

Mantaining Halal Cold Chain Warehouse Temperature Stability Using Iot To Increase Halal Food Brand Equity

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Abstract

As the largest Moslem population in the world, Indonesia needs halal food security guarantees. The availability of the abundant natural resources (animals and plants) make Indonesia has a great opportunity to become a Controlled Halal Cold Chain Center from upstream to downstream, especially during warehouse storage. However, Indonesia has not paid special attention to the preservation of quality and halal in terms of temperature stability for sensitive items to temperature changes. For that reason, logistics actors in Indonesia are advised to utilize the Internet of Things (IoT) by using the cloud-based system in handling halal cold chain to facilitate the tracking of goods, transparency, and integrated with all related parties. If this is implemented, Indonesia will have the potency to control the Halal Cold Chain at world level and encourage Indonesia to be ready to become a World Halal Cold Chain Mecca with guaranteed quality and security. This research was conducted by using the qualitative method because it can to indicates clearly and deeply all the activities that have been done. The result shown indicates that Indonesia may use my cargo platform as a tracking solution and travel history of IoT-based goods. We suggest that My Cargo platform to add temperature control feature from upstream to downstream. The usage of this platform can increase the brand equity of Halal Food to the customers.

Keywords: halal food; halal cold-chain warehouse; internet of things; brand equity

Introduction

According to the census in 2010, Islam adherents in Indonesia amounted to 87.18% of 237,641,326 (Badan Pusat Statistik Indonesia, n.d.). Every day they have to use and consume something that complies with halal standards according to Islam. According to the Quran, Halal means 'permitted' or 'lawful'. It means allowed for consumption and used by Moslem based on the Sharia, which is Islamic Law itself, that refers to food and other edible. Moslem has a responsibility to ensure that any food or beverages they consumed or any activities in their daily lives are clean, hygienic, and not harm their health and well-being. Halal emphasizes cleanness in all aspects of a human being. It is a new way to benchmark quality. Halal trade is the trade of quality certified products that

have used international standards in production and hygiene. Laws of Republic Indonesia Number 33 of 2014 strengthens The Organizer of Halal Product Guarantees or Badan Penyelenggara Jaminan Produk Halal (BPJPH) as a halal certification body and conducts audits, determines fatwas, and issues halal certificates. However, in developing countries, especially Indonesia, halal stamps, especially on cold chain goods as a unified supply chain that handles temperature sensitive products, have not received special attention. (UU No. 33 Tahun 2014 Tentang Jaminan Produk Halal, 2014).

Handling fruits, vegetables, meat, fish, medicines, blood transfusions and organs, and commodities that are sensitive to temperature changes must be kept at a constant temperature so that all parties concerned can know the history of the goods received or consumed in the fresh and halal state.

Therefore, Indonesia which is dominated by Moslem society needs facilities that provide services to temperature control from upstream to downstream to identify problems and reduce the risk of damage goods that susceptible to temperature change by using the Internet of Things (IoT) that connect all stakeholders to control the temperature of their goods remotely. Moslem has a responsibility to ensure that any food or beverages they consumed or any activities in their daily lives are clean, hygienic, and not harm their health and well-being.

- Halal Logistics

First of all, according to Mariam (2012) here is the definition of Halal Logistics, *“it is a process of planning, implementing and managing the efficient, seamless flow and storage of Halal Certified products (Raw materials, semi-finished or finished good) from the origin to the final consumption ensuring full Sharia compliance”* (Abdul Majid, Hirawaty Kamarulzaman, & Abdul Rashid, 2014).

- Halal Warehouse

As part of the Halal Supply Chain activities, Halal products and non-Halal products must be separated. Once Halal products enter the warehouse, all tools that are related to handle the products must be different from the non-Halal ones. *“Also, the Halal products should be placed on a different rack”* (Tieman, 2007a; Talib et al., 2010). *“In other words, if the food is not handled or stored accordingly, it would not be considered as*

Halal” (Alam & Sayuti, 2011). Tieman (2007) also mentioned that the integrity of halalness could be maintained if the products were treated in a right way from the beginning until the end of the supply chain process. (Tieman, 2011). Relying on the fact that the Halal food supply chain integrity is becoming important topic (Tieman, 2007b), It is better the Halal certified companies to extend their focus to the halalness of their entire supply chain process, so, it can meet the expectations and requirements needed in the Moslem market. (Ngh, Zainuddin, & Thurasamy, 2010).

- Cold Chain

Mr. Simatupang explained that cold chains are part of a supply chain that aims to keep them throughout processes, and distributions, to consumers, while management is the best in analyzing, using, performing, and validating to be effective and efficient (Simatupang, 2016). According to Sondoro, the correct design and the right use of cold storage can minimize damage during storage and extend the shelf life of the product. The most important design factors are low temperature, uniformity of temperature in the whole room cold storage, temperature stability with minimal fluctuation, good air distribution maintains temperature uniformity, minimum air circulation to prevent dehydration and minimum air ingress to minimize fluctuations (Yunias Sondoro, 2011).



Figure 1 Industrial Technology Research Institute Taiwan
Source: (Kuo, 2017)

- Internet of Thing (IoT)

Meanwhile, according to Casagras (Coordinator and support action for global RFID-related activities and standardization) defines the Internet of Things (IoT) as a global network infrastructure, which combines virtual and physical objects, and also communication skills. This combination will offer its user necessary capabilities as a foundation for the development of independent cooperative applications and services. Henceforth, the above explanation can also consider as a high degree of autonomous data capture, network connectivity, event transfer, and interoperability. Internet of things technology is an amazing and helpful feature. If it is implemented, this technology will surely help and serve as a helpful facility for human work. (Pamungkas, 2018).

- Halal Blockchain

Marco Tieman and Mohd Ridzuan Darun (2017) concluded that Halal Blockchains provide clear benefits for their users. For better credibility, halal brands and halal certification bodies should adapt to this new invention to support and guarantee their halalness. Halal Blockchain can support their users in transportation and warehousing downstream of the supply chain process. *"Harmonization and standardization of Halal Supply Chain standards in different jurisdictions will be essential in the coming years to better support halal industries and their global supply chains."* So they said. (International Institute of Advanced Islamic Studies Malaysia. & Thomson Gale (Firm), 2009).

- Brand Equity

"Brand Equity is a customer perceives a brand's equity as the added value to the functional product or service by associating it with the brand name." (David A. Aaker, n.d.). Brand equity in halal products has greater responsibility to consumers, because in addition to complying with the regulations of the halal product industry must also comply with the provisions of Islamic sharia. Muslim consumers are very sensitive to halal certification on the raw or processed materials they will consume.

Method

This research approach is qualitative to depict in depth how to Maintain Warehouse Temperature Stability in Halal Cold Chain using IoT. Data collection is done through a

structured interview, semi-structured and in-depth interview and focuses group discussion. The data analysis technique used in this research is developed by Miles and Huberman which includes (after data collection) data reduction, separation of data from unfocused, too detailed and others so that the data will show the pattern or theme. Next is to display data (data display) that serves to help understanding for advanced analysis of an information or event. The last process is the conclusion of the researchers based on the pattern and theme. Withdrawal conclusion is done continuously, that is while doing at the time of data reduction and data display done (Miles, Huberman, & Saldana, 2014).

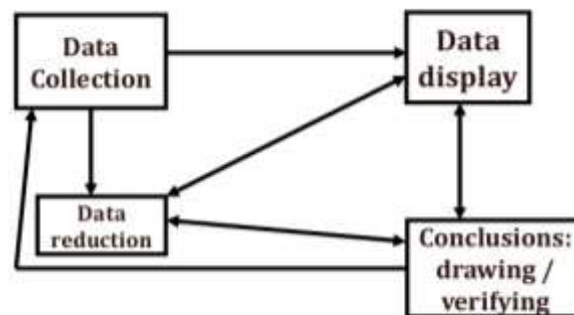


Figure 2

Overview of Qualitative Data Analysis

Source: Miles and Huberman, 1994

Discussion and Result

According to Fleishman-Hillard Majlis, Indonesia is a country whose population is dominated by Moslem and ranked first in the world after Pakistan (178 million inhabitants) and India (177 million). From the picture above, we can see that the expenditures produced from halal food are ranked the second . Thus Indonesia has a huge opportunity to become the largest producer or service provider center of halal logistics in the world due to the following reasons:

1. The Availability of resources we have.
2. The majority of the existing Islamic population in Indonesia that generates the potential for the creation of a "Halal" product certification body.

3. Indonesia's strategic position which plays a very important role in the world trade routes.



Figure 3
The Global Islamic Economy Report 2013
Source: (Simatupang, 2016)

Based on the meeting held by Universiti Malaysia Pahang in Kuantan (Malaysia) at 15 May 2017, showed that halal supply chains have certain problems to be solved, namely in traceability and organising product recalls, transportation and storage in supply chain downstream don't meet the halal requirements, unreliable end-to-end chain integrity from source to end customer, different code of conduct of different markets, and lack of integration in information technology systems. (International Institute of Advanced Islamic Studies Malaysia. & Thomson Gale (Firm), 2009)

According to the IIR (International Institute of Refrigeration), the lack of a cold chain causes significant global food losses: up to almost 20% of the global food supply. In developed countries, food losses from the absence of refrigeration account for nearly 9% of the total food production, and 23% on average in developing countries(Coulomb, Dupon, & Pichard, 2015).

In handling, the cold chain has a heavy obstacle about the ideal temperature of each item because it has a different ideal temperature. For livestock commonly consumed by the Indonesian people (cattle, goats, poultry and fish) decay in meat can occur due to pathogenic bacteria and *Fasciola hepatica* (liver worm)

("Penyakit_FASCIOSIS.pdf," n.d.), whereas for fruits and vegetables other than can be attacked by bacteria biotic pathogens, this can be attacked by abiotic pathogens caused by the influence of extreme temperatures. A number of tropical and subtropical fruits and vegetables are susceptible to damage due to chilling injury (Soesanto, 2006). In the Hepatitis B-PID vaccine and DPT-HB vaccine, for example, at a temperature of 0.5o C, it can last for a maximum of 30 minutes(Kesmas, 2014). Looking at Loekas Soesanto's statement above, standardization in the cold chain is very important, but Indonesia does not yet have cold chain logistics standards and temperature standards for raw materials and refined halal preparations. McKinsey Global Institute sees the Internet of Things (IoT) as a top disruptive technology trend that will have an impact of as much as US\$6 trillion on the world economy by 2025 with 50 billion connected devices. There is a range of technologies which are in some ways complementary but overlap with considerable competition for these devices while fulfilling the ultra-low cost, ultra-low energy and deep coverage requirements necessary for IoT applications("FOOD COLD CHAIN OPTIMISATION: Improving energy productivity using real time food condition monitoring through the chain," 2017). Many analysts forecast the global IT spending in cold chain logistics market to grow at a compound annual growth rate (CAGR) surpassing 8% during the forecast period, according to a report published by Global cold chain forum". The research study covers the present scenario and growth prospects of the global IT spending in cold chain logistics market for 2016 through 2020. Based on topography, it considered the following regions: Asia and Pacific (APAC), Europe, Middle East and Africa (EMEA), and the Americas. In 2015, the Americas accounted for almost half of the share of the market with 48.25%. EMEA accounted for 28.24% and APAC accounted for the 23.51% of the overall market(Madhusudhan Ranganthamuralidhar, 2018).

Nowadays, the development of IoT (Internet of Things) in the cold chain world has been developed. Generally, track cold chain trips using Radio Frequency Identification (RFID) and Wireless Sensor Network (WSN) sensors to monitor environmental parameters such as temperature and humidity. Some use WSN or combine it with RFID(Ko, Kwak, Choi, & Song, 2016).

According to (Department of Finance of Australian Government, 2013), Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Cloud also can be considered as an IoT because it can manage itself and do its own task/work automatically. There are so many frameworks to control the cold chain temperatures suggested by the researchers. Zhang, Liu, Mu, Moga, and Zhang (2009) developed a temperature controlled traceability system for frozen and cold foods during storage and transportation. The integrated RFID system with GPS, mobile communications with Time Temperature Tolerance (TTT) theory can automate tasks, such as daily work routines, and across communicate information flow between the manager, driver, stakeholder and inconvenience about arrival time (Aung & Chang, 2014). Daesik Ko, Yoonsik Kwak, Dojin Choi and Seokil Song (2015) proposed the SCCAF (Smart Cold Chain Application Framework) working on Hadoop and Spark. Hadoop is a framework that allows distributed processing of large data sets across computer groups using a simple programming model whereas Spark is a fast and common machine for large-scale data processing. Spark allows user programs to load data into memory clusters and requests repeatedly. Performance up to 100 times faster must be the application of Hadoop (Ko et al., 2016).

The proposed SCAAF application framework for smart cold chain provides PaaS (Platform as a Service) and IaaS (Infra as a Service) so that intelligent cold chain management system can be developed and operated at low cost and in a short time. SCCAF uses Cloud and IoT techniques that allow heterogeneous IoT such as RFID tags, Node Sensors, WSN Nodes, BLE (Bluetooth Low Energy) Node Sensors, etc. to be used on smartphones and tablets that make all changes in information and data transmitted quickly and easily. Storage manager of all SCCAF data types such as data flow sensing, IOT device data, user data, product data, transaction data and external data. External data are weather data, price data and so on used for analysis. Data storage managers use RDBMS for IoT device data, users, data, product data and transaction data that are

structured data formats(Ko et al., 2016).India has created a long-range temperature monitoring device called Nimble Wireless and distribution manager notices IRIS applications via text or email when temperature variations occur that offer constant connectivity (without the need for cloud-based signal wi-fi) and GPS features to pinpoint accurate positions (“Nimble,” n.d.).

According to Mr. Doddy Himawan, in Indonesia, ILCS (Integrasi Logistik Cipta Solusi) has created My Cargo as a solution for logistics modules that facilitate service users in performing port logistics process online in one portal, including Delivery Order (DO) online, warehouse management online, track and trace container online, and more. With 24-hour online service, all related service users can monitor activity easily, cashless transactions, reports in real time, and most importantly are integrated with all logistics modules. At the warehouse service, My Cargo offers inventory management services, stock transfer, barcode label printing, cycle count process, integration with warehouse devices, ports, custom, and ERP customers(ILCS (Integrasi Logistik Cipta Solusi), n.d.). This can be applied in all warehouses especially for warehouses that handle cold chains to manage cold and well-controlled warehouses. All information contained in the warehouse can be known by the parties concerned to monitor whether the cold chain is running and stored properly.

This solution can be a troubleshooter in trip tracking and supply chain history from upstream to downstream, especially on halal cold chain. However, My Cargo does not yet have a temperature control feature for cold cargo. It would be better if IoT-based platforms like this can be applied throughout Indonesia so that all activities and history of the movement of goods can be integrated and transparent especially for goods that are rotten, damaged, and need special handling.

Conclusion

Indonesia needs an IoT-based platform on the cold chain so that all parties can access historical data of goods including temperature, pressure, light exposure, humidity, shock, vibration, gas content, and travel routes so that the identification and handling of problems in the cold chain become faster and easy. Implementation of IoT in the cold chain promotes the achievement of constant halal quality by complying with safety

standards determined by industry standards and avoiding damage. The suggestion the use of the My Cargo platform as a solution to trace the history of goods from upstream to downstream in a transparent and integrated manner. To concentrate on a cold chain, My Cargo requires the addition of halal cold chain feature to control the temperature to be applied to halal cold chain in Indonesia and to support Indonesia as a halal cold chain logistic center which is controlled from upstream to downstream.

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