# CHAPTER SEVEN

# SUMMARY AND CONCLUSIONS

This chapter presents summary of the work performed. Fist it presents summary of the work which is followed by contributions made. Contribution of the work is presented in terms of how research objectives have been have met and what are their implications. This is followed by quantum and quality of work. Towards the end limitations of work and scope for future research is presented.

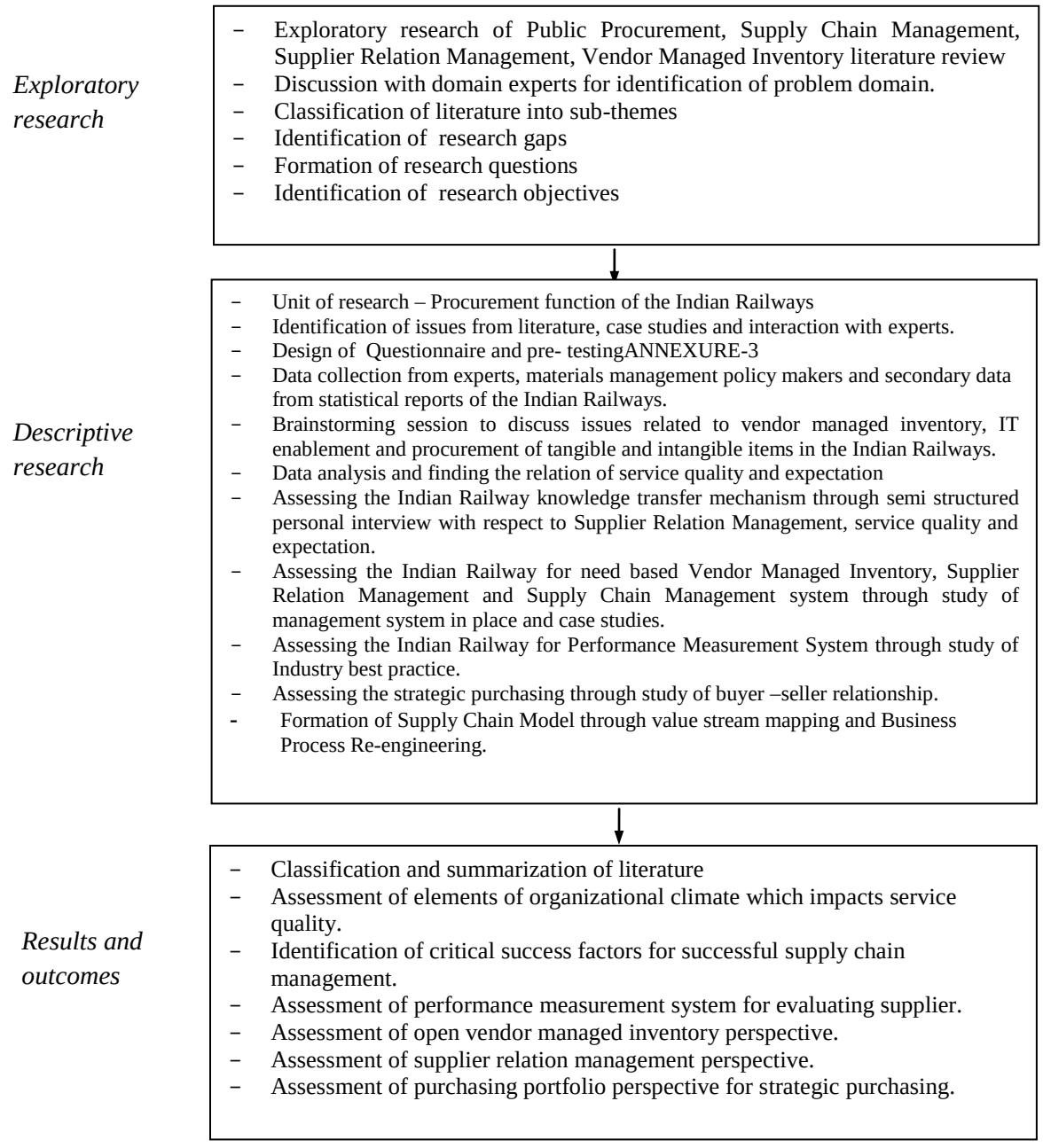
**7.1 Context of Study**: The Indian Railways (IR) is a Government of India organization under Ministry of Railways. Material Management Department of the Indian Railway follows the principle of public procurement, it is strictly rules and procedure driven processes and is required to ensure uninterrupted flow of material for production of rolling stock and maintenance, repair and overhaul of railway's assets. An efficient and effective supply chain management is critical to the Indian Railways and shall benefit the internal users of railway for production and maintenance railway assets; inventory management with budgetary constraint. Strict compliance of rules and procedure and tendency of transaction based approach comes in the way of smooth uninterrupted Supply Chain Management (SCM). A small percentage of saving in the cost of bill of material translates into huge monetary benefit and enhancement in the efficiency of the Indian Railways. This study analyses some issues in procurement function in the upstream portion of Indian Railways Supply Chain Management (SCM).

**7.2 Summary of the Work Done**

This study follows exploratory and descriptive research through case study approach. Based on the exploratory research and case studies a framework has been conceptualized. Literature on assessment of service quality for supplier relation management, public procurement, purchase portfolio planning, Vendor Managed Inventory (VMI)and strategic purchasing were referred. Based on the literature, case studies and interaction with experts in the field, issues have been identified for the study. The unit of analysis is the procurement function of the Indian Railways. This thesis investigates procurement related processes, vendor managed inventory and supplier relationship related issues. This work done for Indian Railways can be

directly used to other public procurement organization including World Bank. Besides developing model for strategic purchasing, a model of Supplier Relation Management (SRM) and Vendor Managed Inventory (VMI) has been suggested through case studies and semi structured interviews for defining issues related with service quality and expectations. The results of the research have been extrapolated to draw inferences about Supply Chain Management (SCM) in public procurement organization. The summary of the work flow as followed during the conduct of the study is depicted in Figure 7.1.

**Figure: 7.1 workflow of the study**



## 7.3 Contributions Made

### *7.3.1 Implication for Theory*

This study started with four research objectives which are pertinent for the analysis of Material Management function on Indian Railway, a Government of India Organization under Ministry of Railway. Table 7.1 depicts mapping of research objectives, the way they have been realized and implications in terms of deliverables, contribution to literature/theory and other associates implication of the research findings.

**Table 7.1: Mapping of Research Objectives with Deliverables and Implications**

| How research objectives have been met? | Deliverables and associated implications |
|---|---|
| ***First Objective:*** To identify Issues related with Public Procurement on Indian Railway. | |
| − Preliminary literature survey on Public Procurement helped in identification of gaps. This led to formulation of four research objectives.<br>− Issues and propositions were framed for Public Procurement organization to study its impact on Supply Chain.<br>− Focused review of literature has provided better understanding of the identified domain. The large available secondary data from Indian Railway was discussed with the Experts through focus group workshop. This has facilitated understanding and enrichment of the knowledge of the present situation and practical insight into the problem domain.<br>− Certain issues were short listed based on literature, case studies and interaction with project team. Focused literature was carried for detail understanding of these issues.<br>− Private Procurement is compared with Public Procurement.<br>− Existing procurement process is mapped.<br>− Case studying of procurement of High Speed diesel is carried out.<br>− Case studying of purchase of electrical energy carried out. | - Research on public procurement is very limited in the Indian context. This study contributes by exploring the role of Public Procurement function in nurturing organization.<br>- Based on the exploratory research a framework of the study has been conceptualized which may be used by future researchers.<br>- Classification of literature into sub-themes presents a unified body of knowledge which may be used by future researchers.<br>- The entire procurement process of Indian Railway is mapped which can be used by future researcher.<br>- Key performance indicators of Indian Railway compared with leading automobile company which helps for bench marking and performance improvement.<br>- Issues with reference to High Speed Diesel were highlighted and solution suggested.<br>- Solution suggested for procurement of electricity substation capacity optimization. |
| ***Second Objective:*** To study issues related to Vendor Managed Inventory and suggesting Vendor Managed Inventory (VMI) model for Indian Railway and integrated with Third Party Logistics (3PL). | |
| - The exploratory research has been followed by the four main critical success factors including descriptive research interview based study through descriptive research using tested tool, the knowledge transfer perspective. Inventory Management and strategic purchasing.<br>- The census outcome for relation between Customer expectation and service quality was analyzed to identify critical factor. The regression equation also suggests the priority to be given to each factor.<br>- The issues which require attention for any Vendor Managed Inventory system are studies.<br>- Bullwhip effect and its impact on Supply Chain is | - The major critical success factors were identified for nurturing public procurement. This can be used for other similar organizations, and can be studied for other sectors.<br>- Various circumstances which influence the decision are listed for researcher to deal.<br>- Secondary data of Indian Railway is collected and summarized to demonstrate the anomaly which has resulted due to bullwhip effect.<br>- The Key Performance Indicator |

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| studied along with budgetary constraint.<br>- Key Performance Indicators (KPI) for Vendor Managed Inventory (VMI) are listed.<br>- Existing system of Supply Chain on Indian railway is mapped along with its association with various Stake holders. Deficiencies in existing system were found out and a model of Vendor Managed Inventory (VMI) suggested.<br>- 3PL system in context of Indian Railway is studied. | (KPI)helps in decision making.<br>- Entire procurement cycle and interaction with various actors in the procurement process are mapped which forms the basis of value stream mapping.<br>- Third Party Logistics (3PL) solution to Indian Railway Material Management is suggested. |
| ***Third Objective:*** *To Suggest model for Vendor evaluation.* | |
| - This customer focused concept based on detailed analysis of requirements, co-creation with stake holders etc. was studied in the Indian Railway through study of best management practices in place and case studies of other private organization with successful Supply Chain Management.<br>- Quality requirements as a motivation for Supply Chain was also explored and it was reviled that increased level of communication and integration improves the opportunity for Supply Chain Management.<br>- Real time information exchange as a force multiplier was explored a model.<br>- Different level of maturity of supply chain is described.<br>- Supplier evaluation criteria are studied through literature review and study of best practices.<br>- Purchase portfolio planning is summarized through case study of Indian Railway.<br>- Existing business process is mapped to carry out the value stream mapping. | - Best practice concept integrated with system engineering approach involving all the stakeholders for cooperation can be used for other projects and other Public procurement system for success.<br>- This approach can be integrated with other Supply chain driven procurement system for sustainable Supply chain.<br>- Collaboration, joint venture, commercialization, export can further be exploited for Supply Chain Management and growth.<br>- This helps the executive to assess the current status of maturity of supply chain and goal setting.<br>- Various criteria of supplier evaluation are defined. Through study of best practice and expert opinion the importance of weightage is assigned.<br>- Items are classified into various category for deciding on strategies for procurement.<br>- Existing process with integration to different stake holder is mapped lead time of entire procurement cycle and each activity is estimated. |
| **Fourth Objective:** *To carry out port folio analysis and redesign the procurement process so as to make it driver of supply chain.* | |
| - This objective is also met through study of the Value Stream Mapping through exploration followed by semi structure interviews of participants from collaborative Supply Chain. A model for real time Information Technology based model for effective transfer of information on real time basis is evolved.<br>- The framework for strategic purchasing defined based on buyers and sellers orientation has been made to result in to supply chain management and their contribution towards value engineering.<br>- Various model of purchase portfolio planning model discussed.<br>- Through value stream mapping of existing system and understanding the requirement of the user, a Business process engineer is carried out and a model is suggested.<br>- A model for real to Share Of Business is suggested using Game Theory concept. | - This perspective is very useful for knowing bottleneck and if combined with other concepts of best practices Improvement of systems and sustainability can be assured.<br>- The model can be used with some modification for other combinations of information exchange and supply chain management.<br>- The model is a contribution to the literature; scholar can further modify and integrate few more aspects in future to make it more useful.<br>- The framework can be used to improve purchasing processes to aid value engineering.<br>- The patterns of purchasing with respect to its strategic nature can be assessed and improved through respective levels of buyers and sellers orientation.<br>- Through Secondary data of Indian Railway the item are classified into |

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|---|---|
| | purchase portfolio for deciding on purchasing strategy.<br>- Expert interview and understanding the requirement of the customer a real time model is suggested on the basis of full system of inventory management so as to make procurement as driver of supply chain management.<br>- Changing the share of business dynamically on real time basis incentivise the supplier to maintain good performance. It also takes care of tendency of cartel formation. |
| **Fifth Objective:** To redesign procurement processes of IR in the light of best practices of procurement and supply chain management so as to achieve enhanced level of functionality under public procurement environment. | |
| - This objective is met by identifying best practices from the literature. This was followed by a workshop where top level materials management managers of IR and Maruti Suzuki India provided practical insights.<br>- Learning derived was supplemented by best practices used by other leading government and private organizations.<br>- Mapping of as-is processes has been performed to identify the non-value adding processes. | - An improved to-be system is designed which customise best practices into public procurement environment.<br>- The new system will have enhanced information flow which will reduce information asymmetry across the IR supply chain.<br>- |
| **Sixth Objective**: To develop a model so as to make procurement as driver of supply chain management in IR | |
| - Learning derived from literature in terms of business process orientation, lean system, performance measurement system, game theory based approaches to design improved procurement system for optimum utilization of budget and to avoid tendency to form cartel.<br>- Study of performance measurement system from literature and best practices various components of vendor performance assessment.<br>- Study of dynamics associated with share of business | - The performance measurement system to assess a vendor is designed. The various parameters of vendor assessment along with their associated weightage is conceptualised which may be of use to rate a vendor.<br>- System is redesigned on the concept of business process orientation with a feedback loop of vendor performance rating to adjust share of business dynamically. |

*This Study Contributes To The Literature of:*

*<u>Knowledge Management:</u> The study is pioneer and benchmark in a sense that in the Indian context, this study identifies various issues related with public procurement through case study of Indian Railway a Government of India organization under Ministry of Railway. To the best of researcher's knowledge this is the first Indian study of its type which flags various issues of Indian Railway Material Management systems and solutions. The knowledge developed in the system is captured in the Material Management Information System (MMIS) in a classified manner and catalogued for quick retrieval. The vendor performance feedback model incentivize for continuous improvement. In this sense it captured explicit knowledge associated with material management which is archived for sharing and future use on which scenarios may be developed to address un-structured decisions and form tacit knowledge.*

*Supply Chain Management:* :This is the first Indian study which analyses the role of supplier-buyer in the public procurement function across upstream supply chain of the Indian Railways. It underscores underlying tenets of supplier orientation and buyer orientation. It comes up with input based predictive model and identifies various patterns along evolutionary trajectory of organizations in their quest towards strategic purchasing.

*Vendor Managed Inventory: This is first Indian study in Public Procurement which analyses requirement driven supply system of various components into the system. This involved trust and sharing of information with supplier on real time basis, redefining the conditions of contract and quality assurance plan to suit the vendor managed inventory into Indian Railway.*

*Supplier Relation Management: This study is pioneer in a sense that it come up with a holistic framework for sustainable Supplier Relation Management eco-system. This framework highlights capacity enhancement through collaborative approaches. It demonstrates the interplay of tacit-explicit knowledge continuum across supplier which introduces improvement of competition. These incentivize the supplier to always maintain good performance.*

Based on ensuing discussions the study defines Supply Chain as need driven all encompassing quest for efficient process or service and successful Supply Chain are interplay of management-technology-management competencies. India has large number of public procurement agencies. Therefore, the imperative for India is to carve out institutional mechanism for creation of knowledge infrastructure and competencies. The model developed here provides effective solution to:

- Inventory management by converting push process of inventory management into pull process.
- It provide solution to Bullwhip effect by providing real time flow of information to all stake holder in transparent manner, therefore takes care of over stock and out of stock out situation.
- This becomes effective tool for budget management by integrating budget with material requirement planning and target setting.
- The model provides the framework for supplier evaluation and communication of score. It creates environment of continuous improvement.
- Dynamic setting of share of business effectively solves the problem of cartel formation and incentivizes the supplier for maintaining highest standard of service.

- It sets the stage for ultimate level of maturity of supply chain which also includes value engineering and global optimization in public procurement environment.
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### 7.3.2 Implications for Social Sustainability

Public procurement amounts to procurement by using tax payer's money. It forms the part of major expenditure of any government. Public Procurement drives the policy of that government. It aimed to create tolerant and well educated society and necessary infrastructure of social and economic growth. For emerging nation like India it contribute 20 percent to 25 percent of GDP or Rs.20 lakh Crores expenditure per annum. A small 5 per cent saving in expenditure means a lot which can be utilized for other project of social and economic importance. Moreover money well and efficiently spent enhance chances of success of purpose for which money is spent.

## 7.4 Quantum of Work

*Lot of work has been done during this research starting from literature survey followed by various aspects of Supply Chain Management through a well-defined research methodology towards a conclusive summary. The quantum of the work is described in brief in Table 7.2.*

**Table 7.2: Quantum of Work**

| **Issue/ Contributions** |
|---|
| **Review of literature** |
| Review and classification of around 250 research papers. Syntheses of literature to bring out the key issues pertinent to public procurement and other perspectives for sustainable supply chain. |
| **Methodology** |
| - Identification of various issues from literature, case studies and interaction with expert. Short listing based on suitability survey.<br>- Design of Questionnaires and its statistical assessment<br>- Data collection from Experts and two workshops conducted at National Academy of the Indian Railways, Vadodara.<br>- Personal interviews using semi- structured questionnaires for knowledge transfer.<br>- Data analysis and finding the relation between service quality and expectation.<br>- Testing of theoretical propositions.<br>- Focused classification of literature.<br>- Case study of supply chain of High Speed Diesel. Identification of issues and solution.<br>- Case study of procurement of electrical energy identification of issues and solution.<br>- Study of best practice of supply chain, bench marking and customizing for public procurement. |
| **Finding and Interpretations** |
| - A reliable tool for studying the customer expectation and service quality on Indian Railway.<br>- Focused classification of literature.<br>- The theoretical frame work of supply chain of Indian Railway, linkages with stake holder.<br>- Frame work of Vendor Managed Inventory.<br>- Frame work for supplier evaluation and supplier Relation Management.<br>- A framework for procurement port folio planning and making procurement as driver of supply chain. |

### 7.5 Quality of Work

In the Indian setting, the research on public procurement and Supplier Relation Management (SRM) in the context of public procurement is limited. This study contributes by exploring issues involved in nurturing of the organizational culture which results in technological driven supply chain solution. Taking public procurement as a process, the work first highlights the importance of public procurement for meeting society needs, development of linkages with academia for various issues related with public procurement. The work also highlights the importance of development of evaluation criteria. In addressing Indian Railways strategic needs the partnership with linked industries as well as various stake holder is also highlighted. In doing so the role of suppliers is highlighted as providers of materials, equipments and components which are transformed by Indian Railway into products and services. The novelty of the study lies in its comprehensive approach and addressing of issues which are not dealt with earlier in India.

### 7.6 Limitations

Only the upstream supply chain of Indian Railway is studied. Although the work has been planned and executed utilizing the available resources in terms of time, data etc. still this study suffers from some limitations. The Indian Railway is taken as representative case of public procurement. To overcome this interview was done with inclusion of technical officers in addition to procurement expert. The availability of secondary data was sector specific due to vast nature of most of Indian Railway. There may be limitation in analysis with respect to knowledge transfer regarding reliability and repeatability which was tried to be normalized by number of interviews, multiple responses from same projects.

### 7.7 Future Research

Based on the work done for this thesis some extensions to the present work can be taken for future research. The survey can be extended to other Government organization under different clusters to compare organization and clusters. This will also give a more applicable model for public procurement on a wider data base for higher level of reliability. Further, the survey can be extended to other Government organization namely, World Bank, Defense, National Thermal Power Corporation Limited (NTPC), Bharat Heavy Electricals limited (BHEL), oil and Natural Gas Corporation (ONGC), Department of Science and Technology (DST), etc. to generalize the model for public procurement organization in the country. Leadership as a most important factor may be studied in these organization to study its effect

on supply chain. This survey can be repeated at different times and different railway zones for the same populations vis-à-vis management decisions implemented for supply chain to compare supply chain in two time zones and also efficacy of decisions implemented.

Research can be done to integrate the innovation and value engineering effort and sharing of resultant benefits between buyer and supplier. Innovation can be built in as criteria of supplier evaluation. The model developed is not very suitable for project expenditure. This model needs to be suitably modified for project environment.

## 7.8 References

1. Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985), "A conceptual model of service quality and its implications for future research", Journal of Marketing, Vol. 49 No. 4, pp. 41-50.