

STUDY OF SELECT ISSUES IN AGILITY AND INTEGRATION OF SUPPLY CHAINS

by

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Submitted

in fulfilment of the requirements of the degree of Doctor of Philosophy

to the



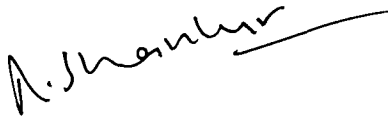
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CERTIFICATE

This is to certify that the thesis entitled “**Study of Select Issues in Agility and Integration of Supply Chains**” being submitted by **Ashish Agarwal** to the Indian Institute of Technology Delhi for the award of the degree of **Doctor of Philosophy** is a bonafide record of original research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirement for the submission of the thesis, which has reached the requisite standard.

The results contained in this thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.



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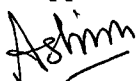
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ABSTRACT

To address demand uncertainty in volatile markets, it is essential to understand the issues related to agility and integration of a supply chain. By gaining insights on these issues, supply chain can be better managed in terms of timely responding to customer demand. The ability of an organization to respond rapidly to changes in demand, both in terms of volume and variety, is being defined as agility. Thus, agility improves profit by providing exactly what the customer requires and reduces costs whilst not impeding the ability to meet customer service requirements. On the other hand, leanness will improve profit through cost reduction and provide service suitable for a level schedule. In a leagile supply chain, which is a combination of lean and agile supply chain, inventory and lead-time need to be slashed through real-time information sharing. To achieve this, better integration is sought among trading partners through centralized planning and control, quality management, and after-sales support.

This research is aimed at examining the agility and integration related issues and their effect on supply chain performance in Indian context. A literature review has been conducted to identify the gaps in Supply Chain Management (SCM) research. Hypotheses were framed and a questionnaire-based survey instrument was developed. A survey was conducted to gain insights on various issues related to agility and integration of supply chains in auto, fast moving consumer goods, and electrical and electronics goods sectors. The descriptive statistics from the survey and hypotheses testing provide insights about the perceptions of Indian companies towards agility and integration related issues in their supply chains. Using Analytic Network Process (ANP)-based model, lean, agile and leagile supply chain paradigms have been

analyzed. Sensitivity analysis has been carried out to understand the relative effect of four important performance variables: lead-time, cost, quality, and service level on supply chain performance. In order to build trust in a supply chain, alternative trust developing environments have also been analyzed using ANP. Sensitivity analysis has been again carried out which focuses on the priority of these alternatives affected by the relative importance of trust determinants. Two case studies of leading Indian companies have been carried out to understand the initiatives taken by these companies to integrate their supply chains and to timely respond to customer demand. Interpretive Structural Modeling has been used to identify the relationships among important variables for supply chain agility. After developing causal relationships among these variables, their effects on supply chain performance have been simulated through System Dynamics (SD) modeling under different market scenarios.

The major contributions of this research are as follows:

- Issues for conducting further research have been identified after reviewing the literature on supply chain management.
- The perceptions of Indian companies towards issues related to agility and integration of their supply chains have been captured by administering questionnaire.
- Through hypotheses testing, similarity or dissimilarity in the perceptions of Original Equipment Manufacturers (OEMs), and suppliers towards agility and integration of supply chain have been highlighted.
- For a given multi-criteria decision making situation, superiority of leagile supply chain in comparison to lean and agile supply chains has been established by developing an ANP-based framework.

- Three alternatives namely feedback system, trusted third party system, and community responsibility system which help to build trust among trading partners of a supply chain have been analyzed by developing another ANP-based framework.
- Using SAP-LAP framework two cases from Indian companies are developed and analyzed. These case studies provide insights about initiatives taken to integrate the supply chains and to improve agility.
- Using Interpretive Structural Modeling, the important variables related to supply chain agility have been modeled and their dependence and driving power have been identified.
- Using System Dynamics Modeling learning insights have been generated towards the impact of integrating enabler and responsiveness enabler on the supply chain performance under different market scenarios.

Keywords: Agility, integration, responsiveness, analytic network process, interpretive structural modeling, system dynamics modeling, questionnaire-based survey.

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