Abstract

The incidence of 9/11 enforced the organizations and the regulators to think and work on delivering the good sense services in a secure way. Further, last few years have witnessed the increasing threats, terrorist attacks (e.g. 9/11 US attack, 26/11 Mumbai attack), natural disaster (e.g. Japanese tsunami, Thailand floods), super-storm (e.g. sandy), labour unrest & accidents (e.g. Maruti Manesar plant, India) and uncertainty. Under these circumstances, both researchers and practitioners have realized that they need to continuously work towards finding secured ways of managing goods and services across their supply chains. While giving attention on the security aspects of supply chain, organizations have realized that attaining only security measures for their supply chain will not help them in managing their supply chain at a consistent performance level. They also realized that, they also need to manage risk across various supply chain functions (comprising of sourcing manufacturing and distribution risk). Further both supply chain security and supply chain risks are associated with vulnerability and disruption with makes the supply chain structure more complex and difficult to manage.

Visualizing, a strong need for holistic and robust approach to supply chain security, an in-depth review of literature was carried out. 205 Research papers, articles, business news, websites from various sources were referred on this subject. This in-depth review highlighted that in-spite of great acceptance by both practitioners and researchers on supply chain risk and supply chain security, not much research is seen for Indian context also a holistic and robust approach is missing. Based on the gaps from the literature, this present research is undertaken with a view to understand the subject of supply chain security holistically (comprising of both security and risk aspects) and develop a robust and secure performance approach on this area. Following key objectives are set for this research:

- To understand robust and secure supply chain in Indian Automobile Manufacturing environment.

- To identify the key dimensions of robust and secure supply chain for Indian automobile industries.

- To develop a methodology for assessment and comparison of the robust & secure supply chain of Indian automobile industry.
To assess the relationship of identified dimensions of robust and secure supply chain of Indian automobile industry.

Being one of the initial researchers in exploring the area of supply chain risk and supply chain security, the need for survey methodology was felt more appropriate in this case and hence it was adopted. Data was collected using a questionnaire survey, which was executed on 201 experienced practitioners from Indian Automotive companies. The profile of respondents includes VP, GM, Sr. Mgr and Managers from various automotive organizations and with relevant experience. The design of questionnaire was based on proven and well recommended approach comprising of refining the inputs of literature review through experts and followed by pilot testing. Review of literature and details of research methodology along with justifications of various tools used are documented in Chapter 2 & 3 respectively.

The collected data is refined through a series of analysis and validation process and procedures which include: Reliability assessment, KMO and Barlett test of sphericity, Exploratory Factor Analysis using SPSS 16.0 (Principal Component Analysis using Varimax rotation and Kaiser Normalization), followed by the recommended tests of validity assessments including content, convergent and discriminent validity assessments using Confirmatory Factor Analysis approach using AMOS 7.1. The analysis of the data revealed a validated 14 factor structure (3 factors for assessing Supply Chain Security, 5 factors for assessing Supply Chain Risk and 6 factors for assessing Supply Chain Risk and Security). The analysis and results are documented in Chapter 4.

In order to develop a robust approach and to develop a methodology for comparison of organizations, multi-criteria decision model was developed and executed using Analytical Hierarchy approach through Expert Choice 11 software. Various approaches of sensitivity analysis viz Performance Sensitivity, Dynamic Sensitivity, Gradient Sensitivity, Head to Head Sensitivity were used to test the sensitivity of the model. Further the robustness is tested by using four supply chain strategies (as recommended by researchers). Under each of these four strategies Collaborative activities, In-House activities, Multi-functional outsourcing, and, Transportation Outsourcing the sensitivity analysis was carried out for rigorous testing. The analysis and results are documented in Chapter 5.

Interpretive Structural Modeling approach is used to develop the model based on the structural relationship of the 14 factors. The model clearly highlighted that “Information risk and security” rests at the bottom of the hierarchy and most important among all factors. This
further validated the results so obtained using multi-criteria approach. The ISM analysis details are documented in Chapter 6.

The findings of this study provided significant implications for both practitioners and researchers working in the area of supply chain risk and supply chain security management. The findings of this study may be used by various manufacturing organizations to develop a supply chain risk and security index which can be periodically measured and monitored. Chapter 7 presents the summary of the research process along with brief discussions of results, implications for practitioners and researchers and relevance for Indian automobile manufacturing organizations.

Key words: Supply Chain Risk, Supply Chain Security, Exploratory Factor Analysis, CFA validations, Sensitivity Analysis, Supply Chain Strategy, Interpretative Structural Modeling.