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Dani, Samir

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MANAGING SUPPLY CHAIN RISKS: AN INTERDISCIPLINARY PERSPECTIVE

Samir Dani

Wolfson School of Mechanical and Manufacturing, Loughborough University, UK
e-mail: S.Dani@lboro.ac.uk

ABSTRACT

In the 1950's a seminal paper was published by Charles Lindblom 'The Science of Muddling Through' which highlights the theory of decision making through small discrete increments rather than big pre-planned steps. Lindblom identifies two methods of decision-making. One is the rational comprehensive (Root) approach where policy formulation is approached through means end analysis and the other approach is the (Branch) approach where means and ends are not distinct. This paper considers these concepts along with the "Garbage Can Model" and the "Mixed Scanning" concept in the context of decision making and managing in uncertain scenarios. The discussion is focussed around the processes for supply chain risk management. The research is presently in its infancy and this paper discusses a conceptual research model. As the research progresses further, validation of the model will be possible using the case-study technique. Presently, in its current state it can be used to retrospectively validate secondary data.

INTRODUCTION

In today's business environment a supply chain is stretched out across the globe. This situation thus exposes the supply chain to a whole new set of factors (external risks), which can create chaos and disruption. But this does not mean that the supply chain is devoid of any risks internally. 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 seen on a steady increase in the past couple of years. The primary aim for this research on 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.

UNCERTAINTY AND RISK

In his influential work, Frank Knight (1965) established the distinction between risk and uncertainty. According to Knight 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,

Risk = (the probability that some event will occur) X (the consequences if it does occur)

According to Lovkvist-Andersen, et. al., 2004, genuine uncertainty, cannot be assigned such a (well grounded) probability. Furthermore, genuine uncertainty can often not be reduced significantly by attempting to gain more information about the phenomena in question and their causes. 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. Also, Norrman and Jansson (2004) also express risk as,

Risk= Probability (of the event) × Business Impact (severity)

They mention that while risks can be calculated, uncertainties are genuinely unknown. Holton (2004) however suggests that it is only a perception that we have of the situation.

RISKS IN THE SUPPLY CHAIN

Supply chains today, are exposed to factors which can create chaos and disruption. Local political turmoil, the ever increasing complexity and uncertainty of weather conditions, terrorism, counterfeiting, and a plethora of other such issues create external risks in the supply chain. The supply chain is also subjected to risks internally. Supplier issues, strikes, quality problems, and logistics issues are more internal operational risks, which need a different level of mitigation. 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, and 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 – organisations and inter-organisational networks.

Level 4 – the environment.

Spekman and Davis (2004) have suggested dimensions for understanding supply chain risks incorporating some regular variables viz. movement of goods, information and money. However, they also stress the importance of secure IT systems, Corporate social responsibility and Relationship between supply chain partners. These dimensions were also resonated by Cavinato (2004) when identifying risks and uncertainties in supply chains, adding innovation to the other variables. In LaFond (2007, www.manufacturing.net) one of the respondents has mentioned that "It really is almost impossible to predict when most emergencies will happen.. Many companies think, 'It can't happen here' or 'We would never have that problem in our plant,' but then when something does occur, they are caught off-guard and not prepared".

SUPPLY CHAIN RISK MANAGEMENT

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.

In considering the risks primarily in the supply chain, Rice and Caniato (2003) and Zsidisin et al. (2000) suggested that a supply chain risk assessment programme motivates a firm to develop contingency plans. Research in this area has primarily focussed on the supplier side. Spekman and Davis (2004) have suggested that interdependency carries risk in the supply chain, but these can be managed. Zsidisin et al., (2000) present suggestions for minimising risk:

- 1) Carrying buffer stock and improving inventory management;
- 2) Using alternative sources of supply;
- 3) Use of contracts to manage price fluctuations; and
- 4) Quality initiatives.

ORGANISATIONAL DECISION MAKING: INTERDISCIPLINARY CONCEPTS

THE GARBAGE CAN MODEL

Cohen, March, and Olsen (1972) proposed the Garbage Can model to explore processes of decision-making in organisations termed as "organized anarchies", which are defined by three characteristics: problematic preferences, unclear technology, and fluid participation. "Problematic preferences" refers to ambiguity regarding problems and goals. Organisational actors may be uncertain as to both the nature of problems they face and what they hope to accomplish. "Unclear technology", refers to an organisational perspective in which organisational members are uncertain of the rules, structures, and processes by which decisions are made. "Fluid participation" refers to a phenomenon when different actors are involved in different decisions, or in the same decision at different times. The basis for the decision making process is that participants interact with problematic preferences and unclear technology to produce distinctive patterns of decision-making. The decision is an outcome or interpretation of several independent streams in the organisation. Four streams were initially identified in the theory: problems, solutions, participants, and choice opportunities. "Problems" are concerns, "Solutions" are answers actively looking for questions, "Participants" are actors involved in the process, "choice opportunities" are the decision making situations.

According to Lipson (2007) in a rational choice theory, solutions are chosen for their optimally efficient resolution of pre-existing problems, whereas in the garbage can theory problems and streams are for the most part, independent. "Solutions," or inherently preferred policies, may exist prior to any problem, and advocates of particular solutions will seek to attach them to any problem and choice opportunity that promises to serve as a vehicle for the policy's adoption. The linking of problems and solutions is determined chronologically, as problems and solutions that arise at the same time become linked in choice opportunities—instead of a rational fitting of solutions to problems. Cohen, et al (1972) suggest that in order to understand processes within organizations, one can view a choice opportunity as a garbage can into which various kinds of problems and solutions are dumped by participants as they are generated.

MIXED SCANNING APPROACH

In his seminal paper Charles Lindblom (1959) highlighted the theory of decision making through small discrete increments rather than big pre-planned steps. He described the incremental mode of decision making as the "science of muddling

through". Lindblom identified two methods of decision-making. One is the rational comprehensive (Root) approach where policy formulation is approached through means end analysis and the other approach is the (Branch) approach where means and ends are not distinct. According to Tarter and Hoy (1998), Lindblom proposed that successive limited comparisons may be the only feasible approach to systematic decision making when the issues are complex, uncertain and conflict-laden. In the rational approach, as suggested by Rosenhead (1980), a decision-maker establishes an agreed set of values, lists all opportunities for action, identifies the consequences which would follow from each action and then selects the action whose set of consequences rates highest on the agreed values. Amitai Etzioni (1967, 1986, 1989) proposed an adaptive strategy which combined the incremental and rational models of decision making. This was named as the "mixed scanning" model. Tarter and Hoy (1998) when considering mixed scanning suggest that organisational drift is unlikely when incremental decisions are consistent with broad policy as it combines rationalism to flexibility. The mixed scanning strategy distinguishes between fundamental and incremental decisions. Fundamental decisions are made by considering the main options with respect to the goal, whereas incremental decisions are made within the context set by fundamental decisions.

THE CONCEPTUAL MODEL

Figure1, depicts the conceptual model which brings together the concepts of "Garbage Can Model" and "Mixed Scanning" in a process map to mitigate and manage supply chain risks. The issues to consider in this case are regarding the:

1. the form of the "Garbage Can Model", and
2. the method used for "mixed scanning"

The Garbage Can as depicted in Fig. 1 could be a symbolic representation of the various choice opportunities (combinations) available to the organization on account of the in interactions between the typical **problems** it faces, the **solutions** it has to these problems (based on resource availability and utilization) and the **human resources** (individual or teams). This however could also be a physical repository of choice opportunities saved in a specific format depending upon the formal knowledge management process that the organization may implement. Another element to all these choice opportunities which may or may not be derived from the three interacting variables is the tacit knowledge stored in individual human beings working in the company on account of experience in a particular task. This tacit knowledge may be utilized by the individuals during the interaction between the three variables to form choice opportunities but may also remain unutilised and hence, is necessary to be tapped into. Cohen et al (1972) in their conclusion did mention that the garbage can process they had simulated does not resolve problems well, however, the process *"does enable choices to be made and problems resolved,, even when the organisation is plagued with goal ambiguity and conflict, with poorly understood problems that wander in and out of the system, with a variable environment, and with decision makers who may have other things on their mind"*.

In the model, when the organisation is faced with a supply chain uncertainty, a mixed scanning approach will used to consider the issue and the possible strategy to tackle the issue. The uncertainty can take two forms: risk (with a

defined probability) and an Uncertain scenario. In the context of this model it is presumed that for a risk scenario, since there is a probability of it happening, a proactive strategy of risk mitigation/ avoidance can be employed as against a completely uncertain scenario where it is required to react quickly to mitigate the risk. In order to derive the appropriate strategy the mixed scanning approach will also take into consideration the choice opportunities available in the organisational garbage can. This will lead to an incremental approach for risk mitigation. In a reactive state solutions are required quickly and hence the garbage can and the incremental approach may prove to be useful. However, sometimes a completely new solution or a breakthrough in innovation is required to mitigate, generally in the proactive state with a rational approach. This may require the organisation to consider externally available choice opportunities. The process map is a closed loop map as the implemented strategy may create a new constraint or uncertainty for the supply chain.

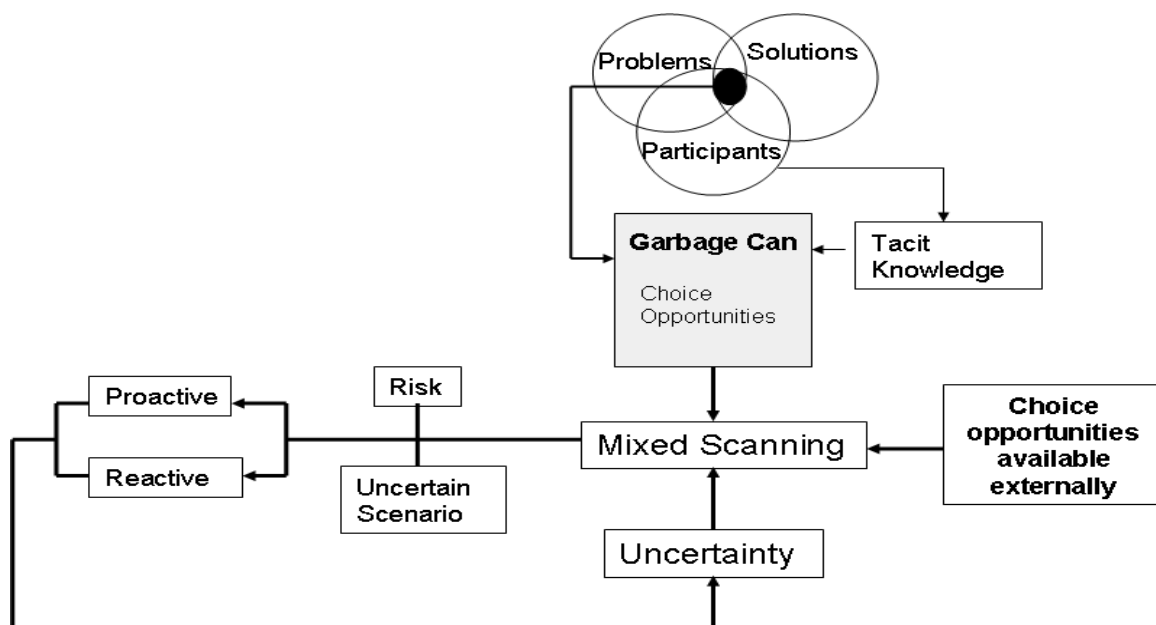


Figure 1: An interdisciplinary perspective towards supply chain risk management

Retrospective validation: The conceptual methodology in its current form (figure 1) needs to be tested empirically. However, the methodology may be used to retrospectively validate secondary data. Following is an analysis of the Nokia- Philips- Ericsson case (Sheffi, 2005; Norrman and Jansson, 2004)

Case: On Friday, March 17, 2000 the Philip's semiconductor plant in New Mexico caught fire when struck by lightning. The fire damaged the fabricator cleanrooms and the contamination ruined wafers in almost every stage of production. The plant's two important customers who accounted for 40 percent of the orders were Nokia and Ericsson. Nokia and Ericsson were informed of the fire and of a one- week delay in the order. Both companies could have handled a delay of a week, but Nokia decided that the situation needed a close scrutiny and initiated a process of collaborating with Philip's on recovery efforts. When Philip's finally declared the scope of the disruption which would have taken months to clear,

Nokia immediately started ascertaining alternative sources of supply. They managed to persuade Philips's to supply chips using spare capacity from their plants in Eindhoven and Shanghai. Nokia also reconfigured the design of their basic phones so that the modified phones could accept slightly different chips from Philips's other plants and other suppliers. Using the management of the risk as a competitive advantage within six months of the fire Nokia's "year-over-year" share of the handset market increased from 27 to 30 percent.

Ericsson however, was slow to respond to the issue partly due to communication issues within the organisation and when they realised the magnitude of the problem, Nokia had already acquired Philips's spare capacity. Ericsson thus failed to obtain the necessary chips for its phones from Nokia and from its other suppliers. It could not deliver the right mix of products in the market and thus lost roughly 400 million dollars. About a year after the fire, Ericsson signed a deal with Sony to create a joint venture to design, manufacture and market handset. The new venture Sony- Ericsson is owned 50-50 by the two companies.

The Model: Applying the model in Figure 1, it is clear that initially both the companies had not thought of a scenario where a supply disruption of one of their most key components would have created a major setback to their production and sales processes. Nokia and Ericsson had different strategies to deal with the uncertainty. Nokia considered the uncertainty to be more of a risk with a high probability of supply disruption. Hence, Nokia used a mixed scanning approach to have a very rational goal (to mitigate the disruption) but an incremental approach towards fulfilling the goal. The incremental approach had two main tasks:

- 1) to have continuity of supply from Philips, and
- 2) to find alternative suppliers to fulfil inventory requirements

To ensure continuity of supply from Philips, Nokia had to negotiate on an incremental basis for diverting Philips's excess capacity from its other plants. For finding alternative suppliers Nokia had to access its "organisational garbage can" to develop a modular design so that it could accommodate chips from alternative suppliers.

Ericsson on the other hand, initially did not consider it necessary to react to the uncertainty nor did the management team consider the probability of supply disruption. Hence, the model is not relevant for the initial stance taken by Ericsson. However, when Ericsson finally started scanning the environment and decided to incrementally negotiate with Philips for continuity of supply, it was too late as the excess capacity was diverted to Nokia.

CONCLUSION

The research presented in this paper in the form of the conceptual model (fig. 1) is still in its infancy. The inter-disciplinary nature of the research in borrowing theories and concepts from the public policy formulation domain provides an opportunity to look at organisational decision making in situations of uncertainty from a different perspective. The research also brings together in this model, "mixed scanning" as an important process for mitigating uncertainty in the organisational supply chain environment. The question regarding the form of the garbage can still lingers on and as the research progresses further, the concepts

of knowledge management will be utilised to form the initial format of the "Garbage Can". In the next phase of this research, semi- structured interviews will be conducted with supply chain personnel in organisations. who have to deal with environmental uncertainty regularly. The decision making systems and information retrieval processes inherent in these organisations based on the "Garbage Can" concept and the mixed scanning process as depicted in fig. 1 will be further explored.

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