The more the provision of government support, the more likely that Malaysian Halal LSP will adopt innovation in Halal logistic technology / ICT

6. Conclusion

This research analyzed the collected qualitative data, given the exploratory nature of the study. The research outcomes show that technology related factors and Halal related factors contributed positively to efficient Halal LSPs operation while the government factors are very important in the reduction of the main barriers and the creation of the atmosphere of ICT adoption in Halal LSP sector. These factors are the influencing factors that give impact to the process of ICT adoption in Halal transportation. In addition, this study also categorized technological components of ICT adoption for Halal controls in transportation into three types: location and tracking, identification of goods and/or cargo and data communication.

This study proposes guidelines for logistics service innovations in the area of logistics and Halal transportations. Besides, the study discussed the improvement in Halal services after they achieved the benefit and the satisfaction of the ICT usage which have taken into consideration several factors. This study also contributes to the advancement of knowledge through the application of Halal concept into logistics service practices. The needs to be innovative in initiating more logistics services that are based on Halal concept are crucial in meeting the needs of the increasing demand by the customers especially the Muslims. The findings provide insights to the practitioners of the importance to be innovative in maintaining Halal integrity along the supply chains to fulfill the growing demand of the Halal products.

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www.IJCSI.org

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