Traceability in Halal Food Supply Chains from a Business Network Perspective

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Abstract

This paper develops a conceptual framework for traceability systems in Halal food supply chains, specifically from the business network perspective. The paper brings together two areas of research: food traceability and innovation within business networks. The Halal food industry comprise of about 16% of the entire global food industry. With the demand for Halal food increasing worldwide, the integrity of Halal food is always questioned, particularly when no unified Halal standard exists in the market. In Australia in particular, not all of its Islamic Organizations’ Halal certifications are accepted in the global Halal food markets. For example, only the following four out of seventeen Australian Halal certifications are accepted worldwide, they are Australian Federation of Islamic Councils Inc. (AFIC), Australian Halal Food Services (AHFS), Islamic Coordinating Council of Victoria (ICCV) and Supreme Islamic Council of Halal Meat in Australia Inc. (SICHMA). The remaining thirteen certifications are only accepted in limited markets. Therefore, there is potential for a Halal food product traceability system to provide transparency of information surrounding food processing and allow customers to be able to track and trace the process involved in food preparation.

Business networks are groups of interdependent relationships, such that successful product innovation requires the resources of the whole network rather than a single actor (Håkansson and Snehota 1995). The implementation of a food traceability system from farm gate to retail shelf can be considered a network innovation as changes to business activities are required by all actors involved in the network.

The focal point of this paper is to examine the factors influencing the adoption and implementation of a traceability system by all actors in the network. The IMP group approach to business network research has been drawn upon to consider innovation within a network context. The proposed framework will integrate a framework for product traceability systems (Regattieri, Gamberi and Manzini, 2007) into the Activity-Actor-Resource-Idea (AARI) model in business network (Welch and Wilkinson, 2002). The framework will address innovation in the supply chain through the adaptation of the traceability system in the network of a manufacturing company, involving buyer-seller relationships at each business functions from farm-to-fork. A case study approach will be employed in this study. As previous research has largely concentrated on theory building, the development of an integrated traceability and AARI framework using an empirical case study will seek to address gaps in the literature regarding industry applications in analysing buyer-seller
relationships. Furthermore, many previous studies have addressed traceability systems from the consumers’ perspective, whereas, this paper will contribute to the business network literature in the area of change and innovation adaptation in buyer-seller relationships in the context of traceability.

Keywords: Innovation within Networks, Business networks, Food Traceability, Halal Food

INTRODUCTION

The food industry grows each year, in line with increases in world population. One segment of the food industry, Halal food is capturing the interest of world’s population globally. The Halal food segment contributes about 16% share of the whole global food industry (Power 2009). It receives positive response not only from the Muslims worldwide, but interestingly, some minority Muslims population countries are now attracted to the segment due to its high quality and safety measures in preparing the food (Berry 2011). A similar trend is also witnessed in the Kosher food market, where the increase in sales of Kosher food in grocery stores doubled the growth rate of the whole food market, despite the shrinking Jewish population. This trend is suspected due to the certification process involved that attracts more consumers seeking Kosher products (Scott-Thomas 2009).

However, the integrity of Halal food faced considerable debate given that no unified Halal standard exists in the market (Irfan Sungkar & Darhim Hashim 2009), thus providing room for unethical fabrication of Halal logos taking place (Anir, Nizam & Masliyana 2008). Therefore, there is potential for a Halal food product traceability system to provide transparency of information surrounding food processing (Meuwissen et al. 2003) and allow customers to be able to track and trace the process involved in food preparation (Zailani et al. 2010).

Implementing traceability system throughout the whole supply chain has proven to be very challenging as it must include the participation in the entire supply chain for its full potential functionality (Opara 2002). As at to date, the only mandatory traceability system being enforced throughout the entire supply chain, is for beef on sale within the EU (Regattieri, Gamberi & Manzini 2007), though there are some instances of traceability systems being implemented voluntarily in other sectors such as those of dairy products (Favaro et al. 2005; Perez-Aloe et al. 2007; Manikas & Manos 2009), poultry (Smith et al. 2005; Chansud, Wisanmongkol & Ketprom 2008), and fresh produce (Alfaro & Rábane 2009; Golan et al. 2004). In general, consumers are becoming even more discerning in terms of the choice of food that they consume, therefore are very much excited about the idea of having a traceability system in the products that they buy (Opara 2002; Hobbs 2003). Although this paper concentrates on the implementation of traceability system in the halal food industry, however, the findings of this study can later be empirically tested on other segments such as organic, free-range and vegetarian food industry.

Meanwhile, the adoption of traceability system by actors in the supply chain can be considered a radical network innovation as changes to business activities are required by all actors involved in the supply chain and network. The network approach was firstly
introduced by the Industrial Marketing and Purchasing (IMP) Group in the early 1970s. In the network approach, innovation is not seen as being dependent on just one single new technology developed by one organization (Gadde, Huemer & Håkansson 2003) but is actually formed from the interaction between organizations in a broader network (Verboven, Vandenbempt & MatthysSENS 2004). (Ritter & Gemünden 2003) in their study revealed that the organization’s ability to manage interorganizational relationships will positively influence the organization’s innovation processes to succeed. (Håkansson et al. 2009) suggested that innovation be dealt with across organizations, rather than just within organization, with the network must be capable of being mobilised by all actors comprising it (Easton 1992), so that successful innovation can take place in the entire supply chain.

In examining the factors influencing the adoption and implementation of an innovation (i.e. traceability system) processes by all actors in the supply chain and network, it is very essential that an understanding of the processes involved in the interactions of all actors are well understood (Håkansson 1982; Anderson, Håkansson & Johanson 1994; Håkansson & Snehota 1995). It is also important to consider the fact that new innovation processes are somewhat vague in nature during their introduction phase and thus requires “specific cognitive models and sensemaking capabilities” of the actors to enable the adoption and implementation of it (Sneddon 2008, p. 48). As such, this paper will develop a conceptual framework, integrating the framework of traceability systems by (Regattieri, Gamberi & Manzini 2007) and the aspects of innovation from network perspective (Håkansson 1987) into the Actor-Activity-Resource-Idea/Schema (AARI) model of business relationships by (Welch & Wilkinson 2002). The framework is aimed to capture the netchain analysis (Lazzarini, Chaddad & Cook 2001) of all parties in the Halal food network. The netchain concept combined the supply chain and network perspectives in the analysis of the interorganizational interactions which emphasises on ‘the value creating and coordination mechanism sources (Lazzarini, Chaddad & Cook 2001, p. 7). The framework also acts as a frame of reference to analyse the interactions involved throughout the relationships at the intrafirm, dyad, supply chain and network levels, from the actor, activity, resource, idea/schema substance layers, in the context of innovation (i.e. traceability system) processes.

Among the objectives of this study are a) to explore the business relationships in a halal food supply chain from the business network perspective; b) to investigate the impacts that the business relationships has over an innovation process and reciprocally how an innovation process affect the business relationships in the network and c) to investigate the external forces that influence the network’s innovation process.

The paper is organised as follows. The next section – the literature review will provide insights on the research areas that led to the objective of the paper. The following section explains in a concise way on the proposed conceptual framework. Then, in the next section, some brief methodological introduction will follows while final section will concludes the paper.

**LITERATURE REVIEW**

**A review of Halal food industry**

Halal food is defined by the Agriculture and Agri-Food Canada as “the food products that are prepared following a set of Islamic dietary laws and regulations, which determine what is
permissible, lawful and clean” (Berry 2011, p. 3). In May 2009, the Halal food market contributed 16% share of the whole global food industry, amounting to about $632 billion annually (Power 2009) with Asia countries dominating, followed by Africa, Europe and Americas. Meanwhile, it is forecast that major opportunities rise from the Australia/Oceania region, where the Halal market has recorded 33.3% growth between 2009 and 2010 (Berry 2011). Halal economy comprises of 1.6 billion Muslims worldwide (Power 2009), that is a quarter or the world’s population.

However, in today’s market, it is interesting that Halal consumption is now appealing to the non-Muslim population. According to (Lodhi 2009), consumers are very much concern about the food safety, nutrition and ethics in determining the quality of the food that they consume. Food safety and nutrition are usually addressed in the implementation of food standards, which often comprise of documented details of ingredients and process involved in the food production. Ethics, on the other hand, address the cultural and religious values of a society as well as the acceptable moral value of the organizational practice. Ethics in food can be reflected through incorporation of cultural inhibitions or religious prohibitions according to the consumers’ individual expectations (Lodhi 2009). In addition, consumers also perceived organisations that use or produce organic and free-range food product as having high ethical concern in the choice of their conducts (Harper & Makatouni 2002).

Therefore, societies that practice or believe in certain cultural values such as fair trade, organic farming, or humane treatment to animals may find that the process of which Halal food is produced and the certification that comes with it is appealing to them. Remarkably, this has led to Halal food being often sought due to its detailed processing for healthier (nutrition) and safer (food safety) food products, which treated the animals as humanely as possible (ethics). Nevertheless, it is also noted that in multicultural and multi religious societies, food ethical standards are rather voluntarily.

Despite receiving high demand from Muslims countries, the Halal food industries are seen growing in minority Muslims population countries where concerns for food quality and safety measures are stressed (eg the United States, Australia and European countries) (Berry 2011). Non-Muslim multi-nationals dominate the Halal food market by controlling about 90% of the global Halal market (Berry 2011). For example, Nestle in the 1980s has introduced a specific committee to engage in Halal matters. Ever since then, it has also put in place segregated facilities for its Halal and non-Halal products storage. In 2008, it has reached $3.6 billion turnover of Halal products with 75 of the company’s 456 factories specialised to cater to Halal production (Power, 2009).

In spite of the importance of Halal product certification, there is still no standard accreditation that is accepted globally. This is mainly due to the varied definitions of Halal related to the slaughtering of animals from the four major Fuqah schools ‘Madhabs’ in Islam – Hanafi, Maliki, Shafi’i and Hanbali (El-Farra 2009). The inconsistencies of the slaughtering requirement in each of the Fuqah schools have led to the enforcement of different certification requirements from different countries throughout the world. Nevertheless, Codex Alimentarius Commision in its Halal guideline standard justify that in spite of the differences of opinion in interpretation of lawful (Halal) and unlawful (Haram) animals and in the slaughter act by different Islamic Fuqah Schools, the certification of Halal granted by the religious authorities of the exporting country should be accepted in principle by the importing country, except when the latter provides further justification for other specific requirements. As a result of the absence of unified Halal standard and its associated logo globally, it has
raised questions about integrity on the Halal certification process, issues of abuse, malpractice and gross profiteering (Irfan Sungkar & Darhin Hashim 2009). In Australia in particular, not all of its Islamic Organizations’ Halal certifications are accepted in the global Halal food markets. For example, only the following four out of seventeen Australian Halal certifications are accepted worldwide, they are Australian Federation of Islamic Councils Inc. (AFIC), Australian Halal Food Services (AHFS), Islamic Coordinating Council of Victoria (ICCV) and Supreme Islamic Council of Halal Meat in Australia Inc. (SICHMA). The remaining thirteen certifications are only accepted in limited markets.

Studies by (Anir, Nizam & Masliyana 2008) witnessed the consumers’ concerns on the authenticity of the Halal certification and its logo due to many fabricating activities done by irresponsible manufacturing companies trying to tap into the Halal food market. The research indicated that “consumers are not convinced on the certificate issues and logo used by manufacturers to claim product are halal” (Anir, Nizam & Masliyana 2008, p. 89). Both identification comprising the certificate and the logo has failed to provide a validity check for consumer to ensure the Halal status of the food. Their survey indicates the consumer’s need of a system that can track and trace this Halal certification. Meanwhile, (Zailani et al. 2010) found that Halal transparency is likely to increase consumers’ trust in ‘Halalness’ of the food due to the increased amount of the information revealed to the consumers. As such, a traceability system where the consumer will be able to track and trace the processes involved in preparing the food will aid to improve the transparency of the Halal food supply chain itself. Though the traceability system will not impact the issues around the standardisation of the certification process directly, but it will indirectly provide validity check to the products’ certifications.

There appear to be a few studies in the literature on traceability in Halal food; however most of them have looked at the consumer’s perspective (Anir, Nizam & Masliyana 2008; Zailani et al. 2010). While the literature is still limited and quite focused to the consumer, this research will look at the innovation (i.e. traceability system) processes in the Halal food supply chain from the business network perspective.

**Halal food supply chain**

The food supply chain as defined by (Lodhi 2009) is a network of organisations (actors) having economic relationships (activities) with each other by producing goods or services (resources) to meet the demand of the consumers. In a consumer’s food supply chain, it begins with the origin of resource material, combined with agricultural production systems before it begins processing. After passing through the primary and further processing, then it will go to final manufacturing stage before finally be distributed to retails or food service industry or domestic user. In normal food supply chain, at every stage of this processing in the chain requires a control point system such as the Hazard Analysis and Critical Control Points (HACCP) system for a proper and timely control of food safety. However, in a Halal food supply chain, a similar control point system should also be additionally implemented to ensure the food production is in accordance to Halal standards. In Halal food supply chain, what makes it different is that the whole network must comply with Halal dietary laws at all appropriate stages to ensure the integrity of Halal food from farm to fork.

(Lodhi 2009) in his book has proposed specific Halal control points within key stages of Halal food supply chain. Interestingly, a complete traceability and monitoring system appears at all other stages in the supply chain except for at the final stage, which is in domestic
consumption (Figure 1.1). Clearly, the traceability system is present in the chain; however the information is not available for consumers to view. It is believed that the traceability system for Halal food can provide transparency and can boost consumers’ confidence level for them to purchase the Halal food (Zailani et al. 2010).

![Figure 1.1 Consumer’s Halal Food Supply Chain (Lodhi, 2009)](image)

The most basic principle in Halal food production is that to avoid all foods, drinks, and materials which are prohibited in the Islamic dietary laws and it must include the nutritional qualities and wholesomeness of the food produced. Halal food production must conform to the guidelines and standards required for Halal food supply chain. Lodhi (2009) in his framework for the guidelines outlined the followings as the important aspects to be monitored throughout the Halal food supply chain:

- a) Slaughtering (Dhabia);
- b) Source ingredients;
- c) Industrial processing;
- d) Labelling and packaging;
- e) Transport, storage and distribution; and
- f) Food services restaurants and catering

Under the food labelling and packaging monitoring, he further stressed that the standards for food labelling must include details for accuracy of labelling information, complete information regarding source ingredients and Halal status of labelling and packaging material. However, in reality, where the authenticity of the Halal certification and its logo are always questioned due to possible fabrication of it (Anir, Nizam & Masliyana 2008), another measure has to be taken to provide a validity check on the Halal status of the processed food. As such, the traceability system via barcode numbering or Radio Frequency Identification (RFID) tag is indeed useful to encounter this problem and will be explained further in the next section. Lodhi (2009) suggested including other information that may increase consumers’ confidence and benefit the Halal brand in the label of the processed food. To include all the information in the label is of course out of question due to limited space, but with a traceability system that holds valuable information of the ingredients and processing of
the food in the database; this is indeed a possible solution. The adoption of a traceability system by all actors in the network must be in place to enable consumers to retrieve such information at their ends.

A review of food product traceability system

The EU General Food Law Regulation (178/2002, article 18) defines food product traceability as the ability to trace and follow a food, feed, food-producing animal or substance through all stages of production, processing and distribution. Traceability in food product has widely been used since late 1990s when organizations have begun to realize its potential benefits to their business operations (Moe 1998; Meuwissen et al. 2003; Regattieri, Gamberi & Manzini 2007; Guercini & Runfola 2009). It has gained ground in food literature since then with research focusing on the technical instrumentations of the traceability system (Moe 1998; Opara 2002; McBratney et al. 2005; Regattieri, Gamberi & Manzini 2007; Anir, Nizam & Masliyana 2008), the catalysts of its implementation (Opara 2002; Golan, Krissoff & Kuchler 2002), and the challenges for its full potential (Opara 2002).

Having traceability system in place does not only benefit the business operations but it also provides advantages to the customers (Meuwissen et al. 2003). A traceability system provides value in terms of the a) information it contains; b) liability protection towards the organisation and c) efficiency in the supply chain management.

a) To customer, a traceability system can boost information transparency of all processes involved in the food product. The information in a food traceability system holds a high market value when sold along with the product (Moe 1998).

b) At the same time, a food traceability system helps to protect the organisation’s self interest in the case of liability claims, improve recall efficiency and improve control of livestock epidemics (Meuwissen et al. 2003).

c) Concurrently, a traceability system brings together the internal efficiencies - supply chain optimization and product safety as well as external control - market advantages to an organisation (Regattieri, Gamberi & Manzini 2007; Guercini & Runfola 2009).

Since its earliest introduction, information technology was seen as the best instrument for implementing the traceability system (Moe 1998). Apart from the adoption of Internet as the medium to link the traceability system in the supply chain to the customers, some environment monitoring technology such as Geographic Information System (GIS), Remote Sensing (RS) and Global Positioning System (GPS) can also be used (Opara 2002). (Regattieri, Gamberi & Manzini 2007) further argued that the best technical instruments for product traceability systems are bar codes and RFID systems. He further added that in food industry; however RFID can only be adopted by the ‘high-value’ food products such as famous cheese and well known wine. Interestingly, (McBratney et al. 2005, p. 14) highlighted that in the future, moving forward, it would be highly valuable if the food manufacturer could provide “a label capable being read by a consumer’s handheld computer” or phone which provides all the information needed in the traceability system. An interesting example is at a duck restaurant in China where at the end of the dining experience, customer will be handed a small card with a barcode number that the customer can key in through the website address stated in the receipt. The amount of information stored in that system covers
every detail parts of the processing of the duck, ranging from the breeding history, the medical report, and to the processes involved right before the duck is ready to be served to the customer. This case is such a good example of the implementation of an extensive traceability system in a developing country.

Given its huge advantages and benefits, most food producers need to have a traceability system in their operations. There appears to be some basic motivation for implementing traceability system, some are initiated by the private sector itself and some are initiated together with the Government (Golan, Krissoff & Kuchler 2002). For example, the private sector is more concern on the globalization of world economy and the rapid growth in international trade (Opara 2002), where the main objective of having a traceability system in place is to improve the production flows or the supply-side management (Golan, Krissoff & Kuchler 2002). Other than that, the genetically modified organism (GMO) issues in food products, the sustainability and welfare issues and also the subtle quality attributes are also some of the catalysts for traceability systems in agribusiness (Opara 2002). Concurrently, the Government has strongly emphasise on implementing the traceability system and together with the private sector, they wish to facilitate and monitor traceback of the food safety issues, especially after the recent worldwide food-related safety hazard cases. The Government concern is of course towards the consumers’ side where it aims to provide necessary information regarding the food safety and quality issues. Apart from that, according to (Golan, Krissoff & Kuchler 2002), the Government’s role in protecting consumers from fraudulent activities and producers from unfair competition has largely contributed to its interference in the traceability system issue.

Nevertheless, implementing a traceability system is not easy. There are some challenges for full potential of traceability system to be implemented. Among the challenge, according to (Opara 2002), is a need of standard procedure for its implementation. All parties in the supply chain have to cooperate and possess a withstanding harmony of the importance of implementing the traceability system in the whole supply chain. With that, the next challenge addresses the impact of the traceability system on the smaller suppliers or partners who originate from the least developed countries. Their commitment and barriers of implementing the traceability system has to be carefully evaluated and taken into consideration. Finally, (Opara 2002) stressed that in order for the traceability system to be fully operational, it must facilitate both forward and backward traceability of products.

It is within the context of these various challenges in implementing full traceability system (i.e. innovation processes) throughout the broader network that this work will be undertaken. We now proceed to discuss the literature that represents a theoretical framework of the network’s perspective within which to analyse such adoption and implementation of the innovation processes (i.e. traceability system).

**Framework for food product traceability**

(Regattieri, Gamberi & Manzini 2007) has outlined four pillars being the most fundamental components for the food product traceability framework. The first pillar consists of product identification where it captures the physical characteristics of the product. This includes the size, weight, packaging and the product life cycle length. As for the duck example earlier, the information of the product identification element includes the weight of the duck at the time prior to the cooking. Meanwhile, the second pillar which is data to trace captures the
information that the system must store, for example the degree of the details of the products such as ranges, digits and etc. In the duck example, data such as the date of the hatching of the duckling and the dates of any medical treatments of the duck were among the data that can be traced from the system.

The third pillar deals with product routing where it holds information such as production cycle, activities, lead times, equipment required, manual/automatic operations, and logistic and storage systems. In the duck example, this is where the evidence such as the detail information of the responsible person processing the duck and the relevant processes within the transfer from the farm to the restaurant are stored. Finally the fourth pillar is the traceability tool itself, may it be alphanumerical code, bar code or RFID, depending on the accuracy and reliability match between the product and the processes involved throughout the supply chain. Another important factor in determining the tool includes cost. As for the duck case, the traceability tool that is used by the restaurant is the bar code system, which is given to the customer so that they can find all the necessary information that matches their queries back at home.

**A review of business relationships in network’s perspective – AARI Model**

Considering that the implementation of a food traceability system from farm gate to retail shelf can be regarded as a netchain (Lazzarini, Chaddad & Cook 2001) innovation process, this paper first seeks to understand the processes involved in the business relationships of all actors in the halal food supply chain and network.

The business relationship is regards as a group of interdependent relationships whereby each relationship individually is somewhat embedded in or connected to other relationships (Anderson, Håkansson & Johanson 1994), developed from the networking process within the broader scale of its interactions (Håkansson 1982). In principal, the chain of connectedness in this perspective is without limits and can span over more than several relationships that are
connected (Håkansson & Snehota 2006), with ethical practice of exchanging resources between the actors in the network (Batt & Purchase 2004). With this connectedness of business relationships, it appears to be existence of an aggregated structure consisting of various interdependent relationships which qualifies as a network (Cook & Emerson 1978; Håkansson & Snehota 1995). Actors in the business relationships do not act or react without purposive intentions outside a social context; instead, their actions and reactions are “embedded in concrete, ongoing systems of social relations” (Granovetter 1985, p. 487) which often requires ‘mutual orientation’ (Ford, Håkansson & Johanson 1986).

As relationships are interconnected with other relationships in the larger scale of interactions, it can be seen that this form of a network becomes borderless. This means that the interaction of the relationships of two companies no longer depends solely on the specific two companies, but now it takes into consideration on what happens beyond the organizational boundaries, at a broader space, involving all the other ‘critical connected activities and the resources’ (Håkansson & Snehota 2006, p. 263). To understand the complex process of interactions in the business network, (Håkansson & Snehota 1995) introduced a conceptual framework – Actor-Resource-Activity (ARA) Model where it describes the fundamental dimensions in relationships between parties in the network. Business relationships are defined in the substance (activity, resource and actor, layers and function (intrafirm, dyad and network) levels. The interplay among these substance layers drives the directions of the relationships (Ford et al. 2008).

Built on the Actor-Resource-Activity (ARA) Model by (Håkansson & Snehota 1995), (Welch & Wilkinson 2002) introduced the AARI model where they argued that shared cognition or hereafter referred to as idea/schema should be analysed on its own separately from the other dimensions in the ARA conceptual framework, given that it affects each dimension differently. When an individual make sense of an event happening instantaneously, that sensemaking process is done at a cognitive level, and that same situation in an organisation will see the sensemaking process be done at a social level (Weick 1995). Here, sensemaking process is regard as the process when a person make sense to the perceived images of event happening to him/her, taking into consideration of the past memory and what to expect in the future into his or her current immediate response to that event. Similar to that concept, Medlin (cited in Batt and Purchase, 2003) mentioned that in any relationship, the idea is that the present is usually shaped by the past, as well as conditioned by the future expectations. Further, (Weick 1995, p. 4) stated that “the concept of sensemaking is well named because, literally, it means making sense. Active agents construct sensible, sensable events. They structure the unknown.”. He further explains that sensemaking is rather not a collective action, but actually is an individual actor’s action (Abrahamsen 2011). However, (Geersbro 2004, p. 13) noted in his study that “what takes place at one level (human actor) will have implications for what goes on and for what can go on at another level (organisation). Presumably, this forms the proposition of this study in which, given that the proposed study will be focusing on the specific Halal food network, where it is believed that the idea/schema of ‘Halalness’ form the basis value in the individual actor at the intrafirm level, that same idea/schema will presumably somewhat influence the idea/schema at the dyad, supply chain and network levels. In the context of Halal being a cultural faith/belief of an individual, this study seeks to see whether “any differences in the cultural orientation of the firms participating in the network can have a significant impact on the ease with which knowledge is shared both within and between firms” (Moller and Svahn, cited in Batt and Purchase, 2003, p172). This is one of the important aspects in the study because the context of Halal is not only seen from the processes involved in the food’s
preparation (activity and resource layers) but it goes deeper than that where it represents the actor’s philosophy (idea/schema layer) and how it affects the network’s philosophy (actor bonds) and vice versa.

Meanwhile, (Geersbro 2004) agrees with (Tahtinen & Halinen 2002) on the similar idea of the need to consider several levels of analysis to understand sensemaking from the network’s perspective when he proposes to include more than one level of analysis in his study. Hence, the AARI model is thereby seen as the most appropriate theoretical framework to be employed in the proposed study. The AARI model will enable the analysis of understanding the variability of relationships developed in the Halal food network from two dimensions; the substance layers (actor, resource, activity, idea/schema) and the function levels of a business relationship (intrafirm, dyad, supply chain and network). The AARI model is also seen to be able to capture the implication of each substance layers and relationships’ functions in the innovation process undertaken in the network so that those critical for their impact on the organisation are carefully taken care of.

**Change or Innovation in business network**

A change or an innovation in an organisation, when viewed from the business network’s perspective, often includes the interactions of all actors across the network (Håkansson et al. 2009). Over time, the other actors in the network will have to eventually fine tune their resources, activities and ideas/schemas either to contribute or adapt to the new change or innovation from the relationships they have built in the network (Håkansson & Snehota 1995; Welch & Wilkinson 2002). Therefore, it is no doubt that a change or innovation may occur from the established business relationships that the actor has, outside and beyond its immediate set of relationships (Wynstra 1998; Håkansson et al. 2009). This can also be evidenced from the new product development process, where cooperation among every actor in the network, whom each plays a significant role individually (Gemunden, Ritter & Heydebreck 1996), contributes to the network’s innovation success (Ritter 1999). As most studies show how diffusion of innovation are often spread in the manner of stemming from the organisation’s initiative (actor layer), then over time, dispersed to the whole network (web of actors), this specific study on the other hand will see how the innovation (i.e. traceability system) processes will have to be implemented all at the same time at the network’s level. This means that the driver of the need to innovate may breeds from the outer network level, but to be successfully implemented, the innovation has to be agreed upon by all actors in the network, all at once, during the same time.

According to (Håkansson 1987), there are three aspects of innovation from the network perspective – knowledge development, resource mobilisation and resource coordination. An innovation is in fact new knowledge to the adopters. It emerges from the interactions of possible solutions to the needs of the intended adopters between different actors. This interactive process of seeking solutions to the problems simply means creation of new knowledge to enable competencies between varied actors (Håkansson 1987). Meanwhile, innovation at the implementation phase will see how actors who have decided to put the new idea/technology into practise will see the interdependence of the resources of these actors to materialise the implementation of the innovation. In this phase, the innovation process involves rapid learning, adaptation and socialization to enable the mobilisation of one actor’s limited resources to be shared or transferred to another actor and vice versa (Håkansson 1987). Final aspect of innovation in the network’s perspective is the coordination of those
shared resources in an organised and systematic manner to enable full utilisation of that scarce and limited availability of resources. It is important to note that all of this knowledge development, resource mobilisation and resource coordination aspects of innovation will only be possible through cooperation and interactions between the actors (Håkansson 1987). This can further be explained in situation where the actor has limited resources to increase technical specialisation (knowledge development). By relying upon complementary resources within the network (resource mobilisation), the actor can coordinate its research activities (resource coordination) and thus create innovation within the other actors in the network (Easton 1992). In the case of the traceability system being considered as the innovation in the network, based on the framework by (Regattieri, Gamberi & Manzini 2007), it is clear that there are interrelatedness of the three aspects of innovation mentioned above with all the four pillars in the traceability system framework. Product identification relates to the resource coordination, while data to trace and product routing relates to resource mobilisation and finally the traceability tools relates to knowledge development of the innovation (i.e. traceability system).

On another point, it is also important to note that innovations often occur to address the needs of the established network participants (Gadde & Håkansson 1994), as a result from the interactions between buyers and sellers (Roy, Sivakumar & Wilkinson 2004). (Gadde & Snehota 2000) stressed that diversity of goals and convictions are always the conditions for innovation and creative development to take place. Innovations are often the outcomes or solutions to incompetence in the network and can be categorised into two which is incremental or radical innovation. Incremental innovation usually encompasses minor changes while radical innovation often includes significant change in the product/process. In this context, traceability system in the study can be regarded as a radical innovation as it adds value to the end-product with the fundamental addition of its instrument in the end-products’ configuration. The traceability system emerges as a new knowledge domain (Truffer & Dürrenberger 1997), facilitated from the buyer-seller interactions.

Innovation can best be described using the S curve model (Rogers 1995) in which in incremental innovation, the emergence of the innovation is sourced from the movement along the same S curve while in radical innovation involves the movement from one S curve to another (Roy, Sivakumar & Wilkinson 2004). Regardless of those varied movements in the categorisation of both the incremental and radical innovations, (Roy, Sivakumar & Wilkinson 2004) argued that innovations in any types, emerges from the buyers and sellers interactions, with internal and external factors mediating the process. The internal factors build around issues involving the intra-firm and dyadic interactions, whereas the external factors bring in the issues external to the firm’s control involving network connections. They further warned that it is possible that the innovation can be generated not only from a single dyad but may also be generated from multiple buyer-seller interactions.

Change or an innovation is led by the perceptions of events rather than the events themselves (Halinen, Havila & Salmi 1999; Abrahamsen, Hakansson & Naude 2007). Based on their perceptions, actors act towards the events, making changes to take place in networks. These efforts by actors in implementing change were indeed a result of re-negotiated process of fitting in into multiple actors’ constituencies (Krath & Andersen 2009). Given that the actors’ perceptions of events may varied according to their individual philosophy, a radical innovation such as the traceability system can only be successfully implemented when every actors in the network has finally aligned their schema together, all in mutual understanding of the same philosophy. Research has shown that the cognitive perspectives of powerful actors
tend to pressure the less powerful actors to embrace those same perspectives (Walker 1985), given that new schemas can often be learned through acquaintance of social relationships between those actors (Janicik & Larrick 2005). On top of the pressure that the powerful actors have on the less powerful actors, research has also shown that experienced actors often hold more broad and thorough schemata than those inexperienced actors (Ramos & Ford 2011), but those experiences do not give the actors the power to control the network, as such control will only make the network become less effective and innovative (Håkansson & Ford 2002).

Now that the need for an innovation has been identified, the next step is to implement it. The innovation journey according to (Håkansson et al. 2009) begins with the development phase, and then continued with producing phase before turned into use at the final phase. In the first phase, all actors (collective actors in the network) from diverse problem backgrounds will have to combine their resources to develop functionality or a solution to their problem. Then in the second phase, all those actors will have to produce the combined resources to ensure the resource compatibility as a proposed solution. Finally, the actors will have to develop the use of the new solution which will bring about interactive effects to address the diverse problems in the first place. Therefore, in order for the proposed solution to become an innovation in widespread use, it has to pass through all these three phases. In another word, the innovation (proposed solution) has to be adapted by all the actors to address the needs in the network.

(Verboven, Vandenbempt & MatthysSENS 2004) pointed out that there are two streams of innovation – technological and strategic innovation. However, this proposed study will not focus on the strategic innovation in business network, but, it will concentrate on the technological innovation (i.e. traceability system) processes in business network. The technological innovation witnessed how actors work together to develop the technical change required in the business operation while the strategic innovation emphasise on the actors’ effort to find a unique, strategic position which has not been taken by other actors in the industry. They further stressed that most IMP research are generally interested in the strategic innovation.

In this study, given that the aim is to examine the factors influencing the adoption and implementation of change or innovation (traceability system) processes by all actors in the network prior to the adoption, during the implementation and its future expectations, it is important that the analysis of the interactions shall include every interactions at the micro-level (intrafirm) to the social-level (network) (Geersbro 2004). Previous literature has done studies on changes in business networks on resource ties (Baraldi, Bocconcelli & Söderlund 2001; Håkansson & Waluszewski 2002), on activity links (Fredriksson & Gadde 2005; Gadde & Håkanssonn 2001), on actor bonds (Håkansson & Snehota 1995; Gadde & Håkanssonn 2001) and on all those three substance layers – actor, activity and resource (Abrahamsen 2011), however, there is no single study that addresses change in the idea/schema substance layer.

Integration of Supply Chain and Network Analyses – Netchain analysis

Inter-organisational relationships are often discussed from two major strands of analyses in the literature - supply chain and network analyses, however, a netchain analysis has been recently introduced to capture both the supply chain and network’s perspectives in the
analysis (Lazzarini, Chaddad & Cook 2001). The netchain analysis provides researchers the ability to include all types of interdependencies of inter-organisational relationships – pooled, sequential and reciprocal interdependencies (Thompson 1967) which might exist simultaneously in a relationship rather than analysing it through either supply chain or network analysis separately. With this concept, the reality of the existence of both the vertical orientation of business relationships in the supply chain and the horizontal orientation of business relationships in the network can be included to perform a more dynamic analysis of those relationships. Therefore, the study proposed to capture the netchain analysis of all parties in the Halal food supply chain and network, analysing the interactions involved throughout the relationships at the intrafirm (vertical and horizontal orientations), dyad (vertical and horizontal orientations), supply chain (vertical orientation) and network (horizontal orientation) levels.

CONCEPTUAL FRAMEWORK

The proposed conceptual framework below seeks to integrate the business network aspects of innovation (Håkansson 1987) with the traceability framework by (Regattieri, Gamberi & Manzini 2007) into the AARI Model by (Welch & Wilkinson 2002). It is noted here that the four levels of analysis of this study are ‘nested’ within one another, such that network interactions are comprised of supply chain interactions, and supply chain interactions are comprised of dyad interactions and dyad interactions are comprised of intrafirm’s interactions.

Figure 1.3: The Emergence of Food Traceability System within a Network

The above framework proposes that the emergence of food traceability system as a radical innovation to the organisation may be influenced by several factors, which can be grouped into three categories: (1) dyad interactions between the buyers and the sellers relationships, (2) supply chain interactions between the upstream and downstream members of the chain and (3) network interactions in the Halal Ecosystem.
In the first category, the proposed conceptual framework suggest that the dyad interactions which include the bonds created between the interacting parties in the links of activity between them, tied together through the combination of resources among them with common idea/schema underlying their actions may shape the innovation (i.e. traceability system) emergent processes and reciprocally, the innovation (i.e. traceability system) process affect the dyadic business relationships of those actors.

Meanwhile, the second factor as per the categories above suggests that the dyad interactions among the members in the supply chain impact innovation (i.e. traceability system) processes, and vice versa.

At the same time, the third category, which is the network interactions, is perceived as an important factor in the emergence of the innovation (i.e. traceability system) process. This is so because any buyer-seller dyad’s decision to adopt a radical innovation, in such a borderless environment may have been influenced by their outer networks’ connections through the communication within its web of actors, activity patterns, resource constellation and their aligned idea/schema configurations. It is also proposed that the network interactions over the innovation process then will come back to impact on the supply chain, dyad and intra-firm relationships.

The netchain analysis is proposed in the study as the emergence of the innovation (i.e. traceability system) process clearly involves the horizontal ties between the halal food producers in the industry (in its intrafirm, dyadic and network interactions), as well as the vertical orientations with the upstream and downstream partners (in its supply chain interactions).

Meanwhile, the combination of the food product traceability framework and the AARI model shall provide a useful framework within which to examine the underlying factors that initially lead to the innovation generation in the network. The proposed framework also highlights the impact of the substance layers (actor, activity, resource and ideas/schema) have on the adoption and implementation process of the four pillars of the traceability system in the network context.

The actors bonds that arise between actors in the dyadic relationship relate to varying extend to all of the pillars in the traceability system. Every actor in the dyadic relationship has individual responsibility to update information in the product identification, data to trace and product route pillars of the traceability system. It is the interpersonal links that are developed in the interactions of these actors that then lead to the adoption of the traceability tool and the traceability system in the supply chain and the network.

Meanwhile, the activity links of the actors in the supply chain / network will provide records of activities such as production, logistics, administration, deliveries which will fit into the product route pillar of the traceability system.

At the same time, the reconciliation of resources of all actors in dyadic relationship / network will feed information to the data to trace pillar of the traceability system. Most importantly, the resource ties also act as the foundation of the innovation process which here will lead to the introduction of the traceability tool pillar in the traceability system.
Above all, the basic underlying philosophy in the idea/schema couplings of those dyadic relationships / network, will very much influence the traceability tools pillar where mutual understanding of the idea/schema of all actors in the supply chain / network will have to be aligned at the same time regardless of in which manner it is spread, either from dyadic interactions towards network interactions or vice versa.

As mentioned earlier, the framework of food product traceability by (Regattieri, Gamberi & Manzini 2007) is seen to fit into the three aspects of innovation that was highlighted by (Håkansson 1987). Here, product identification pillar of the traceability system relates to the resource coordination aspect of innovation, while data to trace and product routing pillars relate to resource mobilisation aspect of innovation and finally the traceability tools pillar relates to knowledge development aspect of the innovation. The proposed framework is designed in such a manner to argue that:

i) The resource coordination aspect of innovation certainly need the coordination of the resource collections of the web of actors involved in the network, under the umbrella of the product identification pillar to enable successful implementation of the innovation process – traceability system. Neither of the actors in the network would have been able to develop the innovation process (traceability system) alone.

ii) The resource mobilisation aspect of innovation requires the movement of activity patterns derived from the resource collections of that web of actors in the network under the umbrella of data to trace and product routing pillars in creating the innovation (traceability system). With the scarce and limited resources, the innovation process (traceability system) would not have been able to be initiated in the first place if it is not through this cooperative exchange in the dyad, supply chain and network.

iii) The knowledge development aspect of innovation, which is the new technology that is the instrumentation of the traceability tools of the traceability system (innovation process) is actually the output of all interactions involved in the actor, activity, resource and idea/schema layers of the relationships in the network.

As a conclusion, the proposed conceptual framework aims to bring in the underpinning factor behind the emergence of the innovation (i.e. traceability system) process from the three possible factors. The proposed conceptual framework will provide descriptions of the business relationships of all the counterparts in the network at all levels of analysis (intrafirm, dyad, supply chain and network). Insights into the challenges and problems in all stages of prior to adoption- implementation-future expectation will also be addressed from the two dimensions – the substance layers of actor-activity-resource-idea/schema and function levels of actor-dyad-supply chain-network.

In achieving this aim, the followings are the guiding questions that may assist in focusing the work of the proposed study:

1. How does the role of actor bonds, activity links, resource ties and idea/schema couplings affect the intrafirm, dyad and network’s interactions?
2. How will innovation affect the relationships in the business network?
3. How do the relationships impact the network innovation processes?
4. How do external forces influence the network’s innovation processes?
METHODOLOGY

Qualitative inquiry is appropriate when studying process as it enables comprehensive descriptions of interactions taking place between the parties involved, permits the apprehension of varied experiences of many people in the interactions, allows for clearer description of the dynamic element in the process not presentable on a single rating scale, and when considering the process is actually from the perceptions of the people involved in it (Patton 2002). This study focuses on innovation process involves in the network from a holistic approach, in which the researcher firstly look at ‘how’ the innovation process occurs, then only, begin to look at the outputs and outcomes of the adaptation of innovation process (Piekkari, Welch & Paavilainen 2009).

A case study approach will be employed in the study, specifically on a network of halal food products in Western Australia. One of the advantages of using case study method is the chance of employing various data sources to come up with a binding and rich description of the case (Halinen & Törnroos 2005) and demonstrate convergence on one meaning (Johnston, Leach & Liu 1999). The case study will incorporate a triangulation strategy where at stage one, review of literature on business networks and traceability in halal food products will be carried out. The documents and archival records include studying organisation’s administrative records, memos, email correspondences, minutes of meetings, books, journals in the literature and government publications on policy and fieldwork data collection throughout the network of halal ecology in Western Australia. Other than that, Government’s and organizations’ reports (if there are any) will also be obtained from the Government departments and the organizations. These reports containing related information regarding the issue of halal industry are an important source to the data collection as they include the unpublished information, which are not accessible through other mediums. According to (Yin 2009), this source of data collection is important to corroborate and augment evidence from other sources.

Secondly, at stage two, the researcher will conduct interviews with the experts in the Halal Ecology in Western Australia. Halal Ecology refers to all suppliers’ suppliers, suppliers, industry organisations, competitors and authorization bodies in the halal food industry (Dougherty & Dunne 2011). The interviews will be conducted through semi-structured interviews, with the interviewees chosen based on their expertise and credibility in a given specific area. In qualitative methodology, interviews are seen as a method that is most commonly employed (Piekkari, Welch & Paavilainen 2009; Pettigrew & Roberts 2011). In-depth interviews can produce direct quotations on the experiences, opinions, feelings and knowledge of the interacting parties (Patton 2002). Hence, this method will be employed in the study, using a semi-structured approach, where the interviewees will be selected based on their expertise and credibility in the areas.

The third stage will involve site visits to the organisations in the business network of halal food products, covering the individual actors and collective actors’ (organisation’s) perceptions of their interactions across the business network. Next, in stage four, the actual mapping of data collected throughout the whole process will be carried out. Final stage will see the researcher develop an overall framework, which will contribute to the business network literature in the area of change and innovation adaptation in buyer-seller relationships in the context of food product traceability.
In terms of data analysis, (Yin 2009) suggested that the analysis must rely on all the relevant evidence. The typical case study normally produces three types of verbal data, which are interview transcripts, observation memos and site visit documents. Here, the researcher will review all the notes from the interviews, observations and formal or informal information gathered during the site visit. It is strongly suggested that the researcher to employ device such as tabular displays and graphs for the qualitative data management (Miles & Huberman 1984). It is also recommended that computer organisation of the data is essential to ensure all data collected are captured safely in an accessible medium for future usage purposes. For this study, the researcher will engage data management software such as Nvivo or Leximancer to facilitate analysis in coding of texts from the interview transcriptions (Pettigrew & Roberts 2011).

**CONCLUSION**

The study will employ a case study approach on a network of halal food products in Western Australia. One of the strong point of using case study is the chance of employing various data sources to come up with a binding and rich description of the case (Halinen & Törnroos 2005) and demonstrate convergence on one meaning (Johnston, Leach & Liu 1999). The case study evidence for this study will be derived from a triangulation strategy where data will be collected from multiple sources comprising of documents and archival records (review of literature and other relevant documentations), in-depth interviews, and observations.

The proposed framework will be of interest to any manufacturer or retailer as it will provide an understanding of current business relationships and provide interesting insights of ways to improve the current relationships to achieve mutual benefits for all parties involved within the network. The proposed conceptual framework is a useful tool to assist all parties in the Halal Ecology when analysing the variety of relationships in which they currently operate. Halal Ecology here refers to individuals who are directly and indirectly involved in the Halal food manufacturing operations organisations (from purchasing, production, marketing, sales and other relevant departments in the organisations), the organisations’ suppliers’, the suppliers, the Islamic Organisations, the Government as well as the competitors in the Halal industry.

The framework shall also be used to identify ways of managing the effectiveness of those business relationships in the future. The research findings can develop and hold the standard, give guidelines as to how the appropriate business relationships can be strengthened and formalized to be a platform for catalyst of change for the Halal Ecology. The framework presented in the study can also be applied to other sectors and businesses, and be extended to the other inspired states / countries throughout the world.

As a final point, this paper contributes to knowledge development in food supply chains by integrating traceability systems and data transparency within a network context (i.e. the IMP framework). Previous literature on traceability focused on consumer attitudes or single actor issues while this paper addresses the gap in understanding it at the network level.

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