

Information Communication Technology Adoption Process for Malaysia Halal Transportation

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Abstract—The purpose of this paper is to propose the Information Communication Technology (ICT) adoption process for Malaysia Halal Transportation. Three leading Halal Logistic Service Providers (Halal LSPs) in Malaysia, which have technology adoption experience for monitoring Halal in transportation and logistics, were interviewed. The assent degree by interviewer on the adoption and the utilization of ICT that complies with Halal transportation standard in their services provided were evaluates. The study finds that the three important element that is considered an important step when deciding to adopt ICT for Halal transportation which are a) Assessing the Halal Transportation's requirement b) Validating the need for technology specifically for Halal Transportation Controls and c) Assessing organizational capabilities or readiness - activate halal transportation critical controls through ICT assistance. The result is expected to provide better understanding of the Halal transportation requirements, ICT characteristics and components, internal and external factors on technological adoption among Halal LSPs in Malaysia.

Index Terms—Halal Transportation, Halal Transportation Process, Halal Logistic Service Providers, Halal Logistic

I. INTRODUCTION

INFORMATION Communication Technology (ICT) plays an important role in monitoring Halal in transportation.

According to Tierman (2009), the use of ICT may increase the effectiveness and organization of the Halal supply chain. The potential benefits that an organization can obtain when it utilizes ICT in logistic are extensive.

Benefits can take a number of forms, such as efficiency gains (e.g. the visibility of information – real time tracking in product handling), increased management effectiveness (e.g. in decision making), and improved Halal business performance (e.g. by entering into strategic alliances with other firms).

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However, it appears through a critical review of the literature that the evaluation of ICT adoption has not been widely studied in Halal transportation in logistic and also in Halal LSPs, and as such research literature around it remains limited. Therefore, Halal LSPs are in seeking answers for the effect of ICT adoption, as it will assist them in understanding the factors such as benefits, barriers and cost that influence the adoption of ICT. The reasons for limited research on ICT adoption in Halal transportation operation may also due to many of LSPs each differing in size, with distinct in serving requirements, distinct organizational structures and functions and, encompassing incoherent levels of IT capacity and capabilities (human and IT infrastructure aspects). This disparity may be attributed to the organizational readiness towards adopting ICT. Besides, their awareness to provide extra value added services that are Halal services that influenced their decision-making process in adopting and deploying versatile ICT-based solutions is high. The disparity among and within LSPs in their organizational operations and functioning, illustrates that there are no specific guidelines available specifically for Halal LSPs regarding the importance of prioritizing specific Halal related factors in ICT adoption process (Tierman, 2006, 2010). Thus, the decision-making process for adopting ICT for Halal transportation controls in logistic are more complex. The lack of guidelines for adopting ICT might be the reason why LSPs or even Halal LSPs do not adopt advanced technology although they have the intention to adopt and realize the potential of ICT in improving Halal services.

Therefore, this paper was aimed to focus on the current Halal transportation technology adoption and utilization process among Halal Logistic Service Providers (Halal LSPs) where those intergrated process were then being studied starting from the decision making process up until the ICT implementation process.

II. LITERATURE REVIEW

A. Halal Transportation

There are many definitions of Halal transportation being discussed in literature and used by other researchers. Table 1 below shows the various definitions of Halal Transportation.

TABLE I
 HALAL TRANSPORTATION DEFINITION

Author	Year	Definition
Halalan Toyyiban Forum	(2010)	<ul style="list-style-type: none"> • Guarantee halal supply chain ‘farm to fork’ • Cross contamination avoidance. • Third party Halalan-Toyyiban process verification
Halal Development Corporation, HDC	(2009)	"The movement by any type of mode of transport of materials, parts and finished inventory in compliance with the general principles of Shariah Law"
Halal Journal – Marco Tierman (Tierman, 2008)	2008	"The basic principle of halal Transportation is to ensure physical segregation of halal cargo from non-halal cargo in transport. This is to avoid cross contamination, avoiding the possibility of making mistakes and ensure that the transportation system is aligned with the expectation of the various Muslim consumers "

Table 1 above shows principle or definition of Halal Transportation which take into consideration some fundamentals but with different definition, objective, and activities within cross contamination and segregation needs. As a conclusion, the author conclude as randomly, the principle of Halal Transportation covers main aspect that is all Halal products must segregated (physical separation) with non-Halal product to avoid cross contamination that may occur for ensuring the integrity of the product at the point of consumption and comply with the Syariah law.

B. Halal Transportation Controls

Halal control in transportation is the process of controlling the ‘Halal’ status during transporting Halal goods to consumer using various type of road of transportation (e.g trucks, lorries, van, etc). According to Husny (2010), for halal goods delivered using any transportation modes, there are risks of these Halal goods can turn into non-halal during the transportation process. Therefore, the words ‘control’ is monitoring the Halal status in transportation activities as to avoid the risk towards Halal is compromised. Figure 1 below illustrates the flow of Halal control in transportation in general. This figure is adapted from Tierman, (2010). CCP1 is stand for *critical control point 1*.

Many dialogues have been held with the industry and halal authorities in Europe, the Middle East and Asia-Pacific with technical committees and working groups under the auspices of International Halal Integration Alliance (IHIA). Important conclusions can be drawn from these discussions: (Tieman, 2009)

1. No mixing of halal goods with non-halal goods in one container/common transportation vehicle in case of bulk shipments.
2. No mixing of halal unitized shipments with severe najis (like pork meat) in container/common transportation storage in case of refrigerated transport.
3. No mixing of halal and non-halal goods one load carrier and the use of tertiary packaging to protect the halal load, not only during transport but throughout the entire supply chain.
4. Physical segregation of halal can also be facilitated through containerization at a lower level.

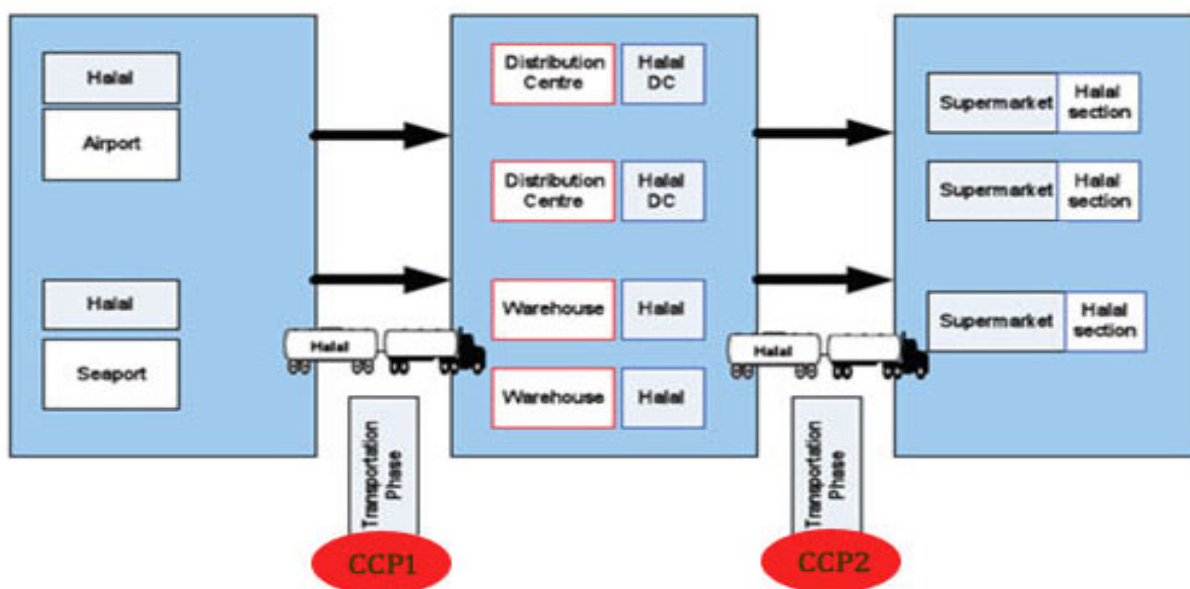


Figure 1: Halal Controls in Transportation

Those principles can be applied in conducting halal control in transportation. As Malaysia setting itself up to be the world hub for halal products and the leading edge on halal supply chain logistics, there's a need to avoid comprising the integrity of halal products by taking control of the entire process from production, storage and transport, and through the supervision over the local suppliers it uses for certain products.

C. Current ICT Adoption Process for Halal Transportation Controls –Innovation-Decision Process Theory (Roger's 1995)

In this study, author decided to apply Roger's Innovation-Decision Process Theory to study the adoption of innovation, specifically on ICT adoption in Halal transportation within Halal LSPs.

The innovation-decision process theory by Roger's (1995) is based on time and five distinct stages. The first stage is *knowledge*. Potential adopters must first learn about the innovation. Second, they must be *persuaded* as to the merits of the innovation. Third, they must *decide* to adopt the innovation. Fourth, once they adopt the innovation, they must *implement* it. Fifth, they must *confirm* that their decision to adopt was the appropriate decision. Once these stages are achieved, then diffusion results (Rogers, 1995). Figure 2 below shows the technological innovation adoption process, portions from Roger's Innovation-Decision Process Theory.

The author has conducted early data collection to review the adoption process. This data explained in the following is based on literature and also non-formal interview. Based on this review, the author will develop and the ICT Adoption Process for Halal Transportation Controls.

III. METHODOLOGY

A. Research Objective

The objective of the research was to study ICT adoption process for Malaysia Halal Transportation. To achieve this objective, overall there were five steps involved. Specific reviews on current Halal transportation process were done according to Roger's theory. Three leading Halal Logistics Service Providers in Malaysia (CsA, CsB, CsC) have been chosen to be the cases. The data is gained from eight interviews conducted separately at both premises comprising of corporate and operation managers from those three LSPs.

B. Qualitative Data

The research strategy for this research is based on interviewing 12 experts in the field of information system in logistic and also Halal logistic. Case study data were collected primarily through structured face-to-face interviews with managers of 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, respondents 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.

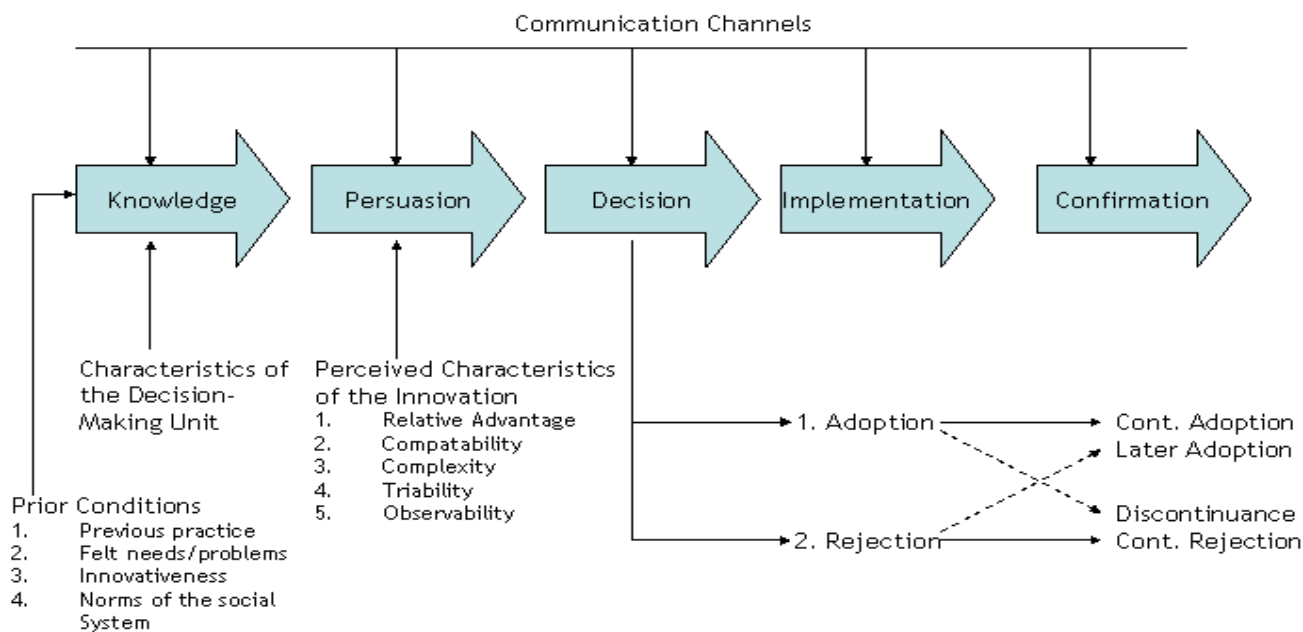


Figure 2: Innovation-Decision Process Theory (Roger's 1995)

C. Data Collection and Analysis

The data collection was conducted from February 2010 until April 2012. The data gathered through extensive interviews with Head of Halal operations, Head of Logistics Infrastructure and ICT manager. The data interview later is transcript. The codes extracted from the interview transcripts interpreted and arranged in order to understand the issues of adoption process, which surrounding participants experience in adopting and deploying ICT in monitoring Halal transportation's controls. Apart from interviews, author conducts a comprehensive observation about how technology being use and applied for monitoring Halal controls during transportation process. The author has the opportunity to see how technologies were applied. Both step of interviews and observation activities are based on proposed ICT adoption process in Table II and following from literature. The analysis and discussion for every phase as elucidated below.

IV. PROPOSED ICT ADOPTION FOR MALAYSIA HALAL TRANSPORTATION PROCESS

A. Development of ICT Adoption Process

This section discusses the proposed ICT adoption process by Malaysian Halal LSPs. In this section, the author will explain the process of adoption in four phases proposed. These four phases are:

- Recognizing the Halal transportations requirements and characteristics
- Recognizing the needs of ICT and its characteristics
- Recognizing the internal technological organizational factors i.e. Organization readiness or capabilities, Technology strategy, Technology culture and People
- Recognizing external technological environmental factors i.e. sources of technologies, government and non-government support agencies, assistance from vendors and consultants and etc

Upon recognizing elements critical, to be integrated in the process of technology adoption among Halal LSPs in Malaysia, a process flow based on the discussion above is constructed as in Table II and the explanation for every phase will be discussed in the following section.

B. ICT Adoption Process for Halal Transportation Proposed

- Phase 1: Identification of Halal Transportations Critical Control and Requirement

This refers to the knowledge of Halal transportations requirements. In this stage, the manager and the staff becoming aware of an innovation in logistic where the syariah (Halal requirements) is being applied along the supply chain (farm to fork) and being interested in understanding how it functions. During the data collection activities, the authors have identify some questions that can help authors identify the level of LSP's knowledge (prior conditions) in Halal transportations operations before they make a decision to adopt technological innovation for improving their Halal services. Among the important questions is 'what are the Halal transportations requirements and practice?'

Three Halal LSPs (CsA, CsB, CsC) has determined what are the requirements and the resource needs to support incident response during the Halal transportation's operations. Besides, all Halal LSPs has identified existing guidelines or standard available to support response and recovery operations regarding Halal Transportations Critical Controls.

- Phase 2: Identification of Technology Characteristics and Requirement

LSPs generally deal with a large amount of goods and data. Data collection and exchange are critical for logistics information management and control (Lin, 2007). In the case of Halal transportation services, good quality in data collection can help Halal LSPs not only deliver customers' Halal goods more accurately and efficiently but the Halal integrity also can be maintained at the end of consumptions. Figure 3 the RFID application in CsA warehouses. The importance of technological innovation towards Halal transportation monitoring is a crucial as expressed by the following participants:

"Our Halal Tracking Product System will be monitored 24 hours. As the integrity of Halal product has to be maintained, the movements of product will be monitored, not only when it being delivered to customer (outside) but also in our warehouse. This concern is to avoid the Halal

TABLE II
 ICT ADOPTION PROCESS FOR HALAL TRANSPORTATION CONTROLS PROPOSED

Phase	Activities	Key Output
1 Identification of Halal Transportations Critical Control and Requirement	<ol style="list-style-type: none"> 1. Identify existing standard available on Halal critical controls in transportations operations 2. Determine resources needs to support Halal transportation critical controls 	<ul style="list-style-type: none"> • Analyzing a particular process (<i>the critical controls points and the important stage</i>) where it can be observe how those technologies are put in place to assist the monitoring process. • Considered as an important element that drive other aspects of technology adoption since the Halal integrity status of a goods can only be confirm as 'Halal goods' if they are Shariah compliance.
2 Identification of Technology Characteristics and Requirements (Adapted from Mierka and Zans, 2008)	<ol style="list-style-type: none"> 1. Identify the technological innovation factors and its attributes. 2. Identifying the technologies and the components (<i>the criteria for selection to cater Halal transportation requirement above</i>) 3. Rating the technology according to specific requirements 4. Rating the importance of each attribute 	<ul style="list-style-type: none"> • An evaluation of a list of all possible technologies that are related to Halal transportations controls process, Halal performances efficiency in transportations operations and the competitive advantage of a firm. • Considered as an important requirement as technology can only produce a value when it is integrated with other key performance indicators /factors.
3 Internal Evaluation	<ol style="list-style-type: none"> 1. Assessing organizational readiness 2. Technological readiness 3. Resource capabilities 4. Quality of human resource 	<ul style="list-style-type: none"> • An evaluation of current status of organization and technology applications. • Considered as an important element that drives other aspects of technology adoption since organization readiness could determine the gap between current condition and desired condition (<i>desired ICT features for Halal transportation controls</i>).
4 External Evaluation	<p>Identify the supports in nurturing technology adoption among Halal LSPs in Malaysia.</p> <ol style="list-style-type: none"> 1. Competitive pressure 2. Suppliers/buyers (transport logistic company) 3. Public policy (Halal transportation standard) 4. Government's role 	<p>Identification of supports related to technology adoption in Malaysia, which includes the government support mechanism, consultancy form vendors, relevant incentives, and many more.</p>

goods mixed with non-halal goods. This is where the system and technology were used.” CsA

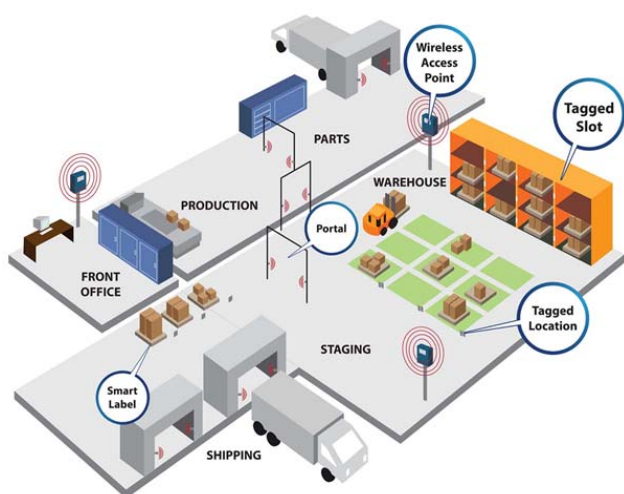


Figure 3: CsA Warehouses and their RFID Application

- Phase 3: Internal Evaluation

In phase 3, an evaluation of status of organization and technology applications has been proposed. This phase is considered as an important element that drives other aspects of technology adoption since organization readiness could determine the gap between current condition and desired condition (desired ICT features for Halal transportation controls). Among the questions is ‘What is the level of ICT adoption in your company in providing services to customer and what is your strategy for ICT implementations?’

Halal LSPs has initiated internal capabilities available and current organization's readiness support for Halal Transportations operations. Before planning to adopt an ICT for their Halal services, CsA and CsB have identified their ICT readiness and current condition organizations. Because one of the primary functions of the logistics service providers is to provide a communication network that links the customers and the manufacturers, the nature of logistics service today demands that firms can interact with their customers and manufacturers instantaneously. The common problems that face logistics service providers are how to improve their efficiency and effectiveness in managing the information flow in the supply chain. Accordingly, to the logistics activities, logistics information systems include the

application of data collection systems, data acquisition technologies (RFID, GPS), decision support systems and the application of the Internet (Lin, 2007).

“We believe that we can utilize RFID Technology as suitable alternatives than Barcode Technology to monitor halal goods” CsC

“The need for particular type of ICT that can help the company in replacing Barcode Technology has been analysed” CsC

“We also aware that our company did not possessed sufficient manpower to handle neither complex IT system nor Halal integrity monitoring in warehouse and transportation activities at that time. So we outsourced to vendors” CsA

At the same time, they also make sure that their organization capabilities meet ongoing Halal Transportation Critical Control needs through appropriate ICT solution application. Among the capabilities is to make sure that system is established and in place to monitor Halal controls during transportation process.

“This automated system (STAR KN System), will track all incoming and outgoing human and materials resources is in place to include provider resource and recipient resources.”CsA

“Tracking system applied in our Halal services is established to track document resource type, where resources is needed (physical location), who requested, point of contact, resources immediate supplier and estimate time of arrival (ETA) of delivery.” CsB

TABLE III
VALIDATING THE NEED FOR TECHNOLOGY
SPECIFICALLY FOR HALAL TRANSPORTATION CONTROL (ACTIVITY 2)

No	Task (sub-activities)	Summary Findings
1.1	Identify technological components involved in; <ul style="list-style-type: none"> ▪ Inbound transportation ▪ Outbound transportation 	<ul style="list-style-type: none"> ▪ Location tracking – System to determine location of Halal goods being delivered to customer (e.g. DGPS, RFID) ▪ Identification 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. (e.g. RFID, Barcode, OCR) ▪ Data communication - Technologies to access and deliver the information (e.g. E-Commerce, Internet etc)
1.2	Gain an information from secondary resources (e.g reports, standard) <ul style="list-style-type: none"> ▪ Identify Halal Transportation process characteristic ▪ Identify Process 	<p>Process Characteristic In Halal transportation requirement, all inbound and outbound transportation services shall be described in documents to the extent needed to conduct the risk analysis; the Halal transportation critical control point:</p> <ul style="list-style-type: none"> a) Description of containers and equipment (trucks, van, etc)

Flow

- b) Mode of transportation
- c) Placement, stacking and storage condition
- d) Conduct check list prior to dispatch and receiving
- e) Handling and distribution activities
- f) Acceptance criteria or specifications appropriate for the transportation services
- g) The information shall be kept updated

Process Flow

Malaysian Halal LSPs shall prepare a complete flow of diagrams of the process covered by the Halalan Toyiban standard, shall be clear, accurate include the following:

- a) The sequence and interaction of all steps in the operation
- b) Any agents and/or assigns involve
- c) Where inbound and outbound goods, and intermediate goods are released
- d) Where inbound and outbound goods intermediate goods enter the flow. Where human contacts is involved

Where the Halal transportation critical controls points are identified

Transportation Activities

- a) Customer instruction
- b) Identification and separation on non-Halal products
- c) Incoming goods subjects to integrity checks
- d) Goods transfer to warehouse
- e) Unload goods to pick face location
- f) Storage at cold room location (frozen and chilled products)
- g) Storage at ante room (for ambient products)
- h) Maintenance of cold chain
- i) Sorting of goods according to customers order (SO)
- j) Supplier monitoring
- k) Custom or authorities inspection

Data Item or Information Involved

- 1.3
 - Identify transportation activities (key activities in monitoring Halal transportations controls)
 - Identify data involved for technology requirements
- a) Container number
 - b) Container location
 - c) Weigh & Load type
 - d) Hazardous Placards
 - e) Seal check results
 - f) Damage inspection results
 - g) Empty inspection results
 - h) Truck identification
 - i) External drivers personal identification
 - j) Container handling equipment identification & vehicle positioning

- Phase 4: External Evaluation

The findings from data collection found that an external support from government, vendors and consultants are an important factors involved during the ICT implementation process. ICT vendors and consultant were introduced into the ICT adoption process by Halal LSPs to assist with the technical implementation. The study found that during the implementation stage, the role of IT vendors and consultants became more apparent as they were responsible for

acquisition, installation, and training for the manager and staff to use such systems.

“The upgrading module system for Halal services was made in a month and then the IT Vendors were visiting us daily after that to resolve any issues that arose during the first week application.” CsC

A result discussion from phase 1 and 2 gives an important finding about necessary activities that need to be done during the earlier process of ICT adoption. What distinguishes between applying technological innovations for Halal transportations critical control is to identify what is the requirement and how technology plays a role in meeting those needs?

V. CONCLUSION

The research was undertaken to investigate the process of ICT adoption for Halal Transportation controls among Halal Logistic Service Providers. The motivation is driven by the evidence that no research was done in exploring the usage of ICT in Halal transportation.

As conclusion, the research has discussed on the data collection findings and discussion on the importance of ICT adoption process as a competitive resource for Halal LSPs. Four phases were proposed as a process to identify technology adoption process among Halal LSPs in Malaysia. The result is expected to provide better understanding of the Halal transportation requirements, ICT characteristics and components, internal and external factors on technological adoption among Halal LSPs in Malaysia. Output from these findings has raised the idea for authors to propose a guideline that explain the process flow and the steps that are needed for ICT adoption in Halal transportation's operation controls.

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