

A STUDY OF SUPPLY CHAIN COLLABORATION IN INDIAN AUTO COMPONENT INDUSTRY

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A STUDY OF SUPPLY CHAIN COLLABORATION IN INDIAN AUTO COMPONENT INDUSTRY

by

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*“One not knowing a land asks of one who knows it,
he goes forward instructed by the knowing one.
Such, indeed, is the blessing of instruction;
one finds a path that leads him straight onward.”*

Rig Veda 10.32.7

Dedicated to my parents

Mrs.Nirmal and Mr. Ashok Tuli

CERTIFICATE

This is to certify that the thesis titled “**A Study of Supply Chain Collaboration in Indian Auto Component Industry**” being submitted by Mr. Prashant Tuli (Entry No. 2011SMZ8104) to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy (Ph.D.) is a record of bonafide research work carried out by him. He has worked under my guidance and supervision, and has fulfilled the requirements for the submission of this thesis, which has attained the requisite standard for Ph.D. degree from the Indian Institute of Technology Delhi. The results presented in the 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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ABSTRACT

Automotive industry in India has been one of the key drivers of industrial growth and an ambitious growth in the passenger car industry is foreseen. The component industry, being a major contributor to this segment holds the key to its growth. It needs to meet the challenges of technology, quality, capacity and cost, to be able to support the vehicle manufacturers (OEMs). In doing so, it must overcome the limitations of resources, skills and investment and enhance speed of new product development (NPD). However, the firms face challenges of resource constraints, gaps in the critical skills and concerns regarding self-interest or opportunism by the supply chain partners. Collaboration has long been viewed as a key lever for overcoming such limitations of supply chain and enabling superior performance at a supply chain level.

The purpose of this thesis is to enhance the understanding of supply chain collaboration in the context of Indian automotive industry. This thesis accomplishes it using a combination of studies comprising theoretical underpinning of the concept, extensive industry survey and detailed case studies of collaborative practices in the industry. It identifies the various antecedents and outcomes of the process of collaboration through extensive study of extant literature and various theoretical perspectives in the context of supply chain collaboration. These are modeled in the form of a conceptual framework using the interpretive structural modeling (ISM) and the opinion of the industry experts. The proposed framework represents the process of supply chain collaboration as a set of select collaborative practices along with the motivation and expectations of the collaborative engagements between the supply chain partners. The framework highlights two key aspects, focused on systems and relationship respectively, which promote collaborative exchanges between the supply chain partners and enable the stakeholders to generate collaborative advantage out of such engagements.

However, it is foreseen that various categories of suppliers may exhibit different levels of collaborative engagement with their partners. The thesis compares the collaborative engagement across the different categories of suppliers based on their type of product, sales turnover or workforce and position in the supply chain etc. An industry survey of Indian auto component suppliers covering different categories, as explained previously, is conducted to note the significant differences among them based on their participation in the collaborative practices. A detailed analysis is done to understand differences in the collaborative engagement of different supplier categories. The findings indicate several factors that may explain the category specific preferences or biases towards collaboration.

Additionally, the thesis studies some actual cases of collaboration in the industry to understand the collaboration among supply chain partners and its outcomes for the individual members of the supply chain. As the automotive industry has a tiered structure consisting of OEM, Tier-1 and Tier-2 suppliers, the case studies include the cases related to both vertical (e.g. between the Tier-1 supplier and OEM) and horizontal (between a group of Tier-1 suppliers) engagements. These cases provide detailed insights into the prevalence and nature of collaborative relationships between the supply chain members.

The thesis provides multiple insights into the process of supply chain collaboration in the Indian automotive industry. These include the concept of collaboration as viewed by the industry and the categories of suppliers that are likely to collaborate more than the others. The findings from the industry survey and the case studies indicate the collaboration as an important initiative at the supply chain level. The findings may be leveraged by the researchers and practitioners in the automotive domain. The findings may also interest the policy makers and industry associations concerned with the automotive sector.

सार

भारत में मोटर वाहन उद्योग औद्योगिक विकास के प्रमुख चालकों में से एक रहा है और यात्री कार उद्योग में महत्वाकांक्षी वृद्धि की अपेक्षा है। घटक उद्योग, इस सेगमेंट में एक प्रमुख योगदानकर्ता होने के कारण इसकी वृद्धि की कुंजी है। वाहन निर्माताओं का समर्थन करने में सक्षम होने के लिए इसे प्रौद्योगिकी, गुणवत्ता, क्षमता और लागत की चुनौतियों से निपटने की जरूरत है। ऐसा करने में, इसे संसाधनों, कौशल और निवेश की सीमाओं और नए उत्पाद विकास की गति में वृद्धि करना होगा। परन्तु, कंपनियों को संसाधन सम्बंधित बाधाओं में चुनौतियों का सामना करना पड़ता है, महत्वपूर्ण कौशल में कमियां और आपूर्ति श्रृंखला भागीदारों द्वारा स्व-रुचि या अवसरवाद से सम्बंधित चिंताएं भी होती हैं। आपूर्ति श्रृंखला की ऐसी कमियों पर काबू पाने और आपूर्ति श्रृंखला स्तर पर बेहतर प्रदर्शन को सक्षम करने के लिए सहयोग को काफी समय से एक प्रमुख सहायक के रूप में देखा गया है।

इस थीसिस का उद्देश्य भारतीय मोटर वाहन उद्योग के संदर्भ में आपूर्ति श्रृंखला सहयोग की समझ को बढ़ाना है। यह थीसिस अवधारणा के सैद्धांतिक आधारों, व्यापक औद्योगिक सर्वेक्षण और उद्योग में प्रचलित सहयोगी प्रथाओं के विस्तृत केस अध्ययनों के संयोजन से इसे पूरा करने का प्रयास करती है। यह आपूर्ति श्रृंखला सहयोग के संदर्भ में मौजूदा साहित्य और विभिन्न सैद्धांतिक दृष्टिकोण के व्यापक अध्ययन के माध्यम से सहयोग की प्रक्रिया के विभिन्न पूर्ववर्ती और परिणामों की पहचान करता है। इन्हें व्याख्यात्मक संरचनात्मक मॉडलिंग (आई एस एम) और उद्योग विशेषज्ञों की राय का उपयोग करके एक वैचारिक ढांचे के रूप में तैयार किया गया है। प्रस्तावित ढांचा आपूर्ति श्रृंखला सहयोगियों के बीच सहयोगी जुड़ाव की प्रेरणा और अपेक्षाओं के साथ चुनिंदा सहयोगी प्रथाओं के एक सेट के रूप में आपूर्ति श्रृंखला सहयोग की प्रक्रिया का प्रतिनिधित्व करता है। प्रस्तावित ढांचा क्रमशः सिस्टम और रिश्तों पर केंद्रित दो प्रमुख पहलुओं पर प्रकाश डालता है, जो आपूर्ति श्रृंखला भागीदारों के बीच सहयोगी आदान-प्रदान को बढ़ावा देता है और हितधारकों को इस तरह के जुड़ाव से सहयोगी लाभ उत्पन्न करने में सक्षम बनाता है।

हालांकि, यह पूर्ववत है कि आपूर्तिकर्ताओं की विभिन्न श्रेणियां अपने सहयोगियों के साथ सहयोगी जुड़ाव विभिन्न स्तर प्रदर्शित कर सकती हैं। थीसिस आपूर्तिकर्ताओं की विभिन्न श्रेणियों में सहयोगी जुड़ाव की तुलना उत्पाद के प्रकार, बिक्री कारोबार या कार्यबल और आपूर्ति श्रृंखला आदि

के आधार पर करता है। जैसा कि पहले बताया गया है, विभिन्न ऑटो श्रेणियों को कवर करने वाले भारतीय ऑटो घटक आपूर्तिकर्ताओं का एक औद्योगिक सर्वेक्षण उनकी सहयोगी प्रथाओं में भागीदारी के आधार पर, उनमें महत्वपूर्ण मतभेदों को ध्यान में लाता है। विभिन्न आपूर्तिकर्ता श्रेणियों के सहयोगी जुड़ाव में मतभेदों को समझने के लिए एक विस्तृत विश्लेषण किया गया है। निष्कर्ष कई कारकों को इंगित करते हैं जो सहयोग की दिशा में श्रेणी विशिष्ट प्राथमिकताओं या पूर्वाग्रहों को समझा सकते हैं।

इसके अतिरिक्त, थीसिस आपूर्ति श्रृंखला भागीदारों और आपूर्ति श्रृंखला के व्यक्तिगत सदस्यों के बीच के सहयोग को समझने के लिए उद्योग में सहयोग के कुछ वास्तविक मामलों का अध्ययन करती है। चूंकि मोटर वाहन उद्योग मूल उपकरण निर्माता, प्रथम स्तरीय (टियर -१) और द्वितीय स्तरीय (टियर -२) आपूर्तिकर्ताओं से युक्त एक स्तरीय (टायर) संरचना है, केस स्टडीज में दोनों, वर्टिकल (जैसे टियर -१ आपूर्तिकर्ता और मूल उपकरण निर्माता के बीच) और क्षैतिज (टियर-१ के समूह के बीच) आपूर्तिकर्ताओं के बीच के सहयोग का अध्ययन किया गया है। ये मामले आपूर्ति श्रृंखला सदस्यों के बीच सहयोगी संबंधों के प्रसार और प्रकृति में विस्तृत अंतर्दृष्टि प्रदान करते हैं।

यह थीसिस भारतीय मोटर वाहन उद्योग में आपूर्ति श्रृंखला सहयोग की प्रक्रिया में कई प्रकार की अंतर्दृष्टि प्रदान करता है। इनमें, उद्योग द्वारा देखी गयी सहयोग की अवधारणा और आपूर्तिकर्ताओं की वह श्रेणियां शामिल हैं जो दूसरों की तुलना में अधिक सहयोग करने की संभावना रखती हैं। उद्योग सर्वेक्षण और केस स्टडीज के निष्कर्ष सहयोग श्रृंखला स्तर पर सहयोग को एक महत्वपूर्ण पहल के रूप में इंगित करते हैं। निष्कर्ष मोटर वाहन उद्योग से सम्बंधित शोधकर्ताओं और प्रबंधकों के लिए उपयोगी हो सकते हैं। निष्कर्ष मोटर वाहन क्षेत्र से संबंधित नीति निर्माताओं और उद्योग संघों के लिए भी उपयोगी हो सकते हैं।

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ABBREVIATIONS

ACMA	Automotive component manufacturers' association
ANOVA	Analysis of variance
APQP	Advanced Product Quality Planning
BOM	Bill of materials
CAE	Computer aided engineering
CFD	Computational fluid dynamics
CI	Confidence interval
CII	Confederation of Indian industry
DFMEA	Design failure mode and effect analysis
DP	Design prototype
DVP	Design validation plan
HCV	Heavy commercial vehicle
HI	High
IOS	Inter organizational systems
IS	Information systems
ISM	Interpretive structural modelling
IT	Information technology
KM	Knowledge management
LCV	Light commercial vehicle
LO	Low
MP	Mass production
NPD	New product development
OEM	Original equipment manufacturer
PFD	Process flow diagram
PFMEA	Process failure mode and effect analysis
PP	Production prototype

PV	Passenger vehicles
QA	Quality assurance
RFQ	Request for quotation
SC	Supply chain
SCC	Supply chain collaboration
VA	Value Analysis
VSM	Value stream mapping
2W	Two wheelers
3W	Three wheeler