Investigating risk management capability within UK food supply chains

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Abstract

This paper presents a literature review of the issues surrounding supply chain risk management within the UK food industry and identifies key risk management techniques used by the food industry. The paper also presents the results from a pilot survey. The survey was conducted in an effort to explore further the understanding and perceptions that entities within the UK food supply chains have regarding supply chain risks and the techniques deployed to mitigate and manage risks and disruptions.

Keywords: food supply chains, supply chain risks, food supply chain risks

Introduction

Supply chains today, are stretched out across the globe to harness the cost savings and facilities provided by emerging economies. New business models within the logistics environment and better transportation facilities have facilitated the global nature of supply chains. However, this has also exposed the supply chains to a whole new set of uncertainties and risks, which can create chaos and disruption. These risks and uncertainties do not only arise from external sources but can be internal to the supply chain. Supplier issues, strikes, quality problems, logistics issues, etc. lead to more internal operational risks, which need a different level of mitigation. The academic work on supply chain risks has increased steadily in the past couple of years. The primary aim for the research surrounding supply chain risks is the necessity to avoid or at least reduce the impact of supply chain disruption and create a perpetually working supply chain devoid of any uncertainty. However, this is not always possible and hence, there is a need to investigate ‘proactive’ and ‘reactive’ methods to deal with supply chain uncertainties and risks.

Supply chains in the food sector have also assumed truly global dimensions. In times of extreme competition, focus on efficiency and leaning of supply chains, is pushing the raw material procurement process to different corners of the world which makes the food supply chain particularly vulnerable. Recent examples of food contamination ranging from Salmonella in Salsa sauce to Sudan1 dye in Worcester sauce and perhaps the most critical Chinese milk scare leads to question the preparedness of the food sector to tackle disruptions and recall procedures.

Although several theories of supply chain risk mitigation and management are available in the literature, the penetration of these theories in practical implementations
appears to be less structured. In an effort to capture the risk preparedness and the techniques deployed by UK food sector organisations to mitigate and manage risks and disruptions, a survey was conducted. The sample included not only food manufacturers but also affiliated companies which formed the food supply chain. This paper presents a literature review of the issues surrounding supply chain risk management within the UK food industry and identifies key risk management techniques used by the food industry. The paper also presents the results from a pilot survey and discusses the risk management capability of UK food supply chains.

Supply Chain Risks

According to Knight (1965) a phenomenon which is un-measurable is “Uncertainty” whereas one that is measurable is “Risk”. Risk is defined as uncertainty based on a well grounded (quantitative) probability. Formally,

\[ \text{Risk} = (\text{the probability that some event will occur}) \times (\text{the consequences if it does occur}) \]

According to the Royal Society (1992, p4) “risk is the chance, in quantitative terms, of a defined hazard occurring”. Deloach (2000) has defined business risk as the level of exposure to uncertainties that the enterprise must understand and effectively manage as it executes its strategies to achieve its business objectives and create value. Norrman and Jansson (2004) also express risk as,

\[ \text{Risk} = \text{Probability (of the event)} \times \text{Business Impact (severity)} \]

They mention that while risks can be calculated, uncertainties are genuinely unknown. Chiles and McMackin (1996) observe that a manager’s perspectives of risk is associated with the notion of economic loss. Supply chains, today, are exposed to factors, which can create chaos and disruption. Christopher and Peck (2003) taking inspiration from Mason-Jones and Towill (1998), have categorised supply chain risk into five categories:

- Internal to the firm: Process, Control,
- External to the firm but Internal to the Supply network: Demand, Supply,
- External to the network: Environmental

Peck (2005, 2006) also suggests that the sources and drivers of supply chain risk operate at several different levels. The four levels suggested are:
- Level 1 – value stream/product or process.
- Level 2 – assets and infrastructure dependencies.
- Level 3 – organizations and inter-organizational networks.
- Level 4 – the environment.

Spekman and Davis (2004) have suggested variables for understanding supply chain risks viz. movement of goods, information and money along with secure IT systems, corporate social responsibility and relationship between supply chain partners. The concept of “resilience” is related to risk and vulnerability in a perspective that not all “risks” (hazards or threats) can be avoided, controlled, or eliminated. Instead, resilience focuses on the ability of the system to return to is original or desired state after being disturbed, i.e. its ability to absorb or mitigate the impact of the disturbance (Peck, 2006).
Supply Chain Risk Management

Risk management can be considered from an operational viewpoint and from a strategic management perspective. Juttner et al., (2003) suggest that supply chain risk management is the process of identifying and managing risks in the supply chain through a co-ordinated approach amongst supply chain members in order to achieve the supply chain objectives. Rice and Caniato (2003) report that many firms have developed various risk assessment programmes that are intended to:

1) Identify different types of risks;
2) Estimate the likelihood of each type of major disruption occurring;
3) Assess potential loss due to a major disruption; and
4) Identify strategies to reduce risk.

Spekman and Davis (2004) have suggested that interdependency carries risk in the supply chain, but these can be managed. Zsidisin et al., (2000) and Zsidisin, (2003) present suggestions for minimising risk from the supply perspective. Various other researchers have looked at supply chain risk management from the perspective of supply risks. Sheffi (2001) and Kleindorfer and Saad (2005) suggested the use of multiple suppliers as a way to reduce certain supply chain risks. Quality management has been identified as an important risk management process. Smeltzer and Siferd, (1998) concluded that risks associated with poor selection of suppliers can be reduced by developing quality certification programs and auditing the suppliers to assure that they meet the required standards, whereas Lee and Whang (2003) developed a model to show how firms can reduce inventory due to less inspection time. Some other approaches to supply chain risk management involve managing risks affecting: specific supply chain levels (Cavinato, 2004), systems inside and outside the chain, such as the information system (Finch 2004), specific projects (Halman and Keizer, 1994) with an aim to identify and manage risks that threaten the project’s success (Ramgopal, 2003) and causes of project failure (Spekman and Davis, 2004).

Supply chain risk management can also be conducted for various other organizational reasons: financial and corporate governance (Meulbroek, 2002), business continuity and crisis management (Adams et al., 2002), the ability to react quickly to ensure continuity (Van Hoek, 2003; Rowbottom, 2004), reputation management (O’Rourke, 2004). New technologies and management models can provide risk management capability. These provide better visibility, velocity and more effective process control (Christopher and Lee 2001). Some of these are: **lean**, **six sigma**, **agile philosophies** (Christopher and Rutherford 2004, Chapell and Peck, 2005), **event management software** (Malykhina 2005), **radio frequency identification (RFID)** (Niemeyer et al. 2003).

Food Supply Chains

Generically, a food supply chain starts from the farmer, who produces (grows) 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. Depending upon the food product being produced and the customer requirements, the number of entities within the chain increase or decrease. As entities increase, the supply chain gets more complex and issues of Traceability, Transparency and Trust increase. The downstream food supply chain will consist of the distribution network from the food processor to the final consumer via. wholesalers/distributor and retailers. Sometimes
food processors may bypass wholesalers and supply directly to retailers and if required sometimes directly to the final consumer. 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). The major forces affecting the traceability and transparency are identified by Roth et al (2008) as **globalisation, consolidation and commoditisation**. Globalisation refers to the movement of the food supply chain model from regional, as witnessed few decades ago, to global in terms of both importing raw materials to reduce cost as well as exports of final products to increase revenue at all levels of the supply chain. Consolidation refers to the growing trend amongst entities within the food chain to combine as many food categories as well as levels of the supply chain in pursuit of higher margins. Lastly commoditisation refers to the distinction between food products as either value added or commodities. Studying the literature surrounding supply chain risks in the food sector (e.g. Peck, 2006a), the vulnerability towards risk in practical terms is centered around three fundamental conflicts. Firstly, the conflict of operational strategy where lean and agile supply chains are encouraging less stock and buffer but making the supply chains more vulnerable. Secondly, the conflict of control where the current trend of out-sourcing to suppliers at cheaper costs as well as introducing multiple players in the supply chain including 3PL suppliers which makes financial sense but reduces control over products as these suppliers may follow different regulations and span huge geographic distances and finally, the conflict of uncertainty where due to the changing socio-economic and climatic conditions it has become very difficult to judge or allocate a specific budget or resource allocation for risk management.

*Food Supply Chain Risks*

Despite extensive food safety legislation, increasing customer concerns and its consequential costs imposed on society as a result of frequent food safety and security scares has lead to an increase in the focus on the causes, effects and prevention of hazards (Fearne, et. al., 2001). Helen Peck (2006a) in her report on business reliance in the food sector identified a big gap in the preparedness for business continuity management (BCM) as very few companies had adopted a proactive or preventative stance to crisis management and operated mostly in the reactive 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. The consolidation of distribution networks by food manufacturers and the trend towards using 3PL (Third Party Logistics) providers, and reducing distribution sites 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. Statistically such events are predictable but as shown by Peck (2006a), many managers pointed out that the trend toward fewer and larger production and distribution sites meant that the potential impact was increasing. Supply chain risks have been classified by Kliendorfer and Saad (2005) in two broad categories. First, risk arising from the problems of coordinating supply and demand and second are risks arising from disruptions to normal activities. Agiwal and Mohtadi (2008) suggest that food safety events and security events arising from either intentional or unintentional events pose risks that are above and beyond operational and market risks. 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.

In her report for the Department of Food and Regulations Authority (DEFRA) Peck (2006a) includes risks in the food supply chain under as the following:

- Product contamination & recall
- Loss of access – terrorism
- Loss of access – protesters
- Loss of site
- Reduced capacity
- Loss of people
- Loss of supplier
- Contractual cover
- Dual sourcing
- Market forces

**Research Methodology**

The literature review has identified only sporadic academic research conducted on food supply chain risks. With reference to the recent cases of food contamination, food safety has gained increased focus once again and various government agencies around the globe have been involved in monitoring food safety practices in their respective countries. Although there are consultancy reports available with respect to managing food supply chain risks, there is limited academic literature with respect to research conducted on managing food supply chain risks. Hence, one of the objectives of this research was to explore how supply chain risks are managed within the UK food supply chains.

The two research questions for this research are:

1. What types of risks do food supply chain members attribute importance to?
2. Among the different techniques available in supply chain risk management, how many are known to the people working within the food supply chain?

A survey was conducted in an effort to explore further the understanding and perceptions that entities within the UK food supply chains have regarding supply chain risks and the techniques deployed to mitigate and manage risks and disruptions.

**Data collection and analysis**

Although it was decided to conduct a survey with various entities within the UK food supply chain, it was necessary to conduct a pilot to test the questionnaire and also explore the kind of data being received. This paper presents the results of the pilot study. The pilot study was conducted with the help of a confectionary and snack manufacturer. The respondents from the food manufacturer agreed to send the questionnaire to some of the companies within its supply chain. This consisted of upstream suppliers of raw/finished food products to downstream distribution and logistics providers (including packers). Eight companies in total responded to the questionnaire which was deployed electronically using the ‘ surveymonkey’ website and the question building toolkit. Twenty-eight respondents from the eight companies attempted the questionnaire, of which only fourteen filled it in completely, giving a survey return rate of 50%. The data was recorded electronically and analysed using Microsoft-Excel. Although, the data is limited, taking into account that the survey was
conducted as a pilot study, it provides an insight into one food supply chain (upstream – downstream).

The questionnaire consisted of two parts: first, a set of general questions enquiring about respondent company data (sector, size and product category). Second, three main questions enquiring about risk management and perception:

1. whether the respondent company had a risk management team
2. different risk management techniques: 18 techniques were identified from the literature
   a) whether the respondent were familiar with the technique
   b) whether the respondent company used the technique
3. different types of risks affecting the food sector- 19 types identified from the literature
   - respondents were asked to rate the importance, the company attached to each risk type (high risk, medium risk, neutral, low risk and no risk)

The survey depicted the following results:

a) Does your organisation have a risk management or similar functional team?
   Table 1 depicts the results for this question.

   *Table 1 – Availability of risk management teams*

<table>
<thead>
<tr>
<th>Availability of risk management teams</th>
<th>No of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, a full time team</td>
<td>8</td>
</tr>
<tr>
<td>Yes, a team of members from other departments working part time</td>
<td>4</td>
</tr>
<tr>
<td>No, we use external consultants to guide us</td>
<td>0</td>
</tr>
<tr>
<td>No, we handle risk as an when it happens</td>
<td>2</td>
</tr>
</tbody>
</table>

b) Risk Management techniques. Table 2 depicts the results for this question. It shows the perception of the individual respondents in identifying which risk management techniques are familiar to them and which of these techniques are used by their organisations.
Table 2 – Risk management techniques (values show number of respondents)

<table>
<thead>
<tr>
<th>Technique</th>
<th>Are you familiar with this</th>
<th>Does your organisation use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Safety (H&amp;S) audits</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Crisis Management Team / Incident Management Team</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Recall procedures</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Risk control guidelines/Emergency phone numbers</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Roles and responsibility allocation</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Quality Control/Assurance (QC/QA)</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Supplier compliance audits and risk diagnosis</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Continuity planning with suppliers and customers</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>IT disaster recovery plans.</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Risk analysis and categorisation (Likelihood / Impact)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Test drills for known risks</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>New British Standard PAS56/HASP/ISO9001</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Risk registers</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Risk mapping</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Scenario planning</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Relocation readiness</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Mission critical assets and activities identification</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Freephone support</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

c) Importance attributed to the different types of risks associated with the food supply chain. Table 3 depicts the results for this question. It shows the perception of the respondents in rating the risks.

Table 3 – Risk ratings (values show number of respondents)

<table>
<thead>
<tr>
<th>Types of Risks</th>
<th>High Risk</th>
<th>Medium Risk</th>
<th>Neutral</th>
<th>Low Risk</th>
<th>No Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of Personnel - Pandemic</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Loss of Reputation - Food contamination</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Loss of Power- Electrical , Oil.</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Loss of Water</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Loss of Premises-Manufacturing or DC</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Loss of Logistics</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Loss of IT</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Unexpected Economic Forces and Regulations</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>New food safety legislation</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Natural Disasters</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Asset Price Collapse</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fuel Price Rise</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Panic Buying</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Exposure of confidential data</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Terrorism</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Increased labour cost</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Climate change.</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Cost of raw materials</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Increased competition</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Discussion and Conclusions

Although the number of respondents was less, it was an interesting set of data to see a complete supply chain and the risk management practices within it. From table 1, it is seen that >55% of the respondents identified that their organisations had setup, dedicated risk management teams, whereas only 14% of the respondents said that they did not have any formal risk management teams and they solved their issues as they happened. It can be assumed that larger the company, the greater the possibility of having formal risk management teams, however among the respondents, one company having >2000 employees does not have formal risk management teams to deal with risks.

Considering the results of the question exploring the familiarity of risk management techniques (table 2), 14 techniques out of the 18 surveyed are known to >50% of the respondents. The techniques that are less familiar are: Scenario planning, Relocation readiness, Mission critical assets and activities identification, freephone support. If this is considered in more detail, although the respondent sample size is small, it can be inferred that the respondents are more familiar with operational risk management techniques and less with strategic risk management techniques. When considering the techniques that are implemented by the organisations, only 12 out of the 18 surveyed had >50% return. Again considering this in more detail, it can be inferred that organisations in the food supply chain implement more operational risk management techniques and less of strategic risk management techniques. However, in this case ‘risk registers’ and ‘risk mapping’ techniques can also be termed to an extent as strategic and have a limited implementation. Freephone support interestingly has been a technique the least familiar and the least implemented, however ‘Freephone support’ is vital when a risk materialises, especially in cases such as the recent ‘Peanut Butter’ contamination in the USA, however this is more of a operational expense which some companies may not want to put forth.

Considering the results of the question exploring the importance attributed to different risks associated with the food supply chain (table 3), only 3 out of 19 risks have a >40% rating as High risks, these are: Loss of reputation (food contamination), Loss of power (electrical, oil, etc.), Loss of IT. When considering the recent food contamination cases of ‘peanut butter’ and ‘chinese milk’, in which both the companies had to close down, it is clear that Loss of reputation (food contamination) has the highest rating. There are a number of risks that have between 35%- 40% within medium risk category. But surprisingly, the respondent food supply chain has rated ‘Natural disaster’, ‘Panic buying’, ‘Exposure of confidential data’ and ‘Terrorism’ as Low risk.

The limitation of this survey is that the results may be related to only a specific food supply chain and may not be generic of all food supply chains. Also, the sample size is small and does not give a robust result. However, this is only a pilot study and provides some good insight for conducting a bigger survey with a larger sample size. The analysis has highlighted that ‘Loss of reputation’ – primarily due to food contamination is the risk that is rated as ‘high’ and thus needs better ‘strategic risk management techniques’ to control and mitigate. As shown from this analysis, it is important to note that entities in the supply chain are focusing on operational techniques for risk management, but are paying less attention to ‘strategic techniques’ which may be needed in the longer term to make risk management a more proactive approach.
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References


