

Chapter 7

Development and Validation of Strategic Sourcing Risk Management Normative Framework

7.1 Overview

In this research we have looked at strategic sourcing from a risk perspective. In literature various authors have mentioned the growing importance of risks in strategic sourcing and global sourcing. The cost structures in supply network are dynamic and static decisions based on a one particular scenario may be detrimental for the automobile industry or the whole supply network. The traditional supply management models and frameworks are focussed on goals like cost reduction, quality improvement, supply assurance, new product development etc. The risk management as a supply management goal has been underlooked. In this research we have integrated risk management in strategic sourcing/ supply management process.

First we developed a risk assessment model for supply management. The generic risk sources identification and assessment framework was integrated with supply management. A Bayesian model that is useful for both qualitative and quantitative risk factors for the Indian automobile industrial context has been developed.

In the second step we assessed the organizational process variables that help in implementing a risk management model for the sourcing process. In this we established the current state of strategic sourcing risk management barriers and enablers by exploratory factor analysis (EFA). We analyzed the relative importance of each one and through the force field analysis (FFA) we determined the position of Indian automotive industry on barrier/ enabler weighting.

In the last step we have developed a risk-adjusted total cost of ownership (TCO) supplier selection model wherein the transaction costs as well as risks were incorporated. The integration of two methodologies AHP and DEA is unique and these methods are appropriate for supplier selection in today's global volatile economic environment. First supplier general evaluation criteria like management capability, process and technology capability etc (detailed discussion is given in chapter 6) were used as qualifying criteria. Then in the second stage two important criteria cost structure and risk structures were being used for final selection of suppliers.

Based on the above objectives and work, we propose the SSRM normative framework as given in Fig. 7.1.

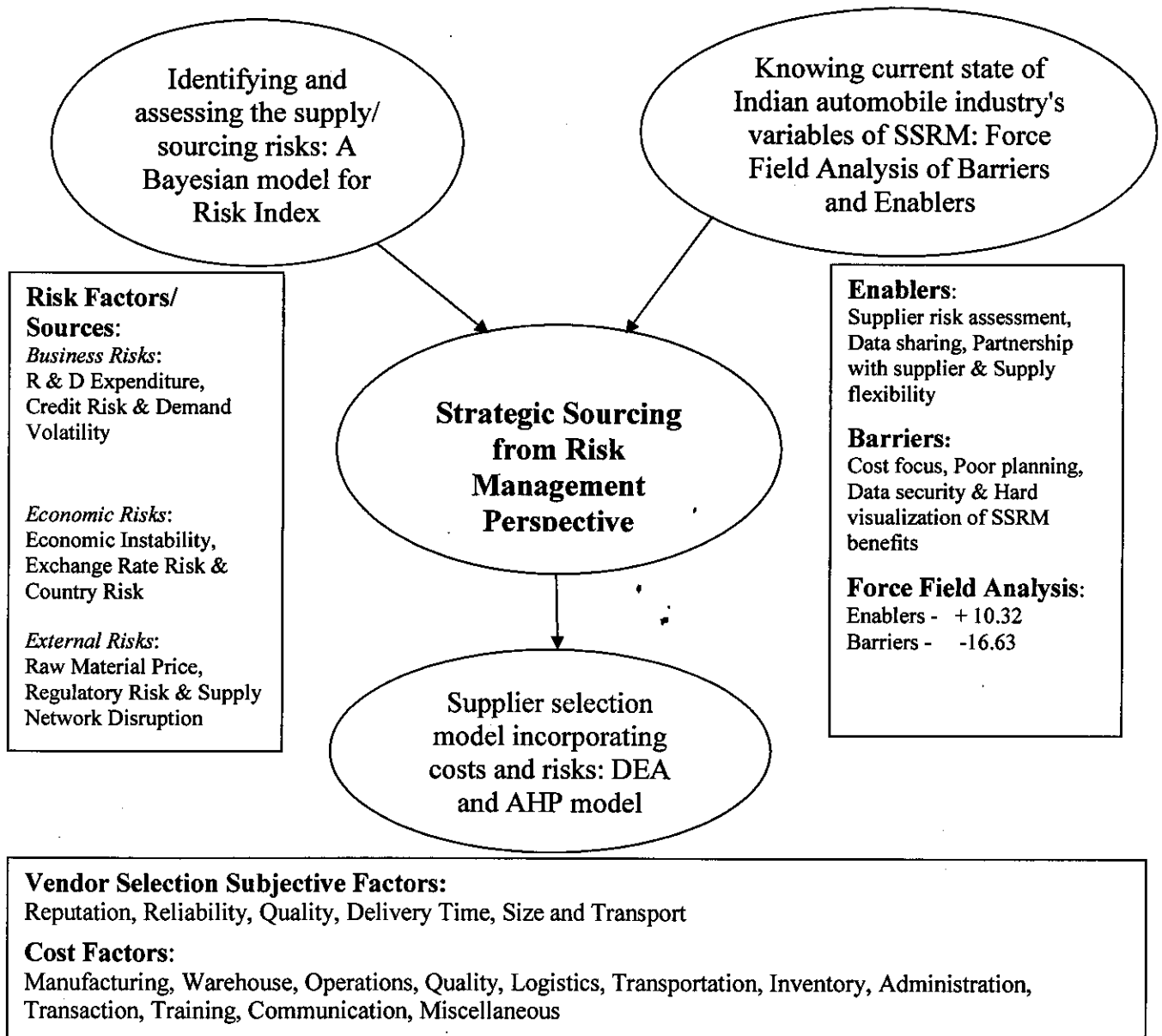


Fig. 7.1: SSRM Normative Framework for Indian Automobile Industry

7.2 Environment Scan: Indian Automobile Industry

India's automotive industry is the world's sixth largest producer of automobiles in terms of volume and value and has grown 14.4% in the last decade. The industry contributes 7% to India's GDP, 7-8% of the total employed population (about 13 million people), 4% of exports (AT Kearney, 2013; SIAM 2015), 39% of FDI inflows (USD 5.5 billion) between 2009-13 and contributes 17% to total indirect taxes collected. However, in global terms, even with export earnings of 4 billion USD (including 1.8 billion USD as exports of the auto component sector), the automotive sector contributes only 2.37% of world production and is ranked a low 26th in rank in the world auto export market with a share of 0.53%. Overall domestic sales are led by two-wheelers, (77.4% of total sales in 2012-13) followed by passenger vehicles (15.1%) and commercial vehicles (4.45%) (SIAM, 2015). The Indian auto component industry's turnover has grown significantly with a compound annual growth rate (CAGR) of 11% in the period 2010-15 with total exports of approximately USD 11.2 billion in 2014-15 (SIAM, 2015). Significantly, the majority of exports (59.64%) were to Europe and North America (ACMA, 2015). Domestic sales of passenger vehicles grew by 7.2% in 2014-15 compared to the previous year's sales with exports increasing by 14.89% in the same period (SIAM, 2015). There has been a steady growth, since 2009, in the quantum of production, domestic sales and exports of all types of vehicles as can be seen from Table 7.1.

Table 7.1: Growth of Indian Automotive Industry (2010-2015)

Years	Production		Domestic Sales		Export	
	Number	Growth %	Number	Growth %	Number	Growth %
2009-2010	1,40,50,064		1,22,95,397		18,04,426	
2010-2011	1,78,92,409	27.3	1,54,81,381	25.9	23,19,956	28.6
2011-2012	2,03,82,026	13.9	1,73,61,769	12.1	29,37,905	26.6
2012-2013	2,06,47,611	1.3	1,77,93,701	2.5	28,98,907	-1.3
2013-2014	2,15,00,165	4.1	1,84,23,223	3.5	31,10,584	7.3
2014-2015	2,33,66,245	8.7	1,97,52,580	7.2	35,73,806	14.9

We can see that the automotive industry in India is on the right path indicating the global outlook of the industry with accompanying achievements of high-quality standards. This entails the adoption of contemporary management practices in all disciplines including the sourcing/ supply network management. In order to ensure relevance and continued growth trajectory it is important

to incorporate risk management as part of strategic planning by the decision makers. The automobile industry footprint is probably the largest in terms of volume and sourcing base. Hence, the inter-linked fortunes of the large number of contributing industries can be studied based on the trends in this sector. As shown in figure 7.1, the model comprises three important facets (elements) that are being explained in further sections.

7.3 Identifying and Assessing the Strategic Sourcing Risks: A Bayesian Model

In the first phase as part of this study the risk factors that are present in the industry, and their probabilities have been identified through extensive literature review and close interaction with the management professionals to get the industry perspective.

Sourcing/ supply disruptions have been widely researched for all the industry sectors. Tier 2 stoppages, natural/ man-made disasters, suppliers' financial stress, suppliers' union issues are some of the external factors that may lead to supply disruptions (Chopra, et. al. 2012; Seck et al., 2015). They concluded that the firms take a lot of time to rectify the negative effects of disruptions. No company wants disruptions in supply network operations and these are undesirable in view of negative effects and time penalties. Companies emphasize upon business continuity and customer satisfaction (Wei et al., 2018).

Strategic sourcing of raw materials acquired in order to develop their product by the company contributes to supply network's stability and consistency. Current sourcing/ supply network management practices, built on the basis of the low price of a single commodity such as oil, or low labour cost, may no longer fit the current environment that most of the companies operate in nowadays (Christopher and Matthias, 2011) and a new system needs to be explored to overhaul the supply network foundations (Das and Nayak, 2017). A company's sourcing/ supply risks could be identified through linkages between the raw material market indices, various liquidity ratios and quantitative analysis of business and credit risk (Lockamy and McCormack, 2012).

A total of nine risk factors, namely Demand volatility, R & D expenditure, Credit risk, Exchange rate risk, Raw material price, Supply disruption, Regulatory risk, Economic instability and Country risk, have been identified from the literature and details including their description and references have been given in Table 2.4, as part of literature review chapter. Three main risk indicators – business risk, economic risk and external risk have been examined for the Indian automobile industry. This study tries to integrate and draw linkages between various risk factors

through a generalized Bayesian network model, which considers both repetitive historical data and the expert judgment as part of risk assessment (Fanoni et al., 2005). Thus, proposed BN modelling for 'Risk Assessment Index' captures both subjective and objective data and it is more useful in the situations where there is data scarcity in developing nations like India. Data has been obtained from propriety firms/ secondary sources and subject experts with respect to subjective factors like supply chain disruptions probabilities. Collection of the secondary data for objective factors has been one of the important academic contribution of this research. The probability of high risk of the gross turnover of the industry is only 29%, which is quite low compared to the amount of risk factors at play and the probability of low and medium risk effects are higher at 36% each. This shows that the Indian automobile industry has taken quite a few steps to rectify the amount of effect the risk indicators can have on its net turnover and counter-measures to address sourcing disruptions/ outages have been adopted.

7.4 Knowing current state of Indian automobile industry's variables of SSRM: Force Field Analysis of Barriers and Enablers

Excessive focus on efficiency and cost with initiatives like outsourcing, inventories reduction, just-in-time can cause supply network to be fragile and can make supply vulnerable (Kleindorfer and Saad, 2005; Snyder et al., 2012). Production breakdown in automobile firms can lead to substantial economic losses (Hendricks and Singhal, 2005; Aspa, 2017). It is vitally important to minimize the rate of disruptions and improve recovery time from disruptions. The industry needs to examine the interplay and maintain balance between enablers and barriers to work out a strategy to mitigate the risks at all levels of organizational hierarchy and identify/address implementation challenges. In this step as a natural follow up post-establishment of the Risk Index developed through Bayesian model, the risk drivers, i.e. enablers and barriers of SSRM have been identified, followed by force field analysis thereof. The research question guiding the current study is to identify the underlying factor structure of enablers and barriers of risk management in the strategic sourcing in the Indian automotive industry. Responses were collected through administered survey in form of structured questionnaire from respondents belonging to senior management cadre including purchase/ procurement professionals in the industry belonging to all automotive companies in CII's directory. Exploratory factor analysis (EFA) and force field analysis (FFA) tools have been used for this part of the research. The research framework analyses

the risks in the prioritized order and also discusses supply network design factors which have risk implications.

In this step, main processes of risk management in strategic sourcing has been presented and issues that contribute to main risks and conclusions about their treatment processes have been covered as part of this study. Through independent EFA of SSRM adopted in the Indian automobile industry, four SSRM enablers, namely, Supplier risk assessment, Data sharing in supply network, Partnership with supplier, and Supply flexibility were identified. Similarly EFA revealed four SSRM barriers, namely, Cost focus, Ad-hoc or poor planning, Data security/ privy breaches, and Hard visualization of SSRM benefits.

Force field analysis was conducted by taking the mean scores (product of mean response of each component and factor loading thereof) of the eight factors (i.e. four enablers and four barriers). The findings of FFA suggest that the barriers have a stronger impact on the strategic sourcing than the enablers. Strategies to overpower the barriers and strengthen the enablers have been evolved. The study has highlighted various factors which have led to this critical situation facing the industry. Managers have to immediately focus on improving the risk management (identification, monitoring and mitigation plans), processes, dissemination of information to partners, aligning the supply chain and strategic sourcing. This is possible only through developing a trust relationship between the partners in the supply network and improving their business processes through investment in technology and strong strategic leadership at the top.

7.5 Supplier Selection Model incorporating Costs and Risks: DEA and AHP Model

In this step, the Bayesian model based risk assessment index of the Indian automobile industry for sourcing/ supply network and a force field analysis of the risk drivers (i.e. enablers and barriers), a risk management framework has been developed in form of a data envelopment analysis (DEA) cost model that includes even the minor cost factors and the identified associated risks. Several subjective factors have been quantified through AHP by employing experts' inputs in order to calculate the costs. DEA calculates the weighted sums of inputs and outputs and hence the efficiency rate. The normative decision making framework for selecting the most optimal supplier employing all the constructs and realms of SSRM in multi-faceted dynamic Indian automobile industry environs of in-house production, off-shoring, outsourcing and global sourcing. Relevant

literature comprising strategic sourcing continuum, cost models and global supply network risks have been examined in detail followed by research methodology and development of the DEA based supplier selection model factoring in both the costs and risks.

Businesses today are expanding globally and increasing competitiveness entails customers' satisfaction and simultaneous profits maximization (Kogut and Kulatilaka, 1994; Sharma, 2016). The make or buy decision comes into play that results in demand and supply points spreading to more than one country. Forward-thinking companies are making their value chains more elastic and flexible. Purchases of outside goods and services are increasing in almost all industries (Nassimbeni, 2006). Optimum manufacturing and selling point(s) depend on targeted costs, quality and other factors. Cost reduction is feasible through cheaper raw material costs, or better labour costs etc. Though, if apt technique and strategy isn't applied, the cost of outsourcing can almost nullify the savings from labour and materials. Firms also enter into relationships to access new technologies/ better products, or new markets (Monczka and Trent, 1991; Cho and Kang, 2001). It is of great importance that companies are aware of both benefits and risks about sourcing, since the results are dependent on the skill levels of the employees. Businesses often encounter risk factors like price fluctuations, political, disaster and natural risks, exchange rates, huge transportation costs, taxes and duties (Manuj and Mentzer, 2008; Daš and Nayak, 2017).

The study proposes to focus on need and benefits of incorporating often neglected cost factors into sourcing decisions and prepares a method for an ideal global supplier selection model for the Indian automobile industry based on the combined costs and risks factors. A set of six vendor selection subjective factors, i.e. Reputation, Reliability, Quality, Delivery Time, Size and Transport, have been initially identified through close interaction with the professionals of the Indian automobile industry and after assigning relative weights, the vendor selection process is undertaken. The DEA evaluates all the risk factors represented through an estimated cost allowance along with other costs as inputs. As part of the DEA, the input factors of the developed model comprises 12 identified cost factors, namely Manufacturing, Warehouse, Operations, Quality, Logistics, Transportation, Inventory, Administration, Transaction, Training, Communication and Miscellaneous, and three risk factors, namely Business risks (R & D Expenditure, Credit Risk & Demand Volatility), Economic risks (Economic Instability, Exchange Rate Risk & Country Risk) and External risks (Raw Material Price, Regulatory Risk & Supply Disruption). The output factors include Cost Competitiveness, Timely Delivery and Quality Excellence. The efficiency rates of each option is examined to shortlist the best option. This model allows the OEMs in Indian

automobile industry to take into account beyond the visible major costs, pertinent for short-term strategy for sourcing, to evolve a better strategy for sourcing decisions which shall result in significant lesser costs for the company.

7.6 Validation of the SSRM Normative Framework

In this section the SSRM normative framework is validated by conducting a survey of Strategic Sourcing Management (SSM) automotive professionals and risk managers and eliciting their opinions and reflections (favourable and unfavourable remarks) on the proposed SSRM normative framework. In addition, proposed vendor selection model has been validated by means of using a case study.

7.6.1 Survey of SSM Automotive Professionals and Risk Managers

The survey included a one-page introduction, two-page SSRM framework description and one-page containing relevant questions. The purpose of the survey was to carry out a limited test of the usefulness of the framework and indications of possible adjustments therein. To attain that goal, it was sufficient to get the opinions from just a handful of SSM managers. The investigator contacted SSM experts in automotive supply network through contacts of CII, SIAM and ACMA bodies. Through personal contacts, face to face interviews have also been conducted. Important questions included in the survey are given below and the questionnaire is as per Appendix 3:

Q.1 Which models, framework or guidelines do you use for SSRM?

Q.2 What are the tools and techniques used by automobile industry professionals for identifying and assessing sourcing risks?

Q.3 What are your comments about the proposed SSRM normative framework?

Q.4 Is there anything in the SSRM normative framework, which needs elaboration?

Q.5 How would you like to position the SSRM normative framework in relation to other models within the area? What are the similarities and differences?

Comments received from the professionals and managers were treated anonymously. These varied from being short to few being quite comprehensive. Respondents observed the framework to be comprehensive and exhaustive as well as of real use, especially for automotive companies and could be of interest to many others as well. One respondent observed that the model is part of risk management, a fundamental framework in automotive sourcing/ supply network context. The

model has been found to be highly applicable to that part of RM that deals with business interruptions caused by sourcing disruptions. It has been received as a valuable contribution to a structured and consistent way of dealing with important and difficult facet of SSRM. A general remark is that the term risk is used in so many meanings, both in layman's language and in science. This framework provides a new way to look at sourcing network. The importance of calculating sourcing/ supply network risk exposure has been incorporated in the model. This framework has been considered as a tool for the 'risk assessment process' in 'business continuity management', a part of risk management that seems to have developed as a 'stand-alone' discipline in practice.

The tools and techniques adopted include the brainstorming with management team to find out/ analyse critical risks faced by strategic sourcing framework/ supply networks. Specific SSRM framework is not employed by the industry and sourcing disruption model is not available. COSO framework in parts and traditional tools like PFMEA for strategic sourcing risk analysis are adopted.

95% of respondents agreed on completeness of the framework and have said that it's a complete guideline for SSRM. Knowing about strategic sourcing risk index has been appreciated and one respondent commented that it had to be complemented with more specific risk analyses to be complete. It is an eye-opener for strategists. The model being simple is easy to understand and as it also covers SSRM implementation part, it is very useful for top managers. Operation managers struggled to fix sourcing disruption problem and fight hard against supply network risks. One of the comments stated that probably all frameworks have more or less imperfection and how does one know in an ever-changing world that this model includes all the relevant variables. There is a structure suggested for SSRM barriers and enablers and has been observed to be workable. One respondent proposed that more elaboration on how barriers could be minimized and enablers could be enhanced are needed in the model. Like all other models it is likely to be rather hard to spread and get acceptance in the organization, as it sought answers to strategic questions from decision makers as well as difficulty to quantify the risks and intangible cost factors in probabilistic terms. PI matrix are used for this and then suitable actions are devised. The model is self-explanatory and covers all generic steps of RM, and that nothing should be deleted.

It seemed that the respondents, in spite of some reservation regarding complexity and larger amount of information needed by model, agreed that the model was easy to understand and that the terminology was not new. The respondents agreed that the model could be useful for SSRM professionals and all those concerned with risk management in the sourcing/ supply

network. Intended users of the framework are supply network members of automobile industry supply network. The model can be converted for the use in other industries also.

7.6.2 Validation by Means of a Case Study

The SSRM normative model has been applied on a case company data to select the best vendor to outsource certain part/ component. The company outsources manufacturing of goods generally to Asian countries, with a budget of 200 million INR. The input cost and risk factors described in Section 7.5 above have been considered. Initially, out of 50 options, five vendors were shortlisted based on the factors and above-mentioned methods. Relative priority of sub-risk factors has been determined using AHP. DEA has been performed on the five shortlisted vendors for the company. The cost ranges and risk ranges of the five vendors for the mentioned input category have been obtained and then efficiency rate of each of them has been calculated.

This model takes into account exhaustive set of costs that are often not considered as well as effect of risk factors. It has emerged that though the Vendor 1 didn't provide the lowest manufacturing, transportation or even logistics cost, still turned out to be the optimal choice by factoring in the results of this model. If we just go by the manufacturing costs, Vendor 2 seems to be the best choice, but the normative framework model shows clearly that after incorporating all the costs and risks, it is not the most efficient choice. Vendor 1 in fact doesn't provide a visible minimum cost in any specific category, yet still gives the highest efficiency ratio due to better internal risk management processes.

The validation of the SSRM normative framework can be summarised in words of one of the senior level professional, who has commented, "A synergy between industry and academicians in intimate collaboration is the path to a glorious sunrise. This is a good starting point and now, industries should come forward and talk to academicians to take this strategic sourcing risk management field to greater heights".