UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF INTEGRATED GREEN HALAL SUPPLY CHAIN MODEL IN FOOD MANUFACTURING INDUSTRY

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By

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July 2019

Chairman : Professor Shamsuddin Sulaiman, PhD
Faculty : Engineering

This project presents the development of integrated supply chain model in halal food manufacturing industry. The model has been integrated with accomplishment and consideration of green supply chain management (GSCM). Halal supply chain is one of most fundamental part in halal food manufacturing industries. The market of halal products is widely distributed throughout the world. There is global increase in the demand for halal products by Islamic countries as well as by non-Islamic countries. Halal food consumers are presently more alert and concern about the integrity of Halal status. Furthermore, they also curious about all the activities involved along the supply chain whether the products that they purchased were truly halal from the beginning to the end. The need of halal supply chain is crucial in ensuring that the concept of halal is not only applicable for the food itself but also for the whole supply chain starting from the farm to the customer. Due to the increasing concerns about environmental issues, many supply chain professionals include food supply chain find it necessary to understand the problems from system perspective rather than in single business entity. Green Supply Chain is then the attempt to measure, analyze and improve performance among various members to ensure that companies are operating in environmentally friendly manner. From the previous supply chain models and the current requirements includes environmental needs, this research project managed to develop an integrated halal food and green supply chain system that can be used by food manufacturers that are developing halal products for better productivity and quality. The identified supply chain components are human resources, process, environment, accreditations, logistics and traceability. These have been verified by food manufacturing companies in Malaysia and Kuwait. Finally, the framework of an integrated green halal supply chain model in food manufacturing industry has been developed successfully.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PEMBANGUNAN MODEL RANTAIAN BEKALAN BERSEPADU HALAL HIJAU DALAM INDUSTRI PEMBUATAN MAKANAN

Oleh

AHMAAD KADMOUSE ALDEEHANI

Julai 2019

Pengerusi : Profesor Shamsuddin Sulaiman, PhD
Fakulti : Kejuruteraan

Projek ini membentangkan pembangunan model rantaian bekalan bersepadu halal hijau dalam industri pengilangan makanan halal. Model ini telah diintegrasikan dengan pencapaian dan pertimbangan pengurusan rantaian bekalan hijau (GSCM). Rantaian bekalan halal merupakan salah satu bahagian yang paling penting dalam industri pembuatan makanan halal. Pasaran produk halal diagihkan secara meluas ke seluruh dunia. Terdapat peningkatan global dalam permintaan produk halal oleh negara-negara Islam dan juga oleh negara-negara bukan Islam. Pengguna makanan halal kini lebih berwaspada dan prihatin mengenai integriti status Halal. Selain itu, mereka juga ingin tahu tentang semua aktiviti yang terlibat di sepanjang rantaian bekalan sama ada produk yang mereka beli benar-benar halal dari awal hingga akhir. Keperluan rantaian bekalan halal adalah penting dalam memastikan konsep halal bukan hanya berkaitan dengan makanan itu sendiri tetapi juga untuk keseluruhan rantaian bekalan bermula dari ladang kepada pelanggan. Disebabkan kebimbangan yang semakin meningkat mengenai isu-isu alam sekitar, ramai golongan profesional rantaian bekalan termasuk rantaian bekalan makanan mendapati perlu untuk memahami masalah dari perspektif sistem dan bukannya dalam entiti perniagaan tunggal. Rantaian Bekalan Hijau kemudiannya cuba untuk mengukur, menganalisis dan meningkatkan prestasi di antara ahli untuk memastikan bahawa syarikat-syarikat beroperasi secara mesra alam. Daripada model-model rantaian bekalan dan keperluan semasa termasuk kehendak persekitaran, projek penyelidikan berupaya membangunkan sistem makanan halal bersepadu dan sistem rantaian bekalan hijau yang boleh digunakan oleh pengilang makanan yang sedang membangunkan produk halal untuk produktiviti dan kualiti yang lebih baik. Komponen rantaian bekalan yang dikenalpasti adalah sumber manusia, proses, persekitaran, akreditasi, logistik dan kebolehkesanan. Komponen ini telah diuji dan disahkan oleh beberapa syarikat di Malaysia dan Kuwait. Akhirnya, satu kerangka model rantaian

bekalan bersepadu halal hijau dalam industry pembuatan makanan telah dibentuk dangan jayanya.

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Declaration by graduate student

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LIST OF ABBREVIATIONS

GMP	Good Manufacturing Practice
GHP	Good Hygienic Practice
GSCM	Green Supply Chain Management
HACCP	Hazard Analysis Critical Control Point
JAKIM	Jabatan Kemajuan Islam Malaysia
SCM	Supply Chain Management

CHAPTER 1

INTRODUCTION

1.1 Background of Study

The food industry grows continuously each year in tandem with the increase of the world population. It is one of the largest manufacturing sectors in the global economic system. One particular segment of the food industry, i.e. the availability of halal food is capturing the interest of discerning consumers worldwide. Halal food is defined as a food allowed or permitted for consumption in accordance with Islamic law. Products certified as halal are products that comply with all aspects of Islamic teachings including cleanliness, sanitation and safety qualities that are synonym with the important aspects of quality food.

The halal food segment contributes about 16% share of the whole global food industry (Van der Spiegel et al., 2012). It receives favourable response not only from Muslims everywhere but, interestingly, also from some Muslim minority countries where the population are now attracted to the segment due to the high quality and safety standards observed in preparing the food. Consequently, there is a significant increase in the demand for halal products not only by Islamic countries but also by countries where the majority of the populace is non-Muslim. This in turn emphasizes the need and demand for a halal supply chain to preserve the confidence of Muslim consumers as well as all other customers globally who recognize the importance of good clean food.

The halal food supply chain involves the operation of managing halal food products along the supply chain from the source of the supply to the customers. The operation must adhere to the halal concept stipulated under Islamic law. The halal products must not be mixed with any non-halal products along the entire supply chain process in order to sustain their halal status.

In halal food supply chain, the main goal is not just to ensure that satisfaction of the customer is achieved, but also to see to it that the halal status of the food product remains intact throughout the whole process of the supply chain. The integrity of the halal food product must be protected by all means, and all necessary steps must be considered by all parties involved in the supply chain to avoid any cross-contamination that will direct to product becoming non-halal, or haram. The food products must not only be halal at the supply chain starting point, but throughout the supply chain until it gets to its final destination.

Thus, it is important to make the right awareness and better understanding among the parties involved in the halal food supply chain on the importance of protecting the halal integrity of the food products. Failure to address this will contribute to dissatisfaction of the halal food consumers and unnecessary wastage of non-consumable halal food products. Furthermore, to cope with the rising demand of halal food from whole over the world, a comprehensive and well managed supply chain management approach need to be embraced to guarantee the accessibility of the halal food product.

Today, environmental pollution is one of the main problems that all industries are facing. Natural environment has become a challenging issue to business organizations in recent years as a result of global and local environmental problems. Many processes in manufacturing are dangerous and have serious effects on environment. Out of all business operations, manufacturing processes have the most impacts on the environment, in terms of pollutants generation, ecosystem disruption and depletion of natural resources (Fiksel, 1996).

Since the early 1990's, manufacturers were under pressure to consider Environmental Management (EM) in all supply chains (Wu and Dunn, 1995). Green Supply Chain Management (GSCM) has emerged to cover environmental issues of supply chain and is generally defined as implementing environmental management throughout the entire supply chain (Lee, 2008).

Due to the increasing concerns about environmental issues, many supply chain professionals find it necessary to understand the problems from system perspective rather than in single business entity (Handfield et al., 2005). Green Supply Chain is then the attempt to measure, analyze and improve performance among various members to ensure that companies are operating in environmentally friendly manner (Sarkis, 2006). Figure 1.1 shows the relations between different parts of green supply chain.

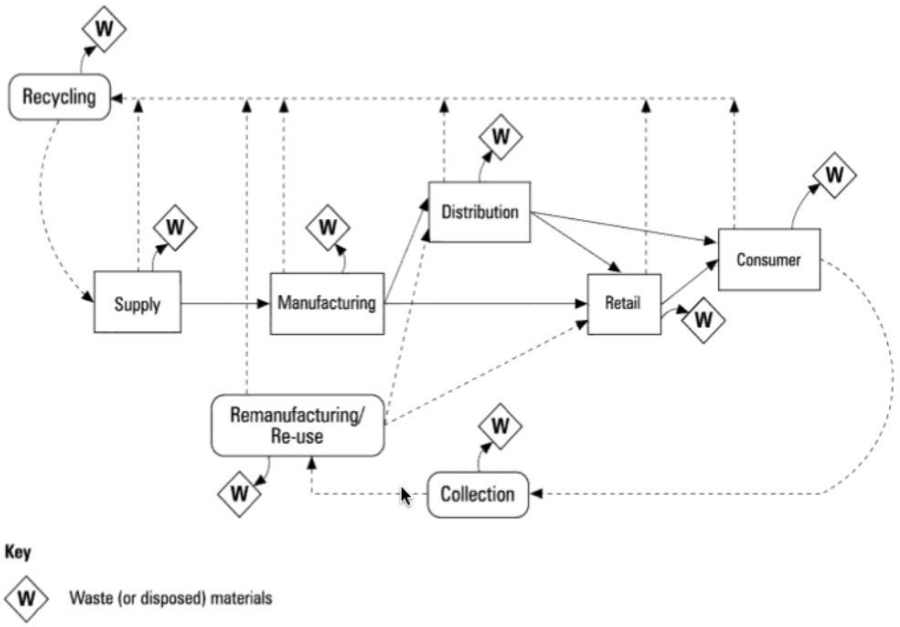

Figure 1.1 : Green Supply Chain
(Source : Otago management graduate review, green supply chain, 2009)

People's attention to green initiatives was less before, but since environmental problems increased, and some of them started to become very serious and dangerous for people's health, they started to consider it as an important factor. An obvious example is the air pollution problem. This issue was well known since many years ago and scientist knew that the air pollution is going to become serious in the future. But as the problem grew and people felt the dirty air, they started to concern themselves (Cousins et al., 2004).

The traditional green initiatives are associated with many weaknesses and problems. Most of the adopted green solutions, especially in developing countries, remain to be the traditional command-and-control or end-of-the-pipe solutions where a firm tries to eliminate or reduce negative environmental impacts, after they are created, rather than adopting a proactive approach to reduce the sources of waste or pollution (Walton et al., 1998). The end-of-the-pipe approach does not eliminate pollutants, but only transforms them from one to another (Sarkis, 2006). Moreover, focusing green practices inside the organization may expose to negative environmental performance of other organizations in its supply chain. For example, the poor environmental performance of small suppliers can affect the performance and image of buying companies (Christmann and Taylor, 2001). In addition, community stakeholders often do not distinguish between an organization's environmental practices and the practices of its suppliers (Rao, 2002).

Studies show that a majority of the world's manufacturing will be accomplished in Asia in the upcoming decades (Rao, 2002). GSCM is gaining popularity in this region, so companies concerned need to pay more attention to GSCM practices to sustain their competitiveness and meet the standards (Zhu and Sarkis, 2006).

Green supply chain management is a new concept in Malaysia. Even though other quality standards such as the ISO 9000, ISO 14000 series were launched as early as 1987, the Malaysian industries only realized the benefits when some of the firms were awarded "registered firms" in 1988 (Rusli et al., 2012). Refer appendix A for a detail information of GSCM in Malaysia.

1.2 Problem Statement

The supply chain has been traditionally defined as an integrated manufacturing process wherein raw materials are transformed into finished products, then delivered to customers. It consists of activities associated with manufacturing, from raw material acquisition to final product delivery (Beamon, 1999).

Supply chain is made up of three main parts i.e. supply, manufacturing, and distribution. Each part in the supply chain can cause pollution and harm to its surroundings. For example, a company may use lead, a highly dangerous substance for the environment, as a raw material in its production. Another example could be global warming due to the increase of greenhouse gasses caused by manufacturing companies. Even in the distribution part of an industry, the transportation vehicles used by the companies may cause serious air pollution. The amount of carbon dioxide which was found to be at around 280 parts per million before the industrial revolution has now reached to an alarming rate of 380 parts per million, and its rise has accelerated. At the present time, humans are adding 2 parts per million on an annual basis. Findings from research shows that a rise in carbon dioxide proportions to more than 450 parts per million would lead to an increase in temperature of up to 2 degrees centigrade. This could result in the faster melting of ice in Greenland and the Antarctic (McKibben, 2007). Companies and the public at large are focusing on environmental problems because of the conflicts that can take place in different directions. Without doubt, there is a risk of human extinction if these crucial problems are not addressed (Ho et al., 2009).

The halal food sector is no longer only an industry that complies with religious requirements. It has now become an economic force in its own right domestically and globally. The flow of the halal food supply chain is critically vulnerable to hazards of food safety contamination and cross-contamination with non-halal materials or products. Halal requires a supply chain approach where the value chain and its supply chain activities totally align with Shariah requirements. Previously, consumers care only about halal foods, but today they are more

aware and concerned about the integrity of halal status and also curious about all the processes involved along the supply chain i.e. whether the products that they purchased were truly halal all the way. In order to ensure that the product is completely halal, it requires a specific procedure of handling, transporting, storing and manufacturing. Therefore, to ensure the halal status of a product, it should be considered from a total movement of the product rather than from a fragmented view.

In Malaysia and many other developing countries, in the early days of abundant resources with slight development pressures, little attention was paid to growing environment protection (Rusli et al., 2012). Recently, the increase in awareness can be witnessed with the establishment of the Ministry of Energy, Green Technology and Water on April 9, 2009 (Eltayeb et al., 2011). Through its agency, various efforts have been implemented on the basis of green principles. However, according to Rao (2002), a majority of the world's manufacturing will be accomplished in Asia in the upcoming decades. Based on this hypothesis, Malaysia's environmental situation is facing a threat and Malaysian manufacturers should be more aware about the effects of this manufacturing growth on the environment.

According to Shing Chyi Chua and Tick Hui Oh (2011), within companies in Malaysia, mainly the larger companies where the headquarters are from the USA, UK, Japan and other European countries, they have already taken the challenge to promote green practices. For the local manufacturing industry, many if not all of them are still having the attitude of wait and see.

Figure 1.3 demonstrates the fact that even within firms that believe green practices are important, not all of them are implementing it.

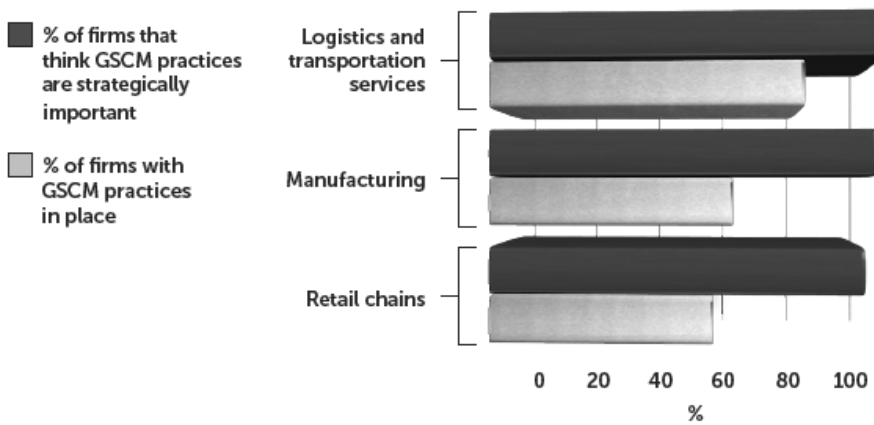

Figure 1.2 : GSCM Practices in Place in Malaysia (Rusli et. Al, 2012)

According to the research literature (Walley and Whitehead, 1994), companies with a traditional view of environmental activities were of the view that these initiatives were not economical and they had the attitude that it generally generates negative returns to shareholders. Many companies still have this view, and that is the main reason for not implementing green initiatives properly even within companies that believe environmental concerns are very important, which is shown in figure 3. Profitability is a very important issue of concern in all industries, and many companies do not inject green initiatives properly in their activities to avoid increase in costs. It is clear that green supply chain management implementation needs additional spending, which results in the increase of costs, but the main issue is whether it will be economical to spend on green supply chain management initiatives.

Based on the articles that have been reviewed, there are limited numbers of academic publications discussing the area of green halal food supply chain and halal integrity, despite an increase in academic publications in the knowledge area of the halal industry for the past few years. Until today, there has not been a unified halal standard in the market, thus providing room for the unethical fabrication of halal logos. Therefore, there is potential for a halal food product traceability system to be in place, to provide transparency of information surrounding food processing, thus allowing customers to be able to track and trace the procedures involved in food preparation.

This research is therefore concentrated to study food supply chain components and develop a model of integrated manufacturing green halal supply chain system in order to enhance the integrity of the halal food supply chain, and to maintain a clean environment in the currently complex food trade manufacturing industry.

1.3 Objective of the Study

Three specific objectives have been identified in this study. The objectives are:

i. To find traceability halal food ingredients, manufacturing processes and raw materials.
ii. To develop a manufacturing halal food supply chain based on the available model.
iii. To develop an integrated manufacturing green halal food supply chain system.

1.4 Scope of Study

The scopes in this study are focusing on the following areas:

i. Food manufacturing industry as a field of study.
ii. It covers Malaysia and Kuwait.
iii. Halal supply chain as the type of supply chain.
iv. Green supply chain management.
v. Manufacturer, contract manufacturing and re-packer are the categories in the food industry.
vi. Halal standards, HACCP, and GMP are referred as the project's standard.

1.5 Overview of the Study

While environmental management principles and standards provide powerful tools that have a potential to generate significant improvements to the environmental performance of organisations, their focus is currently restricted only on creating and documenting environmental policies and procedures (Curkovic et al., 2005). Such policies and procedures may represent efforts to improve environmental performance only within the organisation's operational boundaries rather than being extended throughout the supply chain (Bansal and Roth, 2000). Firms can market themselves as being environmentally proactive by having environmental management systems without undertaking the effort of greening their supply chains (Darnall and Edwards, 2006).

Unlike the traditional environmental management, the concept of green supply chain assumes full responsibility of a firm towards its products from the extraction or acquisition of raw materials up to the final use and disposal of products (Hart, 1995). It represents an application of environmental management principles to the whole set of activities related to the entire customer order cycle, including design, procurement, manufacturing and assembly, packaging, logistics, and distribution (Handfield et al., 1997). This implies that a wide range of initiatives that can be performed within green supply chains.

1.6 Outline of the Thesis

There will be five chapters in this thesis which are introduction, literature review, methodology, results and discussions, and conclusion and recommendations.

This chapter presents the introduction of the study that consists of the background of the study, problem statement, objective of the study and scope of the project.

Chapter 2 presents a review of literature on a few areas, which are on the concept of halal food, supply chain, food supply chain, logistics, traceability, halal standard, Hazard Analysis of Critical Control Point (HACCP) and Good Manufacturing Practice (GMP).

In Chapter 3, it will focus on the methodology by describing how the research is done from the beginning until the end. The research process flow is shown in a flow chart. Other sub-processes will also be explained briefly in this chapter.

Chapter 4 will present the results obtained from the study and the respective discussions. A new integrated halal supply chain model will be developed and the model will be verified. Verification of the model is to ensure that the conceptual model can be correctly implemented into the actual manufacturing industry.

The last chapter i.e. Chapter 5 will conclude the discussions stated in Chapter 4 and some recommendations are proposed for future works.

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LIST OF PUBLICATIONS

Papers in Journal

S.Sulaiman, A.Aldeehani, F.A.Aziz and F. Mustapha (2018). Integrated Halal Supply Chain in Food Manufacturing Industry. Journal of Industrial Engineering Research, Vol 4(3), pp1-5. ISSN:2077-4559.

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A.Aldeehani, S.Sulaiman, F.A.Aziz and F. Mustapha. Development of Green Supply Chain Managementin Food Industry, Proceeding of the Internaltional Conference on Indusrial Engineering and Operation Management, Volume 2018-March, 2018, pp 2489-2494.

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