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Quality Management Measures in Food Supply Chain: An Overview and Case Study of McDonald's Hong Kong

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ABSTRACT

Food is critical to the survival of human beings. High-quality and safety food is not only essential to the health of human beings but also to the economy and sustainable development of a country. With the increase in the number of food contamination incidents and recalls of food products in recent years, the stability and quality of food supply chain has become a worldwide concern. This paper provides an overview of the common quality management measures in food supply chain and examines how McDonald's Hong Kong utilizes some of these measures in controlling and assuring the quality of its food supply chain.

KEYWORDS: Quality Management, Food Supply Chain, McDonald's Hong Kong, Case Study

1 INTRODUCTION

Food is critical to the survival of human beings. It is one of the essential elements in people's daily life. It gives people the energy needed for doing work, raw materials essential for well-being, and a nature's defense against different illnesses (Bourlakis and Weightman, 2007). Besides, food also influences and dominates the performance of countries. The provision of sufficient food supply has been widely found to have significant influence on the economic and social development of a country (Meiburg, 1963).

With the outbreak of a number of food contamination incidents in the past decade, food quality and safety has become a major economic and health problem worldwide (Fu et al., 2014). In relation to this, the concepts of "Food Supply Chain" and "Food Supply Chain Management" are receiving increased attention in the market (Govindan et al., 2013). This paper discusses the common quality management measures currently adopted in food supply chain. It also examines how McDonald's Hong Kong utilizes some of these measures in controlling and assuring the quality of its food supply chain. The paper aims at reviewing useful quality management measures in food distribution and recognizing quality control elements that can serve as foundation for developing framework for effective food supply chain management.

2 FOOD AND FOOD SUPPLY CHAIN

Food refers to those substances – whether raw, semi-processed, or processed – that are consumed by human beings, including drinks, dietary supplements, and food additives (Han et al., 2012). Food is very important to people's health. It provides the body with vitamins, carbohydrates, proteins, and fats that are required for healthy survival (Kalra, 2003). It gives people all the essential nutrients and bioactive compounds for preventing diseases (Patil and Gislerod, 2006). Food also contains various forms of fatty acids, for instance, cholesterol esters, glycolipids, phospholipids, and tri-glycerides. Apart from its role in the health of human beings, food also plays an important role in the economy of a country. From nutritional perspective, food is the fuel for people's bodies as well the fuel for the machines for people's ability to achieve their maximum productive capacity, thereby influencing the ability on which everything else in the economy depends (Schulz, 1948). From business perspective, the food market is one of the rapidly growing sectors of most developed agricultural economies (Sheng et al., 2009). With the increasing importance of food to people and countries, it is critical for the food industry to ensure a safe and efficient global supply and distribution of food.

Food supply chain is the current worldwide focus in the consideration and assurance of food safety (Bosona and Gebresenbet, 2011). Food supply chain is a logistic system of food-related business. It is a sequence of economic activities involved in the movement of food from production to consumption, including pre-production and post-consumption activities. A food supply chain normally consists of a group of interdependent companies working closely together to ensure the smooth flow of food products (Folkerts and Koehorst, 1998). The key players and stakeholders in a typical food supply chain include farmers, manufacturers, warehouses, vendors, wholesalers, and retailers. The close relationship and cooperation between these parties are essential to the success of the food supply chain and, to certain extent, can affect the level of agricultural commodity prices and consumer food prices in the market (Bukeviciute et al., 2009).

A food supply chain traditionally starts at upstream parties like farmers and raw material providers. These upstream parties will send their agricultural products and raw

materials to manufacturers for production. After the production process, those agricultural products and raw materials will become final goods or intermediate goods. Unlike final goods, intermediate goods need to go through one addition step and be further processed before they are sold as final goods. All final goods will then be sent to warehouses for intermediate storage or repackaging. Lastly, these final goods will be shipped to wholesalers and retailers for re-sale to the consumers.

The focus of this paper is on the supply chain of two common types of food, namely fresh food and FMCG food.

2.1 Fresh Food

Fresh food refers to those food items that are grown, raised, picked or fished, without hot processing such as cooking (Chen et al., 2013). Fresh food can be finished on shelves without making deep process (Sun et al., 2015). It is the essential component of healthy diets, bringing good health to people (Mozaffarian and Rimm, 2006; Anderson et al., 2009). The common types of fresh food include vegetables, fruits, seafood, and meats. Since fresh food is highly perishable, the supply chain of fresh food is therefore quite different from the supply chain of other general goods.

2.1.1 Vegetables

Vegetables refer to the roots, stems, leaves, or flowers of plants which are consumed by people through tradition, habit, or custom (Ntuli et al., 2012). Vegetables are very important to the health of human beings. They help people to maintain a healthy digestive system and cure various diseases (Sharma, 2005; Armstrong and Clapham, 2007). There are five main types of final products of vegetables sold in the market, including (i) fresh vegetables that are sold directly, (ii) canned products made with vegetables, (iii) frozen vegetables, (iv) fresh vegetables that are cut and put into plastic bags, and (v) cooked and pre-cooked food with vegetables (Rábade and Alfaro, 2006). Within these five types of final products of vegetables, the fourth type – fresh vegetables that are cut and put into plastic bags – is the most highly perishable one. From reaping to processing, the cycle of these vegetables normally cannot last for more than 5 days. In order to shorten the travel time, some of these vegetables will be transported by air.

To maintain their quality and state of being fresh, most vegetables will be kept in warehouses with temperature control (Bevilacqua et al., 2009). Due to the increase in customer expectations and time arrests, the sale of vegetables has become a crucial part for any supermarkets nowadays (Ahmad and Fehér, 2010).

2.1.2 Fruits

Fruits refer to potions of plants that bear seeds (Roberts et al., 2005). They are the reproductive organs resulted from the development of floral tissues with fertilization or without fertilization (Lozano, 2006). European Union (EU) has one of the largest and best systems in fruit supply chain. The fruit supply chain system in European Union is divided into 4 stages, namely production, wholesaling, retailing, and consumption (China Commodity Net, 2007). China is another big country that produces fruits. However, the fruit supply chain in China is different from the one in European Union. In European Union, “processing” is treated as part of the production stage, whereas, in China, “processing” is always treated as a separate stage. The “processing” of fruits usually involves quality control and repackaging of the fruits. In European Union, the fruit producers and marketers have very close link with different distributors, retailers, and supermarkets for distributing and selling their fruits in the market. Together with good quality control system and high efficiency, the fruit supply chain

system in European Union sets a good model for other countries, like China and Korea, to follow.

Like vegetables, most fruits have to be refrigerated after they have been harvested in order to maintain their freshness and crisp. As a result, this has some implications on the measures to be adopted to ensure their quality throughout the food supply chain.

2.1.3 Meats

Meats are the flesh of animals that are used for people's food (Hallström and Börjesson, 2013). Among different types of meats, beef, and pork are the most popular ones worldwide. In the 2000s, there were a number of incidents in which deceases spread from cows and pigs to humans. Two of the most serious incidents were the mad cow disease in Canada in 2003 (Poulin and Boame, 2003) and the Streptococcus Suis in China in 2005 (Yu et al., 2006). Those incidents have increased people's concern for quality and safety of meats and meat products, resulting in the undertaking of more serious approach to the quality measurement of meats.

One initiative taken is the adoption of RFID (Radio Frequency Identification) in the supply chain of meats. Zhao and Li (2012) illustrate the way that RFID is used in the supply chain of pork in China. Once the pigs are born, they will be raised in the farms. The pigs will have the RFID tags attached to their ears for recording their sex, date of birth, medial, quarantine record, etc. When these pigs are sent to the slaughter houses and even the supermarkets, the tags are still operative and used for updating the status of the pigs and the pork. RFID technology is also found to be used in the supply chain of cows (beef) in Australia, Canada, Europe, Japan, and the USA (Ribeiro et al., 2010). The use of RFID makes it easier for people to identify the origin of the pigs or cows in case of an outbreak of decease among these animals.

2.1.4 Seafood

Seafood is any edible fish or shellfish coming from the sea (Carnés et al., 2007). It is another main food for human beings. Seafood consists of different kinds of fishes (like cods, tunas, and salmons), crustaceans (like crabs, shrimps, and lobsters), and mollusks (like scallops, squids, and snails) (Sicherer et al., 2004). Nowadays, most seafood is distributed and traded globally, in particular those high-value seafood like tunas and lobsters. The supply chain of seafood involves a number of intermediaries operating between the fishermen and the consumers (Roheim, 2008). For frozen seafood, their supply chain will be quite similar to other frozen food. However, for live seafood, there is a unique feature in their supply chain. Since any live seafood needs fresh water to stay alive throughout the shipping and storing process, the provision and maintenance of good quality fresh water is therefore crucial in the supply chain of them.

European Union is by far the largest single market for imported fishes and fish products (Fernández-Tajes et al., 2011). To ensure the quality and safety of seafood and fish products, traceability of these products is critical and has become a fundamental prerequisite in European Union (Luten et al., 2003). Companies are required to keep record of important traceability data of their seafood, like origin of the seafood, distribution, processing history, and state (i.e. location).

2.2 FMCG Food

FMCG (fast moving consumer goods) refer to products that are relatively inexpensive and are frequently purchased and consumed (Miremadi and Faghanie, 2012). FMCG consist of different types of products bought by people daily, like cleaners, soaps, tobacco products,

personal care, cosmetics, and edible oils (Cocks, 2000; Bansal and Sharma, 2012). FMCG industry is characterized by low operating cost, low per capita consumption, and well-established distribution channels (Kavitha, 2012). Due to the high variety of FMCG and the high variation in the demand for them, the supply chain of FMCG is high in complexity (Serdarasan, 2013). The supply chain of FMCG usually comprises a complex network of suppliers and geographically dispersed distribution points.

One category of FMCG is food, commonly referred to as FMCG food. For instance, biscuits, chocolates, instant noodles, and drinks are all popular FMCG food. Producers of FMCG food will pay more effort in building their brand names and creating better packaging. FMCG food is very common in China because of the rapid development of the country and the increasing living standard of the mainland Chinese. FMCG food also contributes significantly to the economy of many Western countries, for example, UK (Francis et al., 2006).

3 VERTICAL INTEGRATION IN FOOD SUPPLY CHAIN

Vertical integration refers to the co-operation between parties at different levels of the supply chain (Caputo and Mininno, 1996). It is intended to balance the supply capacity at the preceding stage of the supply chain against the extent of demand at the succeeding stage of the supply chain (Min and Zhou, 2002). Vertical integration is also considered as an alternative to supply chain management (Ellram, 1991).

Just like in other types of supply chain, vertical integration is also commonly used by companies in food supply chain. There are two types of vertical integration, namely forward integration and backward integration. Forward integration is the flow of information and the management of integration from supplier to producer (manufacturer) to customer, whereas backward integration is the flow of information and the management of integration from the customer to producer (manufacturer) to supplier (Vijayasarathy, 2010). Different parties throughout the food supply chain will be benefited from these two types of vertical integration. For example, if a food supplier integrates and links up with its downstream partners (i.e. distributors and restaurants), it can control the food quantity and prices to meet demand changes instantly. In the other way, if a supermarket integrates and links up with its upstream partners (i.e. food suppliers), it can ensure a stable supply of quality food and reduce costs.

4 COMMON QUALITY MANAGEMENT MEASURES USED IN FOOD SUPPLY CHAIN

In the last two decades, a number of food contamination incidents had been reported (Bernard et al., 1999; Durham, 2005; Bai et al., 2006; Ingelfinger, 2008; Iwamoto et al., 2010). For examples, mad cow disease, salmonella in eggs, vegetables with excessive pesticide residues, and seafood with norovirus. Some people even died in these incidents. The food contamination incidents have shown that the route of food ingredients and substances that get into the food supply chain is very complicated and intricate (Szeitz-Szabó and Farkas, 2011). As a result, people and companies start to pay more attention to the quality and safety of food in the food supply chain.

A number of quality measures are currently used to enhance the quality and safety of food in the food supply chain worldwide. Three most popular and common measures are discussed below.

4.1 Radio Frequency Identification (RFID)

Traceability is the ability to track and trace a product batch and the history of it (Moe, 1998). In the context of food safety, traceability refers to the ability to follow and trace food, food producing animals, or food producing materials through all the production and distribution stages (Folinas et al., 2006). Traceability becomes an important requirement in supply chain management (Wang and Li, 2006). It can ensure speed and accuracy of transmission of a guarantee of quality (Bernardi et al., 2008). A good food traceability system will collect and record all important information to ensure that the quality of food products is in "real-time" (Wilson and Clarke, 1998). It can also provide a greater assurance of food quality to different parties. Manufacturers or farmers can identify any food problem quickly based on those trace data.

Over the last century, a number of technologies have been utilized in enhancing the traceability of food and food products. Among all technologies, the Radio Frequency Identification (RFID) is one of the most popular ones. RFID is the generic name for technologies using radio waves to identify individual items and products automatically (Bottani and Rizzi, 2008). RFID allows wireless identification of the nature and location of an item or a product.

RFID was invented in 1948 and had undergone several developmental stages in the 1950s and the 1960s (Hossain and Prybutok, 2008). Modern RFID tags are about the size of a grain of rice and contain built-in microchip, antenna, and memory. In terms of communication, the passive RFID tags communicate using RFID readers' power while the active RFID tags communicate using battery power (Rieback et al., 2006). Together with the barcode and internet system, RFID brings many benefits to manufacturers and retailers. It creates opportunities for more efficient and effective traceability system design (Kelepouris et al., 2007). Nowadays, RFID is commonly used in different commercial tasks, including managing supply chains, tracking products, preventing counterfeiting, and other security issues (Rieback et al., 2006).

In the context of food quality, RFID has long been used for tracking fresh food and FMCG food. In the 1970s, the American first introduced the RFID tracking scheme in cows. Since then, RFID-tagged animals and vegetables have become very common worldwide. RFID technology is also widely used in tracking beef and pork in countries like Australia, Canada, Europe, and China (Ribeiro et al., 2010; Zhao and Li, 2012). As for FMCG food, chocolate is a common food tracked by RFID. In the USA, due to the commencement of "The Bioterrorism Act of 2002", food producers have to maintain their raw materials and finished goods in good and safe condition. Bloomer Chocolate, the largest cocoa-bean producer and ingredient chocolate supplier in North America, has therefore utilized the RFID system together with its original Warehouse Management System (WMS) for tracking and tracing raw materials and chocolates. With the RFID technology, Bloomer Chocolate can ensure that each shipment of raw materials arriving its manufacturing plans was in good condition and the visibility of inventory. The rest of the supply chain process (i.e. distribution and storage) is also well monitored using RFID until the chocolates reach the final users. The overall effectiveness of the firm has been improved thereby (O'Connor, 2006).

4.2 Hazard Analysis and Critical Control Point (HACCP)

Hazard Analysis and Critical Control Point (HACCP) is a science-based monitor system that enables the production of quality and safe food through identification of potential hazards in the production establishment and critical processing points and establishment of methods for monitoring how well the process control is working (Hulebak and Schlosser, 2002). HACCP is found to be an effective approach to establishing good production, manufacturing, and sanitation practices that produce safe food (Unnevehr and Jensen, 1996).

It can help food manufacturers to identify the key steps for controlling, preventing, or reducing potential hazards in their food and food products.

HACCP was introduced by the Pillsbury Company, the US Army Natick Laboratories, and National Aeronautics and Space Administration (NASA) in 1960s for assuring the safety of food produced for the space programme of the USA (Griffiths, 1996). Since then, it has become a universally accepted system for food safety and food assurance in different food areas. The modern HACCP system is built on seven principles and actions: (i) conducting a hazard analysis; (ii) identifying the critical control points (CCPs); (iii) establishing critical limits to be met for preventive measures of CCPS; (iv) establishing monitoring procedures and requirements for CCPs; (v) establishing corrective actions; (vi) establishing procedures for recordkeeping of HACCP plan; and (vii) establishing procedures for verifying the proper functioning of HACCP system. The paramount goal underlying any HACCP system is to prevent problems from occurring (The National Advisory Committee on Microbiological Criteria for, 1992).

HACCP has been mandated by the government regulation for some parts of the local food system in many countries, like Australia, Canada, the EU, and the USA (Unnevehr, 2000). In the USA, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA) has implemented a mandatory HACCP rule for the processing of poultry and meat products (Shank et al., 1996). In the EU, HACCP regulations have been introduced to fish and fish products (Lupin, 1999).

The popularity of HACCP has led to the development of ISO 22000 which is an international standard ensuring the integrity and safety of food supply chain (Valder, 2009). ISO 22000 specifies the requirements for a food management system that consists of four elements to ensure quality and safety of food through the supply chain, including interactive communication, prerequisite programs, system management, and HACCP principles. The absence of HACCP or ISO 22000 can lead to food poisoning among people caused by food contamination (Sekheta et al., 2008).

4.3 Key Performance Indicator (KPI)

Key Performance Indicator (KPI) is a value or number that can be measured and compared against a target “benchmarking” to provide an indication of performance (Alemanni et al., 2008). It is a quantitative management indicator measured by setting, sampling, measuring, and analyzing key parameter of the input and output ports of the company’s internal process (Luo et al., 2012). KPI is a measurement tool commonly used in the evaluation and improvement of the performance of a company. The strategic goal of a company can be translated to operational long-term target with KPI. The KPI will then serves as a guideline and standard for the department heads of the company, rectifying their directions and maintaining high-quality management for the company. In addition, KPI can also be used in the benchmarking of departments or teams against each other, as well as against those of other companies across the industry.

In food supply chain industry, KPI is commonly used in evaluating and improving the distribution procedure of food (Liu, 2009). Two main problems in the distribution of food are the utilization of trucks and the traveling time. After analyzing the KPI, recommendations can be given to food distributors, including delivery routes, numbers of shipments, and vehicle loadings. Besides, KPI can help improve the linkage between suppliers, distributors, and retailers of food products. KPI allows food companies to view each supply chain member’s performance comprehensively and make sure that all the distribution and logistics steps of their food products are normal. Tesco, one of the Britain’s leading food retailers, has used KPI in evaluating the performance of each of its suppliers (Lindgreen and Hingley, 2003).

5 FOOD QUALITY MANAGEMENT MEASURES IN MCDONALD'S HONG KONG

The McDonald's Corporation (McDonald's) is one of the leading fast-food chains in the world, with more than 36,000 restaurants in more than 100 countries (McDonald's, 2015c). Headquartered in the USA, the company serves nearly 70 million people every day. McDonald's began as a Bar-B-Q restaurant in San Bernardino, California in 1940 (McDonald's, 2015b). In 1955, the McDonald's Corporation was founded. McDonald's went international in 1967 and opened its first international restaurant in Canada and Puerto. Since then, the company has continued to expand its global reach by opening restaurants itself or through its franchisees around the world.

The mission of McDonald's is to be "customers' favorite place and way to eat and drink" (McDonald's, 2015a). McDonald's strives for providing the highest quality fast food and superior service to its customers, in a welcoming, happy, and clean environment. It is committed to improving its worldwide operations and customers' experience continuously. The goal of McDonald's is QSC&V, which stands for Quality, Service, Cleanliness, and Value, for each of its customers in each and every time. In order to achieve its mission and goal, McDonald's has adopted a unique business model formulated around balancing the interests of its three-legged stool of company employees, owner/operators, and suppliers.

McDonald's Hong Kong opened its first restaurant in Hong Kong in January 1975 at Paterson Street, Causeway Bay (McDonald's Hong Kong, 2014). There are more than 210 McDonald's restaurants in Hong Kong currently with over 15,000 staff. The business of McDonald's Hong Kong has evolved over the years, from original fast food restaurant to 24-hour service to coffee services (McCafe) to delivery service (McDelivery). The company pays great attention to food quality and has won the Hong Kong Management Association Quality Award – Gold Award in 2012.

McDonald's owns 3 regional Food Studio and Quality Centre. One of these centres is located in North Point of Hong Kong. The other centers are located near Chicago and Paris. These centres are responsible for developing new food products and monitoring quality of food products for McDonald's. The quality centre in Hong Kong is equipped with two restaurant kitchens, one development kitchen, four meeting rooms, two functions rooms, several food tasting booths, and a translator booth, allowing McDonald's Hong Kong to develop new tastes and ensure the dietary balance of its food served in the local market.

McDonald's Hong Kong successfully practices the "from farm to table" concept and has implemented a lot of quality measures in ensuring the quality of its food throughout the food supply chain, including the use of HACCP and the appointment of SGS. Also, McDonalds' Hong Kong has worked very closely with its logistics partner, HAVI Logistics, in ensuring the quality transportation of its food and food ingredients.

HACCP is well applied in the food supply chain of McDonald's Hong Kong. In sourcing, McDonald's Hong Kong uses strict procedures to source quality ingredients through its global network of suppliers. It requires all the suppliers must have acquired HACCP (McDonald's Hong Kong, 2015c). The suppliers have to ensure that all their facilities and production stages must meet the safety standards. In processing, McDonald's Hong Kong uses stringent processing procedure for producing higher-quality food. It has utilized HACCP in processing its food (McDonald's Hong Kong, 2015a). Workers of McDonald's Hong Kong are all well-trained for HACCP. For instance, chicken is one of the main food of McDonald's Hong Kong restaurants. Chicken will undergo HACCP assessments at different stages of the processing procedure. Their origins, types, forages, or other relevant information will be recorded in the computer system for tracking. Apart from chicken, HACCP is also used in maintaining the quality and safety of other frozen food.

McDonald's Hong Kong has also appointed SGS to test its food ingredients on a regular basis (McDonald's Hong Kong, 2015b). SGS is an internationally recognized independent testing, inspection, verification, and certification company. McDonald's Hong Kong consults SGS regularly. Depending on the characteristics and the risk level of the food ingredients, appropriate testes are conducted by SGS on all food ingredients used by McDonald's Hong Kong. At least 20 selected food ingredients from both current and new suppliers are tested by SGS in Hong Kong every month. These tests meet both international and Hong Kong standards and regulations.

In logistics, HAVI Logistics provides the distribution services for McDonald's Hong Kong. HAVI Logistics, established in 1974 at Chicago, is a multi-functional global logistics service provider (HAVI Logistics (Taiwan) Ltd., 2014). It strives to provide high-quality logistics, food processing, packaging, and distribution services to its customers. HAVI Logistics has built a close relationship with McDonald's Corporation and McDonald's Hong Kong for a long time. It has established a good monitoring system for the storage and transportation of frozen food for McDonald's. HAVI Logistics has even established a distribution center in Sha Tin of Hong Kong to help handle all the logistics activities of McDonald's Hong Kong.

6 CONCLUSION

Food, like fresh food and FMCG food, is the fuel for people's body and essential to people's health. With the recent outbreak of food contamination incidents, people are now more concerned with the quality and safety of the food they eat. To assure the quality of food, one important area will be the quality control of the food supply chain. Food supply chain is a sequence of economic activities involved in the movement of food from production to consumption.

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Vertical integration is a common technique that can ensure a stable supply of quality food in a food supply chain. Besides, a number of quality management measures are also available to help food companies enhance the quality and safety of food in a food supply chain. RFID allows an efficient tracing of a food product, HACCP system enables the production of a safe food product, and KPI improves the distribution procedure of a food product along the food supply chain.

McDonald's Hong Kong has implemented a lot of measures in ensuring the quality of its food and food ingredients. McDonald's Hong Kong has applied HACCP in different stages of its food supply chain. In addition, it has appointed SGS to test its food ingredients on a regular basis and worked very closely with HAVI Logistics in ensuring the quality transportation of its food and food ingredients. Experiences from the case study of McDonald's Hong Kong show that quality management measures are promising tools for maintaining food quality and improving the food supply chains of a food company.

Limitations of the current study are that it focuses on qualitative research and involves the use of only one Hong Kong case. Case studies on food companies in other countries can be carried out in future. Besides, empirical research, i.e. survey with a large sample size, can also be conducted in future so that the findings obtained can be generalized to all food companies. Despite its limitations, the current study is sound for practitioners in food industry for developing quality management strategies for their companies. The findings can also serve as foundation for building framework for efficient food supply chain management in future studies.

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