CAN INTER-FIRM NETWORKS ALLEVIATE SUPPLY CHAIN RISKS WITHIN GLOBAL FOOD SUPPLY CHAINS?

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ABSTRACT
The food supply chain is truly a global supply chain wherein finished products and raw materials are transported across continents to fulfil requirements of consumers. The networks of supply encompass different languages, cultural systems, regulations etc. The entire farmer to end user cycle spans multiple risks and uncertainties which can manifest themselves in form of financial losses to human fatalities. In the past there have been instances of product recalls and food contamination which have had serious consequences as witnessed by the China milk scare, the Sudan1 dye in Worcester sauce and the Tomato salsa recall amongst others. This paper presents a literature study of the issues surrounding these complex and multi-tiered supply chain structures. It also presents a secondary analysis of the literature pertaining to supply chain risks in the food sector. Inter-firm aspects specifically in terms of relationships, trust and governance are analysed and a conceptual model for mitigating risk is derived.

INTRODUCTION
Supply chains feeding the food industry and ultimately the consumer have witnessed a paradigm shift in the past decade. From various non seasonal varieties of fruits and vegetables to processed and frozen foods, the supermarkets in the UK and across the world are stocked with food products which originate from across the globe. To respond to these demands the supply chains involved, have assumed perhaps the most global dimensions amongst all sectors. The ‘farm to fork’ cycle spans different organisation types, continents, cultural systems, regulations etc. Food safety has been in the news quite a number of times recently with cases of food contamination ranging from tomatoes and peppers being recalled across North America due to a salmonella scare, the Chinese milk contamination and the recent case of salmonella detection in peanut butter in North America, all of which have affected entities across the national borders. This highlights not only the high interlinking of the food supply chains but also the vulnerability of such chains. The concept of inter-firm network is considered for managing food supply chain risks. This paper presents a literature review on inter-firm networks and food supply chains. It also presents a secondary analysis of the literature pertaining to food supply chain risks. Inter-firm aspects specifically in terms of relationships, trust and governance are analysed and a conceptual model for mitigating risk is derived out of the above.

FOOD SUPPLY CHAINS
Generically, a food supply chain starts from the farmer, who produces (grown) the raw food and then supplies this to food processors. Transport companies/logistics providers link the farmer to the food processors. Sometimes, wholesalers/marketers may be a part of the chain who will buy from the farmer and sell to the food processors. The exact supply chain path for a particular food product depends on the product characteristics, size and market power of the
supply chain members (Maloni and Brown 2006). As supply chain members increase, the complexity increases on account of issues related to trust, traceability and transparency. Roth et. al. (2008) have suggested that the major forces affecting traceability and transparency are globalisation, consolidation and commoditisation. Globalisation refers to the movement of the food supply chain model from regional to global in terms of both importing raw materials to exports of final products. Consolidation refers to the trend amongst food supply chain members to combine as many food categories as well as levels of the supply chain in pursuit of higher margins. Commoditisation refers to the distinction between food products as either value added or commodities. Peck (2006) when studying supply chain risks in the food sector, has suggested three issues which create complexity in the food supply chain with regards to risk management. These issues focus on lean supply chains and the effect of less stocks when disruption occurs, reduced control over the process due to global supply chains and the difficulty in allocating resources for risk mitigation based on probabilities the risk will materialize.

FOOD SUPPLY CHAIN RISKS
Fearne, et. al. (2001) suggest that frequent food safety and security scares has led to an increase in the focus on the causes, effects and prevention of hazards. Peck (2006) in her report has identified a gap in the preparedness for business continuity management (BCM) as organisations tend to adopt a more reactive mode of crisis management than a proactive mode. One of the conclusions of her report was that the drive for efficiency and the just-in-time philosophy used by the food industry has progressively reduced stock levels throughout the supply chain - with the resulting damage to its resilience when an emergency occurs. Reduction of distribution sites due to consolidation means that the loss of a site due to events such as a fire or flood could also cause a disruption in the supply chain. Although the probability of these events happening can be ascertained, according to Peck (2006) due to larger and fewer distribution sites the impact of the event is greater. Kleindorfer and Saad (2005) classify risks as those occurring due to coordinating supply and demand and those arising from disruptions to normal activities. Agiwal and Mohtadi (2008) categorise the risks on a very broad level including risks arising from either intentional or unintentional causes. They argue that intentional contamination is not very infrequent. Sheffi (2005) argues that robust and flexible systems need to be built to effectively handle contamination incidents and increase the risk management capability of the firm in the wake of an event. Sheffi and Rice (2005) advocate that managers need to look into increasing not just safety measures but also safety awareness and a proactive safety culture increasing supply chain resilience.

INTER-FIRM NETWORKS
Sydow and Windeler (1998) define an ‘Inter-firm’ network as an institutional arrangement among distinct but related for-profit organisations which is characterised by: 1) a special kind of (network) relationship, 2) a certain degree of reflexivity and 3) the logic of exchange that operates differently from that of markets and hierarchies. Ring and Van de Ven (1994) suggest that inter-firm network relationships demand more trust and loyalty and that the relationships are typically complex, reciprocal and relatively stable (Sydow, 1992). Sydow and Windeler (1998) when discussing about the need for reflexivity within inter-firm
networks suggest that managers working in inter-firm networks are more likely to consciously consider process improvements that will cut across organisational boundaries, also they are more likely to keep these inter-organisational processes under control. Granovetter (1985) implies that the logic of exchange within an inter-firm network is the social embeddedness within the network, implying that stable relationships between the social actors shape the expectations and behaviours. This embeddedness thus combines co-operative and competitive elements, autonomy and dependence, trust and control (Sydow and Windeler, 1998). Inter-firm network practices create expectations that are based on the ‘norm of reciprocity’ (Gouldner, 1960) thus creating a ‘collective logic’ (Lincoln, et. al. 1996) of exchange within the network.

RESEARCH DESIGN
When considering the recent cases of food contamination and the percolation of the risk across national boundaries through the supply chain, the research questions that arose for this study were:

(1) Can inter-firm networks alleviate supply chain risks within global food supply chains?

(2) What are the factors that impact inter-firm networks?
In order to explore the research questions, a literature review was conducted on inter-firm networks and food supply chains. Also, the literature surrounding the recent food contamination cases was analysed using grounded theory principles to identify themes impacting inter-firm networks. The analysis identified that for inter-firm networks to work in managing and mitigating food supply chain risks the factors to consider are: Trust and Governance. These have to be supported by the appropriate Internal Controls which will eventually lead to a good Supply Chain Relationship.

CASE EXAMPLES
1) China milk scare
In November 2008, the milk scare materialised after milk and milk powder was found contaminated with Melamine. Kidney dysfunction caused by the Melamine lead to 240,000 infants being affected with 50,000 hospitalised and six deaths were confirmed (WHO, 2008). Although this was a case of deliberate contamination the global dimension of the problem was only apparent when the contamination was confirmed in New Zealand. Despite warning signs and tests confirming contamination the issue became public and production at ‘Sanlu’ stopped only when ‘Fonterra’, a New Zealand based group who owns 43% stake in ‘Sanlu’, confirmed the contamination and informed the New Zealand Government which in turn notified the Chinese Government and the WHO (Vaudine England, 2008). This lead to a trade recall of products with Chinese milk derivatives in it and at least eleven countries stopping all imports of Chinese dairy products. Non fatal cases were reported from Asian countries like Hong Kong and Taiwan and contaminated products were identified as far as the Netherlands and USA. Besides milk, Melamine was also found in derivatives like frozen yogurt dessert, biscuits, candies and in coffee drink. The recalls cascaded down leading to major recalls by global giants like Tesco recalling the white rabbit candy from its UK stores, Cadburys recalled all 11 products made in its Beijing factory supplying to Australia, Hong Kong, Taiwan besides China (Reuters, 2008a). Heinz, Nestle, Unilever and Starbucks also responded with similar recalls or substitutions in Southeast Asia (New Mexico Business Weekly,
2008; Coghlan, 2008). News articles suggest that this was not an isolated case and that Melamine has been used previously by poor farmers, milk collectors and milk dealers as “protein powder” to enrich test results for milk produced by weak or malnutritioned cows. Also, the literature suggests that Melamine can enter the food chain through the use of pesticides like Cyromazine. Testing at lower levels of the supply chains like farmers and marketers is difficult as it can be expensive and time consuming (Coghlan, 2008; Reuters, 2008b ; Fairclough, 2008).

2) Sudan 1
Another recent case of food contamination which affected the UK was the detection of Sudan 1 dye in Worcester sauce produced by Premier foods, a UK based food manufacturer. Sudan 1 dye was identified as a contaminant in chilli powder and is associated with increased risk of cancer. Sudan 1 was first identified in a consignment of Worcester Sauce exported to Italy. This lead to a recall of over 580 products mostly ready meals, snacks, sauces and drinks. (FSA, 2005; BBC, 2005). Although inspection requirements were in place to test Sudan 1 on all chilli powder being imported into the UK since 2003 but the contaminated consignment identified in 2005 was reported to have originated before 2003. Considering the long shelf life of both chilli powder as well as the final products like sauces and snacks the recall of products required extensive coordination between local authorities and the Food Standards Agency (FSA). A review of the incident was commissioned to be carried out by an independent panel. The report identified major failures in communications and coordination between agency, industry and the local enforcement authorities (FSA, 2007).

FACTORS AFFECTING THE ABILITY OF THE INTER-FIRM NETWORK TO ALLEVIATE SUPPLY CHAIN RISK

1. Trust
A high degree of trust between the partners in a buyer-supplier relationship is favourable for co-ordinated behaviour, whereas low trust leads to competitive behaviour (Anderson and Narus, 1990). Long- term relationships and trust encourage effective communication, information sharing and joint pay-offs (Dwyer, et. al., 1987; Ring and Van den Ven, 1992). Liker et. al. (1995) link the concept of trust to mutual dependency, "Trust as mutual dependence suggests that each party realizes that it has much to lose by endangering the relationship." Within a food supply chain trust is very important when traceability and transparency are difficult to achieve. In the food industry, as in others, one strategy for safeguarding quality is investment in long term relationships with trustworthy suppliers, rather than chasing lower prices by constantly putting contracts out for bidding (Roth, et. al., 2008). Trust built up through long term relationships also requires a mutual agreement to meet international certification standards and other auditing requirements. Alternatively, certification programs, shared values and reciprocity in benefits can help in developing trust and long-term relationship.

2. Governance
As food supply chains get global and complex it is getting extremely difficult for individual companies in the supply chain to monitor the supply chains themselves. To add to this, legal obligations to consumers have increased for supply chain entities: for e.g. under the EU law, retailers and brand owners have
a legal responsibility for their brands (Business Standards, 2008). Food certification programs provide an alternative to purely market or regulatory mechanisms in the global marketplace (Roth, et. al., 2008). ISO 22000 standardises global food safety standards and emphasises interactive communication and traceability right through the supply chain. The **Sanitary and Phytosanitary Measures Agreement or SPS** is an international agreement on food safety and animal and plant health standards (the) sets out the basic rules. However, it allows individual countries to set their own food safety standards. Member countries are encouraged to use international standards, guidelines and recommendations where they exist. If an exporting country can demonstrate that the measures it applies to its exports achieve the same level of health protection as in the importing country, then the importing country is expected to accept the exporting country’s standards and methods (http://spsims.wto.org/).

3. **Relationship**
Supply chain relationships have been seen to be an important aspect of managing supply chains. Research has concentrated on the actual dynamics of the supply chain and the role of each entity at the inter-organisational boundary. Some of the researchers have tried to work on developing Relationship assessment programmes (Lamming, et. al. 1996) which have tried to focus more on Vendor assessment. The emphasis upon managing the supply chain as a source of competitive advantage has led many organisations to reassess the role of the supplier within their own ability to achieve or sustain competitiveness and customer service. Within the food supply chain, better relationships could help to reduce opportunistic behaviour and facilitate better implementation of food safety thus reducing the proliferation of the food risk through the global supply chain.

4. **Internal controls**
Some of the Internal controls which an organisation within the food supply chain can utilise to manage/ mitigate supply chain are:

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<th>IT disaster recovery plans.</th>
<th>Mission critical assets and activities identification</th>
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<td>Recall procedures</td>
<td>Scenario planning</td>
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<tr>
<td>Crisis Management Team / Incident Management Team</td>
<td>Relocation readiness</td>
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<tr>
<td>Risk registers</td>
<td>Continuity planning with suppliers and customers.</td>
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<tr>
<td>Risk analysis and categorisation (Likelihood/ Impact)</td>
<td>Supplier compliance audits and risk diagnosis</td>
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**DISCUSSION AND CONCLUSION**
The paper has presented insights from a preliminary qualitative study conducted to explore the effect of Inter-firm networks on alleviating risks within the international food supply chain. The analysis of literature and the case examples (two of which are depicted in the paper) showed that four factors were important for managing and mitigating risks within the international food supply chain. These factors are depicted in figure 1 below:
Since inter-firm networks tend to create motivation and social contracts for working together towards a common goal, it can be implied that in relation to international food supply chains and issues regarding food safety and contamination, the formation of inter-firm food supply chain networks may invoke a collective sense of responsibility towards managing and mitigating risks. In order to create these networks, the factors depicted in figure 1 are important. It can be argued from both sides: that these factors may facilitate inter-firm networks, whereas having inter-firm networks may facilitate trust among the supply chain entities, lead to better governance and eventually form ‘win-win’ supply chain relationships. The focus of this paper however, is in considering these factors only from the point of creating enablers and drivers within the food supply chain to manage and mitigate risks across international boundaries. With reference to figure 1 the links can be explained as follows:

1) Governance will define the internal controls required within individual organisations and the network, reciprocally, when the internal controls are set in it will lead to better governance of the food supply chain,
2) Setting up of the appropriate internal controls will lead to trust among the supply chain members, reciprocally, trust within the members will lead to common network – spanning controls,
3) Implementing internationally recognised governance mechanisms will lead to trust among the members,
4) Implementation of governance mechanisms within the network will help to form better relationships among the supply chain members, coupled with,
5) Trust will help in maintaining and sustaining the relationship and the required motivation and collective focus to manage and mitigate risks,
6) A good relationship among the members will mean that each member will follow the network- spanning controls, reciprocally, a good supply chain relationship will enable the members to modify and implement new controls on a dynamic basis.

The next phase of the research will endeavour to operationalise the links and empirically test out the factors for their strength in alleviating food supply chain risks.

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