STUDY ON IMPACT OF BEST SUPPLY CHAIN MANAGEMENT PRACTICES ON THE PERFORMANCE OF ORGANIZATIONS IN INDIA

Thesis submitted to the Faculty of Technology,
University of Delhi in fulfillment of the requirement
for the award of the Degree of

DOCTOR OF PHILOSOPHY

IN

PRODUCTION AND INDUSTRIAL ENGINEERING

BY

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DELHI-110007, INDIA
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CERTIFICATE

This is to certify that thesis entitled **"STUDY ON IMPACT OF BEST SUPPLY CHAIN MANAGEMENT PRACTICES ON THE PERFORMANCE OF ORGANIZATIONS IN INDIA "** being submitted by **Mr. Hari Om Sharma** for the award of the **Doctor of Philosophy** to University of Delhi is a record of the bonafide research work. He has carried out this research work under our guidance and supervision. The results contained in this thesis have not been submitted to any other university or institute for the award of a degree.

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(Hari Om Sharma)

ABSTRACT

Selection of best supply chain management practices has attracted serious research attention in recent past. This topic is still under considerable development. Present research is aimed at examining the impact of best supply chain management practices on the performance of Indian organizations. Supply chain management practices are necessary to manage integration and co-ordination of supply, demand and relationship in order to satisfy consumers in effective and profitable manners. It helps in improving performance of whole value chain, which is essential for sustainable growth of all organizations.

The contribution to knowledge recorded in this study is four fold. First a comprehensive literature review of supply chain management practices and attributes, Secondly, an extensive multi-sector survey of Indian organizations from different parts of the country to investigate various attributes and practical issues related with SCM. Two hundred and fifty seven organizations belonging to different sectors such as auto component, electronic, plastic and light engineering etc. have participated in the study as respondents. The third contribution to knowledge is made through development of two case studies to obtain further insights into organizations supply chain. The fourth contribution to knowledge is made by developing ISM based model. Major contributions of study are as follows.

- Comprehensive literature review on best practices of SCM for gaps identifications.
- Identified major attributes while selecting SCM practices for organizations.
- Identified the problems faced by organizations during implementation of SCM.
- Identified the motivations for implementing SCM in organizations.
- Identified major investment priorities for SCM success.

- Identified the major hindrances in implementing SCM practices in organizations.
- Identified the level of implementation of the SCM practices and initiatives taken by organizations for SCM.
- Identified major attributes for new product design and development activities.
- Identified the information sharing and selection criteria for suppliers.
- Analyzed environmental related issues in organizations.
- Analyzed the effect of different SCM practices on performance measures such as sales growth, profit growth, return on investment, and delivery on time, responsiveness, reduction in lead time, reduction in inventory cost, reduction in manufacturing cost, reduction in product rejection rate.
- Developed select case studies to analyze supply chain issues in real life scenario.
- Identified enablers for SCM implementation and developed a structural relationship model.

Based on observations and findings, recommendations for successful SCM are made. This study will motivate organizations in taking initiatives for successful supply chain management.

Key Words: Supply chain management practices, Enablers for effective SCM, Supplier selection, Investment priorities, Performance etc.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

3PL	Third-party logistics
ACMA	Automotive component manufacturing association
AMT	Advanced manufacturing technology
ASN	Advanced shipment notice
BSC	Balanced score card
CAD	Computer aided design
CAE	Computer aided engineering
CAGR	Compound annual growth rate
CEO	Chief executive officer
CSF	Critical success factor
EC	Electronic commerce
EDI	Electronic data interchange
ERP	Enterprise resource planning
FDI	Foreign direct investment
FMCG	Fast moving consumer goods
GDP	Gross domestic product
ICT	Information and communication technology
IS	Information system
ISM	Interpretive structural modeling
ISO	International organization for standards
IT	Information technology
JIT	Just in time
LE	Large Enterprise
MRP	Materials Requirement Planning
MRP II	Manufacturing Requirement Planning

MSMEs	Micro, small and medium enterprises
OEM	Original equipment manufacturer
PO	Purchase order
POS	Point of sale
QC	Quality control
RBI	Reserve bank of India
RFID	Radio frequency identification devices
SAP-LAP	Situation-actor-process—learning-action-performance
SARS	Severe acute respiratory syndrome
SC	Supply chain
SCM	Supply chain management
SMEs	Small and medium enterprises
SSI	Small scale industries
TQM	Total quality management
TPL	Third-party logistics
UK	United Kingdom
USA	United state of America
VMI	Vendor managed inventory
WIP	Work in process

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Supply chain management (SCM) practices involve a set of activities undertaken in an organization to promote effective management of its supply chain (Koh *et.al*., 2007). SCM practices help managing integration and coordination of supply, demand and supply relationships in order to satisfy consumers in effective and profitable manners.

The performance measurement systems should be linked to the practices of supply chain management so that managers are able to evaluate how well the supply chain is performing. Performance is also measured by benchmarking comparisons but achieved by utilizing all resources effectively.

In modern economic era, organization finds a commercial world where survival is contingent on performing to standards of practices. Whether proactive in pursuing political and trade agendas or reactive in assessing, diagnosing and responding to extraneous forces, organizations have reaped the benefits of adopting sound business principles. Today, challenge is one posed by the advent of the globalization of business furnished by the internationalization of companies and the networking of their supply chains. Some of the multinational organizations have economic power bigger than many sovereign nations. Global competitiveness is the Mantra which distinguishes this economic era from previous ones. The company has attributed a significant part of its success to the way it manages flows of product, information and funds within its supply chain. The failure of many businesses firms can be attributed to their inability to design appropriate supply chains or manage supply chain flows effectively. The design, planning and operation of a supply chain have a strong impact on overall profitability and success. It is fair to state that a large part of the success of a firm can be attributed to their effective supply chain design, planning and operation.

1.2 SUPPLY CHAIN MANAGEMENT (SCM)

Supply chain management is one of the most important areas that have recently generated a great deal of interest in both industry and academia. The term SCM was first coined by an American industry consultant in the early 1980s.The supply chain (SC) is a linked set of resources and processes that begins with the sourcing of raw materials and extends through to the delivery of end items to the final customer. While the separation of supply chain activities among different companies enables specialization and economics of scale, many important issues and problems need to be resolved for successful supply chain operations (Trkman *et.al.,* 2007).

The supply chain is a network of facilities that procure raw materials, transform them into intermediate goods and then to final products, and deliver the products to customers through a distribution system. It is regarded as a continuous process from the total market supply and demand for products to customer payment. It encompasses all the information- financial, and physical that flows from the supplier's supplier to the customer's customer. The idea of supply chain management is to view the chain as an integrated system, and to fine- tune the decisions about how to operate the various components (firms, functions, and activities) in ways that can produce the most desirable overall system performance in the long run.

The concept of the supply chain, identified as "Process for building improved and stronger upstream and downstream business linkages", focuses toward improving value for the ultimate customer. Related definitions of the supply chain include: "How to integrate and perform logistics and manufacturing activities", or more generally, collaboration among supply chain partners.

A more elaborate and applied definition of SCM is: "The connected series of activities concerned with the planning and controlling of raw materials components and finished products from suppliers to the final customer". Supply chain must include multiple echelons, focus on integration, and goals of service and profitability and may also involve collaborative processes and value–adding considerations. Supply chain flows are both forward and backward. Cash and credit movements are also part of the integrated supply chain flows. Supply chain management (SCM) is the

process of planning, implementing and controlling the operations of the supply chain as efficiently as possible.

Supply chain management spans all movement and storage of raw materials, work in process inventory, and finished goods from point of origin to point of consumption. According to American professional association, Supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers, In essence, Supply chain management, integrates supply and demand management within and across companies. Some experts distinguish supply chain management and logistics, while others consider the term to be interchangeable. Organizations increasingly find that they must rely on effective supply chain, or networks, to successfully compete in the global market and networked economy. In management's new paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

In the 21st Century, there have been a few critical changes in business environment that have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of multi-national-companies, joint ventures, strategic alliances and business partnerships, there were found to be significant success factors, following the earlier "Just-In-Time", lean management and "Agile Manufacturing" practices. Second, technological changes, particularly the dramatic fall in information communication costs, which are a paramount component of transaction costs, have lead to changes in coordination among the members of the supply chain network. Many researchers have recognized these kinds of supply network structures as a new organization form, using terms such as "keiretsu" extended enterprise, virtual corporation, "Global Production Network", and "Next Generation Manufacturing System". In general, such a structure can be defined as "A Group of Semi-independent organizations", each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to

achieve some business goals specific to that collaboration. Supply chain event management (SCEM) is a consideration of all possible occurring events and factors that can cause a disruption in a supply chain. With SCEM possible scenarios can be created and solution can be planned.

1.3 SUPPLY CHAIN PERSPECTIVES: Supply chain can be studied from three perspectives as follows.

1.3.1 Operational Supply Chain

Operational aspect is concerned with the efficient operation of the entities with the supply chain and focuses on control and performance measures. This is concerned with the daily operation of a facility such as a plant or distribution processes to ensure reliable and economic distribution of and daily production schedules.

1.3.2 Design Supply chain

The design involves contributions from different disciplines. Design of the supply chain determines its structure, i.e. number of plants warehouses, distributions etc in supply chain.

1.3.3 Strategic Supply chain

The strategic supply chain involves the analysis of how various goals support the needs of the organization and it is definitely the responsibility of the upper management. Strategic aspect also includes the research determination of opportunities that can enhance the competitiveness of the organization as a part of the supply chain or the network of supply chain.

1.4 TYPES OF SUPPLY CHAIN

Different types of supply chains are as follows-

1.4.1 Lean Supply Chain (LSC)

A LSC employs continuous improvement processes to focus on the elimination of waste or non-value stops across the chain (Turkett , 2001). It is supported by the reduction of set up times to allow for the economic production of small quantities, thereby achieving cost reduction, flexibility, and responsiveness in responding to

customer requirements. For internal responsiveness, the organizations adopt the time-based competition paradigm, which ensured that development and production time is compressed, there by achieving higher responsiveness and profitability, justifying higher prices for enhanced customer service and leading to rapid innovation and lower cost of quality.

1.4.2 Agile Supply Chain (ASC)

Agility relates to the interface between a company and the market. It profits by responding to rapid chang, continually fragmenting global markets by being dynamic, context specific aggressively changing and growth oriented, driven by customer designed products and services.

1.4.3 Hybrid Supply Chain (HSC)

The existence of an intermediate chain known as the hybrid supply chain which is similar in meaning with the word of "legality" (Naylar *et.al.*, 1999). A HSC involves 'assemble to order' products, whose demand can be quite accurately forecasted. The chain helps to achieve mass customization by postponing product differentiation until final assembly.

1.5 SUPPLY CHAIN MANAGEMENT PROBLEMS

Organizations are affected by the internal problems rather than external difficulties which were significantly concerned about the lack of information, lack of expert employees, lack of new equipment, increased product stock, increasing designing time, increasing production time, increasing distribution time, and increasing tooling time (Manzouri, 2011). These problems are mainly as a direct result of rapid developments in supply chain management, technological advancements, globalisation, intensified global competition and the current global economic recession.

Other problems in supply chain management are as follows:-

1. Lack of the level of implementation and use of the supply chain management practices such as: Bullwhip effect analysis: The phenomenon of increasing variability in demand in a supply chain is referred to as the bullwhip effect.

The bullwhip effect is essentially the artificial distortion of consumer demand figures as they are transmitted back to the suppliers from the retailer.

2. Lack of the level of information sharing on various issues with suppliers and customers: information sharing across the chains will bring about many changes such as an increase in the process visibility, and improvement in forecasting in order to reduce the bullwhip effect phenomenon. Information should be shared to make the level of inventory, order tracking, product development, distribution, organization's production cost, demand and order across the chain clear.

3. The level of the hindrances in implementing supply chain management: Halldorsson *et. al.,* (2008), observed that without top management support SCM might fail. Hindrances in implementing supply chain management are lack of top management commitment, resources and funds, transportation facilities, co-ordination among supply chain members, use of modern technologies, demand forecast system, sharing information with suppliers, quality of raw materials, trust among supply chain member, distant location of suppliers and customers.

4. Unreliable suppliers: Suppliers' lead times are too long; the purchasing price of materials is too high; the financial stability of suppliers has become an issue (after the onset of the economic crisis). The financial stability of suppliers (after the onset of the recent economic crisis) had deteriorated, and order fluctuations from customers (after the onset of the economic crisis) had also increased significantly.

5. The low acceptance of integrated Third party logistics (TPL): Apart from the infrastructural challenges, business in India doesn't have the access to the best supply chain services for a variety of reasons. The low acceptance of integrated third party logistics (TPL) firms in India is one part of the problem. The cost differential between the integrated TPL an existing transport firms is wide. So shippers find it difficult to justify the additional cost of a TPL, even though they would be receiving high technology support and generally superior service from such provider. Further, the infrastructural challenge

mentioned above constrains the internationally known TPLs from operating with the same speed and efficiency as they do in developed economies.

1.6 HOW TO MAKE SUPPLY CHAIN MORE EFFECTIVE?

The effectiveness of strategic supply chain management is closely tied to three attributes: agility, adaptability and alignment (Lee, 2004).

- Agility: Strong ability to be proactive as well as responsive to changes.
- Adaptability: Maintain a limited set of multiple chains to ensure distribution.
- Alignment: Interests of participants coincide (developed to be synergistic).
- Competitive priorities: Total value across speed, quality, cost and flexibility.

1.7 STRATEGIC FIT IN SUPPLY CHAIN

Strategic fit means that both the competitive and supply chain strategies have aligned goals. To achieve strategic fit, a company must ensure that its supply chain capabilities support its ability to satisfy the targeted customer segments. There are three basic steps to achieve this strategic fit (Chopra and Meindl, 2001).

- Understanding the customer and supply chain uncertainty: First an organization must understand the customer needs for each targeted segment and the uncertainty the supply chain faces in satisfying these needs. These needs help the organization define the desired cost and service requirements. The supply chain uncertainty helps the organization to identify the extent of the unpredictability of demand, disruption and delay that the supply chain must be prepared for.
- Understanding the supply chain capabilities: There are many types of supply chains, each of which is designed to perform different tasks well. A organization must understand what its supply chain is designed to do well.
- Achieving strategic fit: If a mismatch exists between what the supply chain does particularly well and the desired customer needs, the organization will either need to restructure the supply chain to support the competitive strategy or alter its competitive strategy.

1.8 SUPPLY CHAIN MANAGEMENT PRACTICES

SCM practices are defined as approach applied in managing integration and coordination of supply, demand and relationships in order to satisfy consumers in effective and profitable manners (Wong *et.al.,* 2005).

SCM practices involve a set of activities undertaken in an organization to promote effective management of its supply chain. The literature is replete on the dimensions of SCM practices from variety of perspectives. In a more recent study, (Li *et.al.*, 2005) attempted to develop and validate a measurement instrument for SCM practices. Their instrument has six empirically validated and reliable dimensions which include strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices and postponement. Strategic supplier partnership represents the long-term relationship between the organization and suppliers. Customer relationship covers the practices on complaint handling, customer satisfaction, and long-term relationship establishment. Information sharing means the information communicated between partners where the accuracy, adequacy, and timeliness refer to the quality of information. Lean practices are represented by the elimination of waste, low inventory, small lot sizes and JIT delivery. Postponement is the delayed differentiation of products on the supply chain. Supply chain management (SCM) includes a set of approaches and practices to effectively integrate suppliers, manufacturers, distributors and customers for improving the long-term performance of the individual firms and the supply chain as a whole in a cohesive and high-performing business model (Chopra and Meindl, 2001). As defined by the Council of Supply Chain Management Professionals (CSCMP), SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities as well as coordination and collaboration with channel partners.

1.9 PROMINENT MANUFACTURING SECTORS

To study the impact of best supply chain management practices, different manufacturing sectors are considered in present study for analyzing the issues related with supply chain management.

Sector wise study will help in identifying the key characteristics of each sector and in development of the most appropriate strategy for each sector. In perspective contribution to Indian economy, major sectors are automotive, plastics and chemicals, electronics, light engineering. These sectors have been discussed in following sections.

1.9.1 Automotive and Auto Component Sector

Indian automobile industry

Indian market before independence was seen as a market for imported vehicles besides assembling of cars manufactured by General Motors and other brands. Indian automobile industry mainly focused on servicing, dealership, financing and maintenance of vehicles. Manufacturing started only after a decade. India's transportation requirements were met by Indian Railways playing an important role till the 1950's. Since independence, the Indian automobile industry faced several challenges and road blocks like manufacturing capability was restricted by the rule of license and could not be increased but still it lead to growth and success it has achieved today.

The first automobile was launched in India in the year 1897 in Bombay. Today India is being recognized as a potential emerging auto market. The industry has add up foreign players to their investments. Eighty percent of the segment size is contributed by two-wheelers. India is the largest three-wheeler and two-wheeler market in the world. It is second largest tractor manufacturer in the world, fifth largest commercial vehicle manufacturer in the world. India crossed the one million mark as the fourth largest car market in Asia recently. India is the second largest producer of motorcycles in the world (5.2 million) after China which has a production volume of 12 million.

(Ref: www.indianmirror.com)

Indian Automobile Industry Performance in 2012-13

Overall Indian Automobile Industry has shown marginal growth in financial year (FY) 2012-13 compared to FY 2011-12. According to Autobei Consulting Group (ACG) Production and Domestic sales has registered growth of 1.20% and 2.61%,

however export experienced negative growth due to negative global environment and fluctuation. One of the hot spots in world automotive industry is Indian car market. Indian car industry is going through turbulent times now. Car sales are down by more than 6% in FY 2012-13 compare to FY 2011-12. The main reasons are high interest rates, fuel price, high inflation, low movement in other sectors etc. Utility vehicle segment is having maximum growth in this segment.

Passenger car sales in India fell by 7 percent in FY 2012-13, the first such decline over a decade, based on the data provided by Society of Indian Automobile Manufacturers (SIAM). However, the industry body is, hopeful of a pickup in FY14. Overall, last financial year, CV sales were down 2 percent and motorcycle sales saw only marginal growth.

(Ref**:** Synopsis of India's Automobile Sector, FY: 2012 - 13)

Indian auto components industry in 2012-13:

The revenue growth of Indian auto components industry in 2012-13 was the slowest in last five years as suppliers battled weak demand from domestic OEMs, sluggish export volumes starting Q2 2012-13 and tepid replacement market sales. Revenue growth was particularly weak in Q4 2012-13 due to the unusually high base of Q4 2011-12 (because of vehicle pre-buying that had happened in this period in anticipation of excise duty hike) as well as propagation of demand weakness across all automobile segments. Suppliers of parts to the Medium and Heavy Commercial Vehicle (M and HCV) segment and the Passenger Car (PC) segment were the most severely impacted; while suppliers to the Light Commercial Vehicle (LCV) and Utility Vehicle (UV) segments were relatively better off.

As per sample of 35 publicly-listed auto component manufacturers, the average revenue growth of these select entities (during the last eight quarters) has been steadily declining with growth being lower in each passing quarter since Q1 2011-12 and turning negative for the first time in Q4 2012-13. Nevertheless, there were notable exceptions in this otherwise grim milieu with the revenue growth of select auto component manufacturers being much higher than the industry's on the back of market share gains, favourable change in model mix, rise in content per vehicle,

besides revenue accretion due to corporate actions such as acquisitions and amalgamations. Over the near term, we expect the auto component industry's revenue growth to remain weak in the absence of immediate demand triggers for end-users across domestic automotive segments, besides an uncertain global economic environment that would exert pressure on export volumes. Over the medium term, however, factors such as auto OEMs' growing thrust on localization, auto suppliers' efforts to expand business in new geographies, the strong upside potential to replacement market demand and increasing sophistication of vehicles shoring up part prices, should allow the Indian auto components industry to grow at a relatively faster pace than the auto OEM segment.

(Ref: ICRA Limited, Research Services, 2013)

Auto parts exports from India (2013)

Auto parts exports from India up 4.4% at € 7 billion ($9.7 billion) in 2013. At a time when the Indian auto industry is reeling under a prolonged slump, the component makers have something to cheer as exports grew by 4.4% to touch € 7 billion ($9.7 billion) in 2013. Despite a decline in import by 5% to € 9.7 billion ($12.70 billion) last year, the country remained a net importer of components. 80% of exports are to global original equipment manufacturers (OEMs) and tier I companies. Growing credibility of domestic component makers have led to many global companies setting up their sourcing centres in India. There are 35 - 40 international purchasing offices set up by various global entities in India now.

The US remains India's biggest component export market but shipments to the country were down 7.1% last year at € 1.45 billion ($1.98 billion). Exports to Germany, the second largest market, registered 8.6% increase at € 569 billion ($780 million), while it was up 3.6% to the UK, the third largest, at € 580 million. In 2013, China continued to be the number one country from where maximum components were imported, valued at € 1.91 billion ($2.62 billion), up 10% from the previous year. Germany was second at € 1.35 billion ($1.86 billion), down 3%, followed by Japan at € 1.18 billion ($1.62 billion), down 14%.

India's components imports are mainly in two categories-high tech parts which come mainly from Germany, Japan, Korea and Thailand; and aftermarket parts which are usually originating from China. Annual car sales in India had declined for the first time in 11 years in 2013, posting a 9.59% dip with the auto industry reeling under a prolonged demand slump due to the economic slowdown. The domestic car sales fell to 18, 07,011 units in 2013 from 19, 98,703 units in the previous year.

(Ref: Indian Economic and Industrial Scenario)

Indian two-Wheeler Industry (2012-13)

The domestic two-wheeler (2W) industry recorded sales volumes of 13.8 million units in 2012-13, a growth of 2.9% over the previous year. This pace of expansion was significantly slower than the 13.7% volume compounded annual growth rate (CAGR) posted by the industry in the last five years. In the past, India's per capita real GDP growth at 8.6% (CAGR) over the six year period 2005-2011 had contributed substantially towards raising the standard of living of households, which in turn had been one of the key drivers of growth for the country's automobile industry. But over 2011-12 and 2012-13, inflationary conditions, firm interest rates, rising petrol prices as well as weak monsoons adversely impacted disposable incomes causing a consumption squeeze. Over the long term, the trend in rising two-Wheeler penetration in households in the addressable income segment (already reached around 80%) is an added concern implying difficulty in sustaining penetration-driven growth over an extended time horizon. For the domestic two-Wheeler industry to revert closer to its historical growth trend line any time soon, the pie of total number of target households will need to expand. This in turn would depend on the pace of India's economic growth recovery that could (a) boost personal disposable incomes and resultant consumption growth, (b) pull up the un-penetrated households from a low income segment to the next higher income segment, (c) further enable increase in the number multiple two-wheeler households, enabling penetration supported rise in two-wheeler demand.

Exports growth in (2012-13)

Even on the exports front, the year 2012-13 was a period of weak growth for the industry with volumes at 2.0 million units declining by 0.7% over the previous year. This was consequent to hike in interest rate in several countries, increase in import duty in Sri Lanka, trade restrictions imposed by Argentina, dollar sales embargo with Iran and ban imposed on motorcycle taxis in Nigeria. This apart, the reduction in incentives available to two-wheeler exporters, twice over the last 18 months, has persuaded Indian two-wheeler OEMs to partially hike product prices in overseas markets, further contributing to pressure on sales volumes. The Indian OEMs on their part are taking measures such as introduction of warranties (an uncommon industry practice in several markets), providing of better training to mechanics and appointment of sub-dealers, besides chalking-out an entry strategy into new markets as a de-risking approach. From a medium term perspective, two-wheeler exports continue to present a strong opportunity for industry participants particularly to countries in Africa and Latin America that have low two-wheeler penetration, inadequate public transport infrastructure and adequate scope for both secular as well as market share gain-led growth. In select countries, two-wheeler OEMs in India may also have to budget investments in local assembly/manufacturing units to exercise better control over demand-supply, branding, back-end infrastructure, currency risk, besides other tariff and other non-tariff hurdles.

The deceleration in volume growth of the domestic two-wheeler industry in 2012-13 was largely attributable to the motorcycles segment which grew by 0.1% over the previous year; even as the scooters segment posted 14.2% YoY expansion during this period, albeit on a smaller base. With this, the share of the scooters segment in the domestic two-wheeler industry volumes increased to 21.2% in 2012-13 from 17.5% in 2010-11. Within the motorcycles segment, while the entry and executive segments comprising of 100cc bikes and the premium segment comprising of ≥ 150cc bikes experienced anaemic demand, the 125cc segment (contribution of 20% to domestic motorcycle sales in 2012-13) was a positive outlier recording a volume growth of 26.0% in 2012-13, benefitting both from new model launches as also the trend in up-trading and down-trading from the respective lower and upper price/performance

segments. Also, relatively low volume segments such as the niche occupied by Eicher Motors (Royal Enfield), besides other cruiser and superbikes from the stable of Harley Davidson, Kawasaki, Honda and Suzuki witnessed a strong growth in 2012-13, albeit on a low base.

Industry maintains pricing discipline

Amidst an environment of slackening demand, the two-wheeler OEMs continue to shy away from offering discounts but on the contrary have undertaken two price increases in the last six months-price increase of Rs. 300-4,000 undertaken in October 2012 and a further price increase of Rs. 500-1,500 undertaken in April 2013. Although select OEMs while launching new products have followed a penetrative pricing strategy, the 'discounts' lingo has remained amiss, unlike the passenger vehicle industry. Nevertheless, the two-wheeler OEMs have been resorting to other forms of supply-side push in the form of attractive financing schemes, discounts on insurance for limited period etc. The OEMs had generally not resorted to these latter set of tools in 2009-10, 2010-11 and 2011-12 and their return to use as a promotional lever is indicative of the weak demand conditions. The last year and a half has been marked by greater traction in new product launches and focus on expansion of customer touch points by most two-wheeler OEMs. In terms of market share, while Hero MotoCorp continues to remain the distant leader with a share of 42.9% in 2012-13, it saw its share erode by 221 basis points (bps) over the previous year. A large part of this market share set-back was caused by weakness in Hero MotoCorp's sales volumes in the 100cc segment, even as the OEM expanded its market share in some of the other segments like the relatively faster growing scooters segment and the 125cc segment of bikes, by virtue of new product launches.

The other two leading Indian OEMs, namely, Bajaj Auto and TVS Motor experienced decline in their respective share in the domestic two-wheeler market in 2012-13. Honda, however, continued to demonstrate steady gains in market share across the board and strengthened its market share from 14.9% in 2011-12 to 18.9% in 2012-13. Over the next two years, a large number of new models are likely to be introduced by various two-wheeler OEMs across segments. This, in an environment of weak

domestic demand, is likely to make the OEMs' quest to expand volumes be accompanied by pressure on profitability.

(Ref: ICRA Limited, Research Services, 2013)

1.9.2 Plastic Sector

Indian plastic industry

Ever since 1957, the Plastics Industry in India has made significant achievements as it made a modest but promising beginning by commencing production of Polystyrene. The chronology of manufacture of Indian polymers is summarised as under: 1957-Polystyrene, 1959-LDPE, 1961-PVC, and 1968- HDPE, 1978-Polypropylene. Such potential Indian market has motivated the entrepreneurs in the country to acquire technical expertise, achieve high quality standards and build capacities in various facets of the booming plastic industry. The Phenomenal developments in the plastic machinery sector are coupled with the developments in the petrochemical sector, both of which support the plastic processing sector.

A wide variety of plastics raw materials are produced to meet the material needs of different sectors of the economy. These polymeric materials are broadly categorized as commodity, engineering and specialty plastics. Commodity plastics are the major products that account for bulk of the plastics and in turn for petrochemical industry. Commodity plastics comprise of Polyethylene (PE), Polypropylene (PP), Polyvinyl Chloride (PVC) and Polystyrene. While engineering and specialty plastics are plastics that exhibit superior mechanical and thermal properties in a wide range of conditions over and above more commonly used commodity plastics and are used for specific purpose. These include styrene derivatives (PS/EPS and SAN/ABS), polycarbonate, polymethyl methacrylate, polycarbonates, polyoxy methylene (POM) plastics etc.

There are three broad types of Polyethylene (PE), viz., Low-density Polyethylene (LDPE), High-density Polyethylene (HDPE) and Linear Low-density Polyethylene (LLDPE).Major plastic materials like Polyethylene (PE) and Polypropylene (PP) are derived from Ethylene and Propylene respectively, while other plastics such as Polyvinyl Chloride (PVC), PS and ABS and PC are produced from Benzene, Butadiene and other feedstock.

The plastic industry is one of the oldest one in the history. Plastic is used for a wide variety of products such as toys, household wares and industrial components of various shapes and sizes. In addition, refrigerators, automobiles, radio and television sets, synthetic textiles, aircraft and shipping, defence equipment, medical and surgical products have dependence on plastics of various kinds. Therefore in present era of technology, plastic sector has become an integral part for most of the manufacturing industries.

Indian Plastic Industry in (2012-13)

The Indian Plastic industry witnessed strong growth, with strong off-take from industries like packaging, automotive and infrastructure sector during the financial year of 2012-13. However, the consumption of Plastics in India increased by only 6% in the year 2011-12, which shows significant slowdown in the consumption of Plastics in our country in the last year.

The Indian plastic processing sector comprises three segments namely injection moulding, blow moulding and extrusion, catering to the requirements of a wide array of applications like packaging, automobile, consumer durables, healthcare, among others. According to the All India Plastics Manufacturers' Association (AIPMA), domestic consumption of plastic has been growing at 10-12% compounded annual growth rate (CAGR) over the last decade.

Plastic consumption in India is estimated to reach the 12.5 million tonnes mark making India the 3rd largest consumer of plastics in 2012 after US and China. The size of the plastic processing industry, which currently stands at Rs. 850 billion (9 million tones), is expected to touch Rs 1 trillion (12.5 million tones) in 2013 and Rs 1.3 trillion (18.9 million tones) by 2015. Employment increased close to 4 million in 2012 and is estimated to be 7 million by 2015 from the current 4.5 million-plus people.

A report on the Indian plastics industry stated that the per capita consumption of polymers industry in the country during 2012-13 was low at just 9.7 kg as compared to 109 kg in USA, 45 kg in China and 32 kg in a Brazil.

According to J R Shah, Chairman, National Executive Council, Plastindia, India is a growing market for plastics and consumes about 11 million tonne annually against a

global consumption of 275 million tonne per year and worldwide, the plastics and polymer consumption is growing at an average rate of 10% and is expected to touch 16.5 million tonnes by 2016."

The report points out that about 30,000 processing units with 113,000 processing machines have created manufacturing capacity of 30 million metric tonnes per annum. This has been achieved with a 13% compounded annual growth rate (CAGR) of processing capacity during last 5 years. The industry has invested $5 billion in the machinery and it is expected to make further project investment of $10 billion for further increase in capacities during the next 5 years.

As a result, India is expected to be among the top ten packaging consumers in the world by 2016 with demand set to reach $24 billion.

(Ref: The Times of India-India Business-Namrata Singh)

Increasing use of plastic film and sheet in food and pharmaceutical packaging will propel the growth of plastic in coming years. According to a recent report by Markets and Markets, the global consumption of plastic film and sheet is expected to touch 70.9 million metric tonne by 2018, with compounded annual growth rate (CAGR) of 3.4%.

The report further stated that in terms of value, the global market for plastic film and sheet is expected to grow at a CAGR of 4.4% from 2013 to 2018. China and India are expected to drive the plastic films and sheets market in the future. Increasing demand for packaged food and improving health care infrastructure is the major reason for growth in China and India. Asia-Pacific region has emerged as a key market for plastic film and sheet with 33% of market share globally.

Highlighting the robust growth opportunities for biaxially-oriented polypropylene (BOPP) films in India, Sudhir Mathur, chief executive officer, Max Speciality Films said at recently concluded national consumer packaging conference organized by Indian Institute of Packaging (IIP) that India produces only 5% of global BOPP film and 6% of global demand. This indicates immense growth opportunities.

Mathur added that for 2012-13, India contributed 359 kilo tonne per annum (kta) and is expected to reach 553 kta by 2016.

According to Markets and Markets, food packaging industry is the biggest user of plastic film and sheet, while, in non-packaging segment, agriculture sector dominates the consumption.

(Ref: Modern plastic and polymers-business- business news- Gaurang Damor)

Global automobiles, electronics, telecommunications, food processing, packing and healthcare companies have established large manufacturing bases in India. Joint ventures, foreign investments and access to technology from developed countries have opened new vistas to further facilitate the growth of the industry.

Infrastructure investments have ensured more than 10% growth rate for the sector. Moreover, the agricultural sector's focus on plastic-culture under micro-irrigation scheme will further boost demand. India's manufacturing capacity of polymer products is estimated to reach 12 MMTPA in 2017, from 8.3 MMTPA in 2012.

Polymer consumption in India is poised to grow multifold, applications, infrastructure growth, modernisation of agriculture sector, improved healthcare facilities, improved lifestyle and disposable incomes, automobile demand and rural penetration. Polymer packaging product's development has revolutionised Indian lives. India's packaging polymer consumption, accounting for over 60% of total polymers consumed, reached 5.5 MMT in 2012 and is expected to reach 10 MMT by 2020. The key growth drivers for this sector are foods and processed food items, FMCG and cosmetics.

Each year about 100 million tons of plastics are produced worldwide. Asia has been the world's largest plastics consumer for several years, accounting for 30% of the global consumption excluding Japan, which has share of about 6.5%. Next of Asia is North America with 26% share, then Western Europe with 23% share in the global market. Plastics processing or product manufacturing industry worldwide is facing increased competition due to globalisation of plastics trade.

The plastic processing sector comprises of over 30,000 units involved in producing a variety of items through injection moulding, blow moulding and extrusion.

The plastic industry in India is considered a sunrise industry. It took India 30 years to consume the first million tonnes of plastics. But the second million tonnes were consumed in just five years. Today India is consuming just over 2.5 million tonnes a

year. However, it would be still lower than China's current consumption of 10 million tonnes. The per capita consumption in India is only 2.4 kg as compared to a world average of 16 kg and China's 9 kg. The Indian plastic industry, with about 4 million US dollars in revenues, is just 0.4% of the global plastic industry. It is 1.2% of our GDP as against 3.7% GDP of the global plastic industry.

Major export products of the plastic industry include the plastic moulded furniture, polyester film, raw materials, and laminates, plastic sealing devices, writing instruments, plastic woven sacs, plastic bags, PVC leather cloth and sheeting. The top 10 trading partners for plastic products from India include USA, UAE, Italy, UK, Belgium, Germany, Singapore, Saudi Arabia, China, and Hong Kong.

The total consumption of plastics in India in 2010-11 was ~ 7.9 MnT. Out of this Northern India accounted for ~23%. For the purpose of this report Northern India comprises of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Uttarakhand, Rajasthan, Uttar Pradesh, Delhi and NCR region. Plastic industry in northern India is mostly concentrated in Uttar Pradesh and Delhi-NCR regions, along with Rajasthan.

The Indian plastics industry is very positive regarding its future potential hoping that the plastics industry will grow between 10% to 12%, if not higher, in this decade. The Plastic India Foundation, expects business transactions worth $ 150 million. The polymer production has increased by almost 9 % in the 2005-06 over 1995-96 period from 1.8 MMT in 1995 to 4.5 MMT in 2005.There is a wide variety in the polymer consumption pattern in India when compared with the world. But the main driver for polymer consumption in India has been attributed to packaging.

The current statistics for the industry is as: (1) Major raw material producers-15 (2)Processing units-25,000 units (3)Turnover (Processing industry)-Rs 85,000 crores (4)Capital asset (Polymer Industry)-Rs.55,000 crores (5)Raw material produced-5.3 MMT (6)Raw material consumed-5.1 MMT (7)Employed(Direct/Indirect)- 3.3 million (8)Export value approx-US $ 1.90 billion (9) Revenue to Govt-Rs 7300 crores.

(Ref:www. indianmirror.com/indian-industries/2013/plastic-2013.html)

Industry expert's vision for 2015: (1) Consumption of polymers @ 15% compounded annual growth rate (CARG)- 18.9 MT (2) Turnover-Rs 1, 33,245 crores (3) Additional employment generation- 7 million (4) Requirement of additional plastics processing machines-68113 (5) Additional capital investment in machines (2004-2015)-Rs 45,000 crores.

(Ref:www. indianmirror.com/indian-industries/2013/plastic-2013.html)

1.9.3 Electronics Sector

Indian electronic industry

Indian Electronics industry dates back to the early 1960's. Electronics was one industry initially restricted to the development and maintenance of fundamental communication systems including radio-broadcasting, telephonic and telegraphic communication, and augmentation of defence capabilities. Until 1984, the electronics Industry was primarily government owned and then in 1990s witnessed a rapid growth of the electronics industry due to sweeping economic changes, resulting from the liberalization and globalization of the economy.

Indian Consumer Electronics (2012-13)

India's production of consumer electronics goods during the year 2012-13 registered a growth of 20 percent (7 percent in US$ terms) over the year 2011-12. In value terms, production of consumer electronics goods is estimated at Rs. 41200 crore (US$ 7630 million) up from Rs. 33400 crore (US$ 7146 million) estimated in the year 2011-12. Production of consumer electronics items has been growing at an annual average growth rate of 12.76 percent (6.23 Percent in US$ terms) during the past five years.

Export of consumer electronic goods registered a growth of 30 percent (16 percent in US$ terms) during the year 2012-13 over the year 2011-12. In value terms, export of consumer electronics goods increased from Rs. 1227 crore (US$ 256 million) estimated in the year 2011-12 to Rs. 1600 crore (US$ 296 million) during the year 2012-13.

The Indian Consumer Electronics industry has experienced rapid changes over the last few years. These changes have been resultant of a booming Indian economy growing

at 8% and above till end of last decade, i.e., 2009-10. The changing lifestyles, higher disposable incomes and greater affordability have been important factors in fuelling this growth. The consumer preference has also shifted towards products and devices that come with smart technology, innovative designs, user friendly features and are also aesthetically designed. As a result, premium products, particularly in the metros, are going to provide the future growth stimulus for the domestic consumer electronics industry. However, as in the case of most other manufacturing sectors, this segment of the Industry also faced sluggish conditions during 2012-13 on account of slowing down of the economy but, in overall, the production trends remained positive.

The colour television continues to be the largest contributor in this group and in 2012; it had a market size of about 13 million units. In value terms, the growth was fuelled by the sale of flat panel LCD/LED TVs, which are increasing in exponential terms. The market for LCD /LED TVs has increased from about 4.0 million units in 2011 to approx. 5.5 million units in 2012 and is further projected to increase to about 7.0 million units in 2013.

The DVD player market declined from 4.0 million units in 2011 to 3.7 million units in 2012, i.e., by 7.5% approximately, due to the rapid growth and popularity of the DTH sector and this trend is likely to continue in the future. The home theatre segment however, continued to grow from 0.40 million units in 2011 to 0.48 million units in 2012. Production of about 0.60 million units is expected in 2013, i.e., a growth of about 25%.

There is a large demand for Set Top Boxes (STBs) due to digitalization of Cable TV network, as mandated by the Government of India. In Phase I, in four metros, the cable TV network has been digitalized, which created demand of about 6 million STBs. In the second Phase, 38 cities with a population of more than one million are being covered.

This phase is to be completed by 31st March 2013 and would have generated requirement of about 16 million STBs.

In the last few years, MSOs in Cable TV have voluntarily deployed Digital STBs. However, with mandatory digitalization, the Cable STBs market may be expected to

grow to about 20 million in 2013 and the digital cable subscriber base may cross 100 million by 2015 subject to digitalization of the entire cable network. Given this huge market, Indian manufacturers have been gearing up to meet the demand. In 2012, a total of about 4.0 million STBs were manufactured. Current domestic manufacturing capacity of Indian manufacturers is about 24 million per annum and this can be ramped up in a short time with increasing demand.

In value terms, the overall production of this segment during 2012-13 is estimated at 41,200 crore as against 34,300 crore in 2011-12, i.e., growth of about 20%.

Industrial Electronics- As estimated, during 2012-13, the total production of Industrial electronics is expected to be about `21,500 crore as against 18,700 crore in 2011-12, i.e., a growth of about 15%.

Strategic Electronics- The strategic electronics segment inter alia includes communication, navigation and surveillance systems, electronic warfare and weapon systems, satellite based communication, underwater electronic systems, disaster management system and internal security system. The Indian strategic electronic industry has been able to meet the bulk of the requirements of India's defence and paramilitary forces. The derived value of production for this segment for 2012-13 is likely to be about `9,000 crore as against `8,500 crore in 2011-12, i.e., a growth of about 5.9%.

Electronic Components- Demand for electronic components crossed 56,600 crore (US $ 11.8 billion) in 2011-12 and is estimated to grow to about 68,100 crore (US $ 12.5 billion) in the current financial year, i.e., 2012-13. Against this, the domestic output has remained at approximately 40% of the demand at US$ 4.99 billion and US$ 5.19 billion respectively.

The Indian LED market in 2009-10 was estimated at only US$ 60 million. Today it is estimated to be growing at 54% per annum till 2014. Thus the market worth US$ 112 million in 2011-12 is estimated to be over US$ 170 million in 2012-13. The estimated production figure for this segment during 2012-13 is to the tune of 26,500 crore as against 24,800 crore in 2011-12, showing a growth of about 7 per cent.

Production of Electronics Hardware During 2012-13

India's production of electronic hardware during the year 2012-13 is estimated to be Rs. 177500 crore (US$ 32.87 billion). The production during the year 2012-13 registered a growth of 24 percent (10 percent in US$ terms) over the year 2011-12 when the total production of Electronics hardware was estimated to be Rs. 143300 crore (US$ 29.85 billion).

The annual average growth during the past five years in the production of Electronics Hardware has been 16 percent (9.4% in US$ terms). Maximum production is seen in the Telecommunication sector followed by consumer electronics sector.

The total Electronics Equipment Production of the world during the year 2012-13 is estimated to be US$ 2172 billion. The maximum production is that of Computer Systems and Peripherals (27 percent) followed by communication equipment (26 percent), Consumer Electronics (13.1 percent), Equipment for Government / Military (8.7 percent) and industrial equipment (8.7 percent).

India’s Share in World Electronics Equipment Production (2012-13)

India's total electronics hardware production estimated at US$ 32.87 billion during the year 2012-13 accounts for a share of 1.51 percent in world electronic equipment production. North America dominates world's production of electronic equipment with a share of 18.7 percent followed by Europe (14.9 percent) and Japan (6.2 percent), Asia accounts for a share of 52.1 percent rest of the world accounts for 8.3 percent.

Export of Electronics Hardware During 2012-13

Export of Electronics goods and components from India during the year 2012-13 registered a growth of 3.22 percent (0.15 percent in US$ terms) over the year 2011-12. In value terms, export of electronics goods during the year 2012-13 is estimated to be Rs. 44000 crore (US$ 8148 million) up from Rs. 42627 crore (US$ 8881 million) estimated in the year 2011-12.

(Ref**:** Electronics and Information Technology Annual Report 2012-13)

Indian electronics companies had highly benefited from the economic liberalization policies of the 1980's, including the loosening of restrictions on technology and component imports, deli- censing, foreign investment, and reduction of excise duties. Output from electronics plants in India grew from Rs1.8 billion in financial year 1970 to Rs8.1 billion in financial year 1980 and to Rs123 billion in financial year 1992. Most of the expansion took place in the production of computers and consumer electronics. Indian production of computer rose from 7,500 units in 1985 to 60,000 units in 1988 and to an estimated 200,000 units in 1992. During this period, major advances were made in the domestic computer industry that led to more sales. Consumer electronics in India account for about 30% of total electronics production of the country.

With the growing demand of electronics in the country, which is expected to increase manifold in the coming years, a healthy manufacturing base for hardware electronics needs to be established within the country. For a viable electronics hardware manufacturing activity, the availability of components is a basic requirement. Production of components itself involves two stages-first the design and development and the second the specialized machinery or production equipment. Unfortunately, the production base of electronics components in India has remained poor and weak due to various factors, including the wrong policies pursued by the government, which discouraged investments in this sector and encouraged imports of end products rather than their investment in this sector and encouraged imports of end products rather than their manufacturing within the country, either in kit form or in semi knocked down form or even in fully assembled shape.

Electronics imports have steadily increased in recent years and accounted for 44% of the market, up from 16% in 1993. In contrast exports account for only 18% of production. The huge gap between the demand and supply presents a challenge as well as enormous business opportunity for the Indian electronics Industry. Many auto components and electronic systems fitted in modern automobiles are provided by electronics sector.

Indian electronics hardware production increased from 1, 10,720 crore in 2009-10 to 1, 21,760 crore in 2010-11, registering a growth of 10 per cent.

During the year 2010-11 exports of electronics hardware registered a growth of 56 per cent in rupee terms over the preceding year.

In value terms, exports of electronics hardware was 40,400 crore (US$ 8.9 billion) during the year 2010-11, up from the 25,900 crore (US$ 5.5 billion) in 2009-10. Electronics hardware production was around US$ 33 billion in 2011-12. It was projected that electronics hardware exports will cross US$ 10 billion in 2011-12 as against US$ 8.86 billion in 2010-11, an expected growth of about 12.8 per cent.

Indian electronics industry today stands at US $ 25 billion and is ranked 26th in the world in terms of sales and 29th in the world in terms of production. It is growing at over 25% CAGR and is expected to be worth US $ 158 billion by 2015. Electronic industry is one of the fastest growing industries in the country and is driven by growth in key sectors such as IT, consumer electronics and telecom.

1.10 MOTIVATION FOR RESEARCH

One of the most significant changes in the paradigm of industrial and technical management is that individual businesses, no longer compete as solely autonomous entities, but rather as supply chains.

Technical management has entered the era of inter-network competition and the ultimate success of a single business will depend on management's ability to integrate the company's intricate network of business relationships. Increasingly the management of multiple relationships across the supply chain is being referred to supply chain management (SCM).

Supply chain is not just a chain of business relationships, but a network of multiple businesses and relationships. SCM offers the opportunity to capture the synergy in value chain, company integration and management.

In that sense, SCM deals with total business process excellence and represents a new way of managing the business and relationships with other members of the supply chain.

Top management recognizes that managing the supply chain cannot be left to chance; these executives are searching for way to successful deal with the complexity of the

task. There is a need for building theory and developing normative tools and methods for successful SCM implementation.

There are challenges for SCM, today the supply chain managers are facing various external challenges driven by customer requirements and intense competition. The major challenges are:

Network Planning

This is one of the most important challenges for SCM. Determination of production requirements and inventory levels at the vendor's facility for each product and development of transportation flows between these facilities to the warehouses in a best possible way to reduce total production, inventory and transportation costs with fulfilment of service level requirements.

Supply chain integration and strategic partnering

In SCM, information sharing and operational planning are crucial for successfully integrated supply chain. But the challenges are-what type of information would be shared, and how this information will be used, what level of integration is required and what partnership can be implemented? Supply chain integration is difficult for two primary reasons: first, the supply chain is an integrated system that requires cohesive decisions to optimize the system profit and value. In practice, different facilities in the supply chain may have different, conflicting objectives. Second, the supply chain is a dynamic system, which has its own life cycle and continually evolves. For example, customer demand and supplier capabilities change over time, as do supply chain relationships.

IT and Decision Support System

This is another important challenge for SCM. Today, SCM is driven by the scope and opportunities appearing due to abundance of data and the savings which can be achieved through efficient analysis of these data. What data should be transferred with its significance and most importantly, what infrastructure is required internally and between its partners is very important.

Training

It is important for every company, which is implementing SCM. Companies must leverage extensive training to their employees, who are going to use the system. Understanding the market, risk, and expenditure analysis and applying strategic sourcing methodologies are important.

A number of important challenges exist for supply chain managers. For example, supply chain design and strategic collaboration are quite difficult because of the dynamics and the conflicting objectives employed by different facilities and partners. Inventory control is another tough issue. What is the effect of inventory on system performance? Why should a supply chain member hold inventory?

Distribution network configuration involves management's making decisions regarding warehouse locations and capacities; determining production levels for each product at each plant; and set transportation flows between facilities to minimize total production, inventory, and transportation costs and satisfy service level requirements, the sharing of data, information, and knowledge is a challenge of virtually integrating a supply chain. It must be noted that a large extent of corporate technical knowledge is difficult to articulate and tacitly resides in the minds of knowledge workers.

1.11 OBJECTIVES OF PRESENT RESEARCH

The main objectives of this research are as follows:-

1) To study different issues of SCM such as information sharing among different members, Motivation for SCM implementation and major hindrances in it, Product design and development, Environmental issues, Performance measures etc.
2) Identification of best SCM practices followed by Indian organizations.
3) Identification of investment priorities for successful SCM.
4) To find supplier selection criteria and supplier development activities.
5) To develop case studies for validating the empirical findings.

6) To identify enablers for effective SCM and develop a structural model for successful implementation.

1.12 ORGANIZATION OF THE THESIS

This research study is organized in six chapters. Brief outline of the chapter is given as below.

- Chapter 2 is devoted to the literature review theory of supply chain management and supply chain management practices. Initially theory of supply chain management and different frameworks for studying supply chain management and practices have been discussed. After discussing theory of supply chain management, contribution of researchers in various areas related with supply chain management practices such as: Outsourcing, Integrated Inventory Management, Bar coding/RFID, Third party logistics (3PL), design for logistics, customer relationship management (CRM) etc. have been presented. On the basis of this literature review, gaps have been identified to set the directions for present research work.

- Chapter 3 deals with the Research Methodology. On basis of gaps identified from literature, major objectives have been framed. To achieve these objectives, methodology part of the study has been elaborated It consist of development of questionnaire, pilot testing of questionnaire, administration of questionnaire, analysis of responses, reliability and validity of the questionnaire. Frameworks for analysing performance and best practices have been also discussed.

- Chapter 4 deals with observation and analyses of supply chain management practices on basis of survey data analyses. On the basis of this analysis, strategies for improving performance have been identified. Tools used for this analysis include descriptive statistics, correlation analysis.

- Chapter 5**:** Describes the case studies developed for validation of results. Cases have been analysed on the basis of framework developed for measuring supply chain management practices by Situation-Actor-Process (SAP)

Learning-Action-Performance (LAP) analysis. Two case studies have been developed.

- Chapter 6: Deals with interpretive structural modeling (ISM) of critical success factors (CSFs) for structured relationship between various factors. CSFs have been identified on the basis of survey response and interaction with industry professionals during case studies and after wards. ISM model has been developed and analysis carried out to discuss driver power and dependence power of variables.
- Chapter 7: Presents the summary of work done, contributions of the research, limitations of the study, scope for future work and finally the concluding remarks.

1.13 CONCLUDING REMARKS

In this chapter, an overview of context related to this research has been presented. The motivation and objectives of this research have also been presented in this chapter. Though there are challenges in supply chain management, it has many opportunities to grow. To get these opportunities supply chain management have to focus on- Motivations, Investment areas, Hindrances in implementing supply chain management, Supply Chain Management Practices, Information sharing, Customer satisfaction, Capabilities, Product design and development activates, Supplier selection criteria, Environmental issues, Supplier development activities, Efforts for supply chain management and Performance measures. In next chapter literature review will be done to identify the research gaps for setting directions for present study.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

Supply Chain management encompasses all activities in fulfilling customer demands and requests. These activities are associated with the flow and transformation of goods from the raw materials stage to the end user, as well as the associated information and funds flows. There are four stages in a supply chain: the supply network, the internal supply chain (for manufacturing plants), distribution systems, and the end users. Moving up and down the stages are the four flows: material flow, service flow, information flow and funds flow.

Supply Chain Management is a set of synchronized decisions and activities utilized to efficiently integrate suppliers, manufacturers, warehouses, transporters, retailers, and customers so that the right product or service is distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying customer service level requirements. The objective of Supply Chain Management (SCM) is to achieve sustainable competitive advantage.

The origin of the supply chain concept has been inspired by many fields including (1) The quality revolution (Dale *et.al*., 1994), (2) Notions of materials management and integrated logistics (Carter and Price, 1993; Forrester, 1961), (3) A growing interest in industrial markets and networks (Ford, 1990; Jarillo, 1993), (4) The notion of increased focus (Porter, 1987; Snow *et.al*., 1992), and (5) Influential industry-specific studies (Womack *et.al*., 1991; Lamming, 1993). Researchers thus find themselves inundated with terminologies such as “supply chains”, “demand pipelines” (Farmer and Van Amstel, 1991), “value streams” (Womack and Jones, 1994), “support chains”, and many others. The term supply chain management (SCM) was originally introduced by consultants in the early 1980s (Oliver and Webber, 1992) and has subsequently gained tremendous attention (La Londe, 1998).

The term SCM has been used to explain the planning and control of materials and information flows as well as the logistics activities not only internally within a company but also externally between companies (Cooper *et. al*., 1997b; Fisher, 1997). Researchers have also used it to describe strategic, inter-organizational issues (Harland *et. al*., 1999), to discuss an alternative organizational form to vertical integration (Thorelli, 1986; Hakansson and Snehota, 1995), to identify and describe the relationship a company develops with its suppliers (Hines, 1994; Narus and Anderson, 1995), and to address the purchasing and supply perspective (Morgan and Monczka, 1996).

A number of fields such as purchasing and supply, logistics and transportation, operations management, marketing, organizational theory, management information systems, and strategic management have contributed to the explosion of SCM literature. From the myriad of research, it can be seen that a great deal of progress has been made toward understanding the essence of SCM. The new orthodox of supply chain management, however, is in danger of collapsing into a discredited management fad unless a reliable conceptual base is developed (New, 1996), and many authors have highlighted the pressing need for clearly defined constructs and conceptual frameworks to advance the field (Saunders, 1995; Cooper *et. al*., 1997a; Babbar and Prasad, 1998; Saunders, 1998).

For this research over 350 research papers from the diverse disciplines have been referred. Thus, this study may be considered comprehensive analysis of the multidisciplinary, wide-ranging research on SCM. A list of select definitions of supply chain management is shown in Table 2.1 and list of principal components of supply chain literature are shown in Table 2.2.

Table 2.1: Selected definitions of supply chain management.

Author (year)	Definition and related views
Jones and Riley (1985)	1) "Supply chain management deals with the total flow of materials from suppliers through end users"

Houlihan (1988)	Differences between supply chain management and classical materials and manufacturing control: 1) The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales. 2) Supply chain management calls for, and in the end depends on, strategic decision making. "Supply" is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) Supply chain management calls for a different perspective on inventories which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required—integration rather than interfacing."
Stevens (1989)	"The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of materials from suppliers in order to effect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost."
La Londe *et. al.*, (1994)	A set of firms that pass materials forward.
La Londe (1997)	Supply chain strategy includes: " two or more firms in a supply chain entering into a long-term agreement; the development of trust and commitment to the relationship; the integration of logistics activities involving the sharing of demand and sales data; the potential for a shift in the locus of control of the logistics process."
Cooper *et. al.*,	Supply chain management is "an integrative philosophy to

(1997)	manage the total flow of a distribution channel from supplier to the ultimate user."
Christopher (1998)	The network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer.
Lambert *et.al.,(*1998)	The alignment of firms that brings products or services to market including the final customers as part of the supply chain.
Monczka *et. al.,* (1998)	SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process, and also requires joint relationships with suppliers across multiple tiers. SCM is a concept, "whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers."
Lambert *et. al.,* (1998)	"SCM is the integration of business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders."
Mentzer *et .al.,* (2001)	"SCM is the systemic, strategic coordination of the traditional business functions and the tactics across [these] business functions within a particular company and across businesses with the supply chain, for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole."

Mentzer (2004)	A set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.
Frankel *et. al.*, (2005)	Types of research approaches.
Sachan and Datta (2005)	Types of research, methodologies used and data analysis techniques.
Reichhart and Holweg (2006)	Analysis of methodologies applied in different subfields of SCM.
Spens and Kovacs (2006)	Analysis of types of research.
Burgess *et. al.*, (2006)	Analysis of object of study and methods applied.
Van der Vaart and van Donk (2008)	Survey research in supply chain integration.
Wolf(2008)	Analysis of the nature of SCM research.
Soni and Kodali(2013)	The main objective is to identify the inconsistencies in SCM frameworks by examining selected frameworks under the light of some basic research questions, also aimed to find out what elements (or constructs) are used for making frameworks and the degree of standardization of these elements (or constructs) in SCM domain.
Prajogo (2013)	Supply chain technologies: Internally- Warehouse management

	system, Data capture systems (e.g. barcode scanning), Enterprise resource planning (ERP), Transportation management system, Scan-packing applications, Advanced planning and optimization (APO) Externally- EDI/e-messaging, Electronic/online product catalogue, Electronic/online purchase order system, Electronic customer relationships management (e-CRM), Electronic supplier relationships management (e-SRM), Global positioning system, Radio frequency identification (RFID), Online bidding/tendering, Public e-marketplaces (e.g. global healthcare exchange).

Table 2.2: Principal components of supply chain literature.

S.No	Supply Chain components	Literature attributes
1	Strategic management	Strategic networks, Control in the supply chain, Time-Based Strategy, Strategic Sourcing, Vertical disintegration, Make or buy decisions, Core competencies focus, Supply network design, Strategic alliances, Strategic supplier segmentation, World class manufacturing, Strategic supplier selection, Global strategy. Capability development, Strategic purchasing.
2	Logistics	Integration of materials and information flows, JIT, MRP, Waste removal, VMI, Physical distribution, Cross docking, Logistics postponement, Capacity planning, Forecast information management, Distribution channel management, Planning and control of materials flow.
3	Marketing	Relationship marketing, Internet supply chains, Customer service management, Efficient consumer

		response, Efficient replenishment, After sales service.
4	Relationships/partnerships	Relationships development, Supplier development, Strategic supplier selection, Vertical disintegration, Partnership sourcing, Supplier involvement, Supply/distribution base integration, Supplier assessment (ISO), Guest engineering concept, Design for manufacture, Mergers acquisitions, Joint ventures, Strategic alliances, Contract view, Trust, Commitment, Partnership performances, Relationship marketing.
5	Best practices	JIT, MRP, MRP II, Continuous improvement, Tiered supplier partnerships, Supplier Associations (kyoryoku kai), Leverage learning network, Quick response, Time compression, Process mapping, Waste removal, Physically efficient vs. market oriented supply chains.
6	Organizational behavior	Communication, Human resources management, Employees relationships, Organizational structure, Power in relationships, Organizational culture, Organizational learning, Technology transfer, Knowledge transfer.

Ref: Croom (2000)

2.2 SUPPLY CHAIN MANAGEMENT PRACTICES

SCM practices are defined as approach applied in managing integration and coordination of supply, demand and relationships in order to satisfy consumers in effective and profitable manners (Wong, *et.al.,* 2005). SCM practices involve a set of activities undertaken in an organization to promote effective management of its supply chain. The literature is replete on the dimensions of SCM practices from variety of perspectives. In a more recent study, Li, *et. al.*, (2005) attempted to develop and validate a measurement instrument for SCM practices. Their instrument had six empirically validated and reliable dimensions which include strategic supplier partnership, customer relationship, information sharing, information quality, internal lean practices and postponement. Strategic supplier partnership represents the long-term relationship between the organization and suppliers. Customer relationship covers the practices on complaint handling, customer satisfaction, and long-term relationship establishment. Information sharing means the information communicated between partners where the accuracy, adequacy, and timeliness refer to the quality of information. Lean practices are represented by the elimination of waste, low inventory, small lot sizes and JIT delivery. Postponement is the delayed differentiation of products on the supply chain. Supply chain management (SCM) includes a set of approaches and practices to effectively integrate suppliers, manufacturers, distributors and customers for improving the long-term performance of the individual firms and the supply chain as a whole in a cohesive and high-performing business model (Chopra and Meindl, 2001). As defined by the Council of Supply Chain Management Professionals (CSCMP), SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion and all logistics management activities as well as coordination and collaboration with channel partners. A list of SCM dimensions used in previous literature regarding the SCM practices is shown in Table 2.3.

Table 2.3: SCM Practices.

SCM practices	Measures on SCM practices	References
Product differentiation	Physically efficient (MTO), physically responsive (MTS) and market responsive (ATO) for functional, intermediate and innovative products respectively	Fisher (1997); Holmstro(1997); Li and O'Brien (2001); Wong *et.al.*, (2004);Lo(2010); Hilletofth(2011); Uggla(2014)
Lead-time management	Time-to-market, time-to-serve, time-to-react	Suri (1999); Christopher *et.al.*, (2004); Lo(2010);
Postponement and customization	Logistics postponement, manufacturing postponement, standardization, customization	Pagh and Cooper (1998); Van Hoek (1998); Lampel and Mintzberg (1996); Wadhwa(2006); Buffington(2011); Kamrani(2012)
Inventory and cost management	Gross margin return on inventory (GMROI), obsolete inventory, markdowns, lost sales, etc.	Fernie (1995); Ketzenberg *et.al.*, (2000); Chain Store Age(2002) ; Nag(2014)
Bullwhip effects	Demand variability, induced seasonality	Lee *et. al.*, (1997); Kurt Salmon Associates (1993); El-Beheiry *et. al.*, (2004)); Paiva(2014)
Information sharing and Co-ordination	EDI/POS, flow coordination, risk coordination	Walker (1994); Lee *et.al.*, (1997); Lee and Whang (1998); Sahin and Robinson

		(2002); Golicic(2003); Shukla(2011)
Buyer-seller relationships	Arms-length, cooperative/ partnership, collaboration and integration	Kumar (1996); Golocic *et.al.*, (2003) ; Kumar(2014)
Distribution and logistics	Direct delivery, cross-docking and merge-in-transit	Kakkainen *et.al.*, (2003); Chatterjee *et.al.*, (2010); Lacity(2013); Garcıa-Arca(2014); Roehrich(2014)
Retail strategy, Strategy development	Location, pricing and mark-up, assortment, performance metrics, forward-buying, delivery destination, replenishment frequency, order batch sizes	Holmstrom (1997); Zairi (1998) ; Singh (2007) ; Forslund(2014)
SCM initiatives	Electronic data interchange or point-of-sales (EDI/POS), continuous replenishment planning (CRP), efficient consumer response (ECR), collaborative planning, forecast, replenishment (CPFR), vendor-managed inventory (VMI), radio frequency identification (RFID)	Lee and Whang (1998); Vergin and Barr (1999); McKenney and Clark (1995); Pearce (1996); Waller *et.al.*, (1994); Walker(1999); Husain *et.al.*, (2002); Kakkainen (2003); Ringsberg(2014);
Supply chain	Inventory turn ratio, gross	Chain Store Age (2002);

performance	margin and profit, average in-stock inventory, ability to measure inventory, etc.	Beamon (1999); Estampe (2010); Ganga(2011); Shao *et. al.,* (2012); Datta and Roy (2013); Kleemann and Essig (2013); Selviaridis and Norrman (2014)

2.3 ATTRIBUTES OF SCM: Major SCM attributes are as follows:

2.3.1. Close partnership with suppliers

Co-operation between buyer and supplier is the starting point to establish a successful SCM. "Partnership" is an interfirm relationship between a buyer and a seller in a supply chain that is a close, long-term working relationship having the following characteristics: open communication, coordination of efforts, and joint planning process (Tuten and Urban, 2001). To overcome resource limitations, firms have increasingly adopted the strategy of developing own core competence and cooperating with partners to access needed critical resources (Parise and Casher, 2003; Capo´-Vicedo *et. al.,* 2011). Therefore enhancing partnerships has growing importance to firms interconnected in a cooperative supply chain model (Power, 2005; Matopoulos *et. al.,* 2007).

Suppliers saw many advantages in developing "partnership" with customer organizations. Sales managers charged their salespeople with becoming "partners" with their key customers. However, based on a lack of clarity from management, many of the salespeople did not understand the implication of the term "partner." Additionally, the legal implications of the term "partner" raised concerns. For example, is a buyer "partner" free to solicit prices from competing suppliers? Is a supplier "partner" required to give all of its "partners" the same price and service? While the term "partnership" is still relatively common, but some author used the term, preferring the terms supplier relationship management (SRM), collaborative relationship and strategic alliance (supply alliances). The focus on collaborative

relationship management will require that all elements of relationship management, including trust building, communications, joint efforts, and planning and fostering interdependency, will be increasingly studied and managed to achieve competitive advantage. Supply alliances reap incredible benefits as a result of physical asset specialization (e.g., in customized machinery, tools information system, delivery systems, and so forth) and human specialization refers to relationship specific know-how accumulated by individuals through long-standing relationship.

Increasingly, supplier relationship management (SRM) is being viewed as strategic, process-oriented, cross-functional, and value-creating for buyer and seller, and a means of achieving superior financial performance.

The supplier relationship management process is comprised of two parts: the strategic process, in which management establishes and strategically manages the process, and the operational process, in which implementation takes place. The strategic supplier relationship management process provides the structure for integrating the firm with suppliers, and it is at the operational level that the day-to-day activities occur. The strategic process is led by a senior executive and a team of managers that represents the typical business functions such as: marketing, sales, finance, production, purchasing, logistics, research and development.

The team is responsible for identifying which suppliers are key to the company's success now and in the future and for making decisions about how relationships with suppliers will be developed and maintained. At the operational level, there will be a team for each key supplier and for each segment of other suppliers. The goal is to segment suppliers based on their value over time and indentify opportunities to co-create value (Enz and Lambert, 2012).

The next level requires coordination and collaboration between buyer and suppliers. Thompson identifies three kinds of coordination- Mechanisms, Standardization, Plan and mutual adjustment. Vande *et. al.,* (1976) extend the Thompsons frame work by adding a fourth type of interdependency; team arrangement in which partners work jointly and simultaneously.

Co-ordination is defined as a "Process of Managing Dependencies between Activities" (Malone and Crowston, 1994). Dependency theories were first applied to SCM in the 1990s. Nassimbeni, (1998) maps different network structures to different interdependencies and identifies different coordination mechanisms for each kind of supply chain network structure, Simatupang and Sritharoan, (2002) use of similar approach.

Co-ordination mechanisms along two dimensions, the focus of coordination (operational or organizational linkages) and the mutuality of coordination (complementary or coherency), which results in four coordination modes: logistics synchronization, information sharing, incentive alignment, and collective learning. Finally, they relate these modes to supply chain performance. More recent work in supply chain coordination focuses on quantitative models for revenue sharing (Giannoccaro and pontrandolfo 2004, Cachon and Lariviere 2005) and decision support models for specialized systems (Boyaci and Gallego 2004; Xiao, *et. al.*, 2005).

This includes specified work-flow, sharing information through electronic data interchange (EDI) and the internet, and joint planning and other mechanisms that permit to undertake the Just in time (JIT) system and total quality management (TQM) in the company (Spekman *et. al.*, 1998; Mistry, 2006). Future work is needed to investigate the appropriate use of multiple coordination mechanisms to manage a single set of dependencies.

2.3.2. Close partnership with customers

It is management of customer–supplier relationships through the adoption of a set of practices supporting integration in interface processes. Downstream SCM can be deemed by demand chain management (Frohlich and Westbrook, 2002; Hsu, 2005). Building a close partnership with customers is equally important as establishing a close partnership with suppliers. It must be noted that the partnering with customer is slightly different from building customer relationship in that the latter focuses on relationships management while the former focuses on either joint venture and/or long-term supply agreement.

In today's customer-driven market, it is not the product or services itself that matters most, but the perceived value to the customer of the entire relationship with a organization. The way organizations measure the quality of their product and services has evolved from internal quality assurance to external customer satisfaction and from there to customer value.

Customer value is one of the most central themes in management and marketing theory and practice (Khalifa, 2004; Lindgreen *et. al.,* 2012). Instead of being static features determined by the supplier, the benefits and costs are customers' subjective perceptions that can change over time (Corsaro and Snehota, 2010; Helkkula *et. al.,* 2012). Thus, suppliers can only generate value propositions and offer value potential that, if accepted, is then realized in the customers' processes as value-in-use (Moller and Torronen, 2003; Gronroos, 2011). Determining what customers value in a particular offering, and managing this value over time, has long been recognised as essential for competitive advantage (Landroguez *et. al.*, 2011).

Traditionally, customer value has been considered to relate to functions and performance derived from products as value-in-exchange; however, the recent literature increasingly emphasizes that customer value emerges in customers' value generating processes as value-in-use (Gronroos, 2011).

Customer value is a key constituent in all areas of business (Ulaga, 2011; Lindgreen *et. al.,* 2012), and understanding how firms create, communicate and deliver value to customers is a key factor when seeking ways to differentiate from competitors and gain competitive advantage (Woodruff, 1997; Landroguez *et. al.*, 2011). As a result, firms are increasingly adopting customer value-based selling (Terho *et. al.,* 2012), customer value-based pricing (Liozu and Hinterhuber, 2013), and customer value management (Anderson *et. al.,* 2006; Bowen *et. al.,* 2011). However, successful adoption of these strategies requires an understanding on customer value assessment, which quantifies the impact of a supplier's offering to customers' costs and returns (Payne and Frow, 2005; Anderson *et. al.*, 2006).

2.3.3. Just in time supply (JIT)

JIT is an integrated set of activities designed to achieve high volume production using minimal inventories of raw materials, work in process and finished goods. Therefore, JIT purchasing requires the suppliers to produce and deliver to the manufacturer the right quantity at the right time with the objective of continuous and consistent conformance to performance specifications (Canel *et.al*., 2000; Mistry, 2006; Kros *et.al*., 2006).

The goal of JIT practices is to reduce and eliminate waste (Wu *et. al.,* 2012). While originally focused on the production process inside the plant, JIT practices have been extended throughout the supply chain to include the purchasing and selling linkages (Claycomb *et. al.,* 1999b; Gunasekaran, 1999 and Gonzalez-Benito *et. al.,* 2000).

Frohlich and Westbrook's (2001) paper on 'arcs of integration', empirically corroborated by Schoenherr and Swink (2012), describes this extension to include the 'forward physical flow of deliveries between suppliers, manufacturers and customers,' and the 'backward coordination of information technologies and the flow of data from customers to suppliers'. As a result 'synergies' might emerge (Schoenherr and Swink, 2012). Synergy, from the Greek, means working together or, as stated by Aristotle, 'the whole is greater than the sum of its parts'. Frohlich and Westbrook (2001), have used the term synergy to refer to the result of integrating the components of supply chains (Narasimhan *et.al.,* 2010; Chen and Tan,2011; Furlan *et. al.,* 2011; Schoenherr and Swink,2012 and Wuetal.,2012). Other papers dealing with supply chains have used the terms 'complementary' (Narasimhan *et.al.,* 2010; Chen and Tan,2011; Furlan *et.al.,* 2011; Lado *et.al.,* 2011; Feng *et.al.,* 2012 and Malhotra and Mackelprang, 2012) and 'combinative' (Kristal *et.al.,* 2010; Liu *et. al.,* 2011and Wu *et.al.,* 2012) to refer to the effects of integration. Specific to JIT, Claycomb *et. al.,* (1999b) use the term 'total system JIT', Chen and Tan (2011) use the term 'aggregate bundle' of JIT elements and White *et.al.,* (2010) use the term 'holistic' JIT.

Frohlich and Westbrook (2001) noted that many proponents of supply chain integration fall under the just-in-time (JIT) banner. Chen and Tan (2011) list a number of studies that deal with the complementary relationships between JIT and other manufacturing technologies (such as TQM, TOC, etc.). While there are papers

investigating the result so finte grating supply chain components and integrating JIT with other elements, there is little research published on the 'synergistic' effect of the elements of JIT. Chen and Tan (2011) found that, though the individual elements of JIT had different impacts, there was a synergistic effect, i.e., improved production operations performance that resulted from implementing an aggregate bundle of all JIT elements no matter the industry or scale of the firm.

Thus, JIT may be viewed as an integrative strategy facilitating timeliness and quality not on lyin production, but also in supply and distribution. Claycomb *et.al.,* (1999b) use the term 'total system JIT' to describe the combination of JIT-production, JIT-purchasing, and JIT-selling strategies. Even though the term 'total system' is used, Claycomb *et .al.,* (1999b) identify the need for a 'fully facetted' extension of the JIT concept. In response to this need, a fourth component was added, JIT-information, resulting in the adoption of a different term 'Total JIT' (T-JIT), to capture the comprehensive nature of the construct and its effect on supply chain competency and organizational performance.

2.3.4. Strategic planning

Supply chain management must develop and manage the organizations supply strategy as an integrated whole instead of a series of unrelated strategies. The organizations strategy is the key driver of the supply chain strategy. The technology, marketing, finance, and production strategies are all inputs to the supply strategy. Conversely, the supply chain strategy is an input to the organizations strategies for technology, marketing, finance, and production.

Conventionally, strategic planning focuses on the manufacturing process, technical innovation, financial considerations and market penetration. Firms integrate strategies in each of these areas to produce and sell high-quality products at a low price. Given the state of technology at present, a competitor often can match any single firm's advantage in these areas.

Thus, firms have begun to explore ways to create competencies in the supply chain through more efficient distribution networks (Lin and Tseng, 2006) improved quality

and reduced total cycle time, better post-sale service and higher responsiveness to customer needs (Carter *et. al.*, 1997).

Several studies suggest that entities may not always be able to predict or avoid a disruption, but they can reduce their risk exposure by enhancing flexibility through the implementation of key strategic planning tools. If employed properly, these strategic initiatives enhance the ability of the organization or network to respond to a disruption effectively, minimizing the negative impacts of the event on overall supply chain performance levels.

Contingency planning is a valuable strategic planning tool for many organizations that can bring about enhanced flexibility. Specifically, contingency planning is a special type of planning that provides a blueprint for responding to the risks associated with an unknown event. A properly prepared contingency plan should detail a timely and complete response to a specific risk or a cluster of risks. Research involving contingency planning has become widespread across multiple disciplines (Barnes, 2001) including manufacturing (Iyer and Sarkis, 1998), supply chain management (Svensson, 2002, 2004), and logistics (Hale and Moberg, 2005).

The application of strategic planning processes allows an organization to focus their resources in a manner that enhances firm performance via a competitive driver. Strategy can help an organization in a variety of ways including by identifying the organization's core objectives and guiding the process by which a firm's resources are developed, organized, and allocated in order to achieve selected objectives. Contingency planning has been shown to have a positive impact on a firm's flexibility, ultimately enhancing their ability to respond to unforeseen disruptions in a manner that minimizes overall risk exposure (Fawcett *et. al.*, 1996). Wagner and Bode (2008), who defined supply chain risk as a "negative deviation from the expected value of a certain performance measure, resulting in undesirable consequences."

2.3.5. Supply chain benchmarking

Benchmarking of supply chain performance enables comparison between peer's supply chain and competitor's supply chain. This stimulates continuous improvement and hence allowing key performance indicators such as delivery speed, enhanced service quality and experience to be re-positioned and re-valued over time subject to market forces and dynamics.

2.3.6. Suppliers rationalization

In contemporary business, many firms prefer a strategy of using few suppliers (Chandra and Kumar, 2000). The strategy of few suppliers implies that a buyer wants to secure a long-term relationship and the cooperation of a few dedicated suppliers. Using few suppliers can create value to the buyer and yield lower transaction and production costs.

Traditionally, vendors are selected from among many suppliers on their ability to meet the quality requirements, delivery schedule and the price offered. In this approach, suppliers aggressively compete with each other. The relationship between buyer and seller is usually adversarial. The main purchasing objective in this approach is to obtain the lowest possible price by creating strong competition between suppliers, and negotiating with them.

2.3.7. Holding safety stock and sub-contracting

Buffering and dampening approaches including safety stock and sub-contracting have been widely adopted SCM practices to cope with uncertainties in a supply chain (Koh and Tan, 2006). Although holding safety stock could be considered as a type of SCM practice for dealing with supply chain uncertainty, not every company has the capacity and resources to produce the goods and services required. Then, in this case, sub-contracting becomes a typical SCM practice for dealing with supply chain uncertainties under resource constraints.

2.3.8. E-procurement

Electronic procurement (e-procurement) as a virtual purchasing application also enhances visibility of data by leveraging supplier negotiations. It allows a company to

control their suppliers, hence reducing purchasing cost. Very often, an e-procurement tool also interfaces with an ERP to automate many purchasing and payment tasks (Koh and Tan, 2006).

Procurement is an area of operations where the deployment of innovative technologies can bring about significant cost savings and additional benefits for public sector organizations (Johnson, 2011a). It also represents a major source of organizations' costs (Angeles and Nath, 2007) and is an area of public sector operations criticized for being inefficient (Kumar and Peng, 2006). An e-procurement is an information technology-based purchase system which is at the input end of the supply chain (Presutti, 2003). It has been commonly accepted that information infrastructures such as e-procurement systems become increasingly connected and embedded with other infrastructures to initiate the growth of enterprises (Vaast and Walsham, 2009). In line with this notion, the usage of information technology in e-procurement systems is considered to be an innovation strategy action (Mishra and Agarwal, 2010).

In recent years, e-procurement has been advocated as a new strategic view of supply chain management. The innovation of implementing e-procurement systems can create value for enterprises through utilizing IT-enabled resources on supply chain management (Dong *et. al.,* 2009). Previous studies have focused on the benefits of e-procurement on supply chain performance (e.g., Presutti, 2003; Timme and Timme; 2001,). However, the process through which e-procurement contributes to supply chain performance is still an unknown issue. For academics, e-procurement is an emerging phenomenon in the business world, and it needs to be systematically analyzed. For supply chain managers, e-procurement creates a need to understand the impact of information technology on the achievement of competency on a practical level (Dong *et. al.,* 2009; Jonsson and Gunnarsson, 2005; Presutti, 2003).

2.3.9. Outsourcing and Third-party logistics (TPL)

Many firms in our contemporary business have been revising their priorities and focusing their resources on a limited number of selected activities and processes to gain more competitive advantages. The outcome of this trend is that firms increasingly outsource some selected activities and processes (Sink and Langley,

1997). As competition becomes more intense, many firms are considering the option of logistics outsourcing in order to streamline their value chains (Franceschini *et. al.*, 2003). Boyson *et. al.,* (1999) noted that outsourcing relationships historically are based on routine functions, such as warehousing operations and freight payment, whereas today they are based on logistics activities that require more strategic knowledge and expertise, such as information systems, inventory management and customer order fulfillment. A third-party logistics (TPL) is a type of services of multiple distribution activities provided by an external party (assuming no ownership of inventory) to accomplish related functions that are not desired to be rendered and/or managed by the purchasing enterprise (Sink *et. al.,* 1996). The use of a third-party provider for all or part of an enterprise's logistics operations (Coyle *et .al.,* 1996) is increasingly popular (Lambert *et. al*., 1999). Coyle *et. al*., (1996) identified several key benefits of logistics outsourcing, namely operating cost reduction, service level improvement, core competence prioritization, and employee based reduction and capital cost reduction. Third party logistics is simply the use of an outside company to perform all or part of the firm's material management and product distribution functions. TPL relationships are typically more complex than traditional logistics supplier relationships they are true strategic alliances. Modern TPL arrangements involve long-term commitments and often multiple functions or process management. TPL providers come in all sizes and shapes from small companies with a few million dollars in revenue to huge companies with revenues in the billions. Most of their companies can manage many stages of the supply chain.

The TPL has undergone several changes and developments in the past decade. Since TPL has implications for logistics service innovation, these changes will be as: Customers have outsourced a broader range of logistics services (e.g., financial services, contract manufacturing, procurement support) and some customers even desire 'one-stop shopping' with a lead logistics provider which offers a variety of outsourcing services through a single point of contact. Such a provider must be able to offer wide geographical coverage and sophisticated technological solutions (Rafiq and Jaafar, 2007; Tian *et. al.*, 2010).

The TPL industry also faces technological challenges (e.g., Anderson *et. al.,* 2011; Lai *et. al.,* 2008). On the one hand, a challenge to the industry is the high cost and low return on IT investments. This problem stems from the rapid changes in technology, the customers' demand for systems customization, and the customers' unwillingness to pay the true costs of these applications. On the other hand, TPL providers must invest in technology because customers demand more technological competences and IT solutions. Customers increasingly rely on their TPL providers for expertise in complex technologies such as transportation management systems (TMS), warehousing management systems (WMS), supply chain event management (SCEM), and international trade logistics systems (ITLS). TPL providers acquire valuable technology-specific knowledge and expertise by working with multiple customers.

Thus, the TPL providers can maximize the productivity of the technology. Therefore, customers favour TPL providers who can afford upfront investments in technology and have multiple customers. In sum, IT enables TPL providers to enhance productivity, reduce costs, provide Innovative and customized services, and improve service quality- consequently circumventing competitive pressures (Bitran *et. al.,* 2007; Lai *et. al.,* 2008; Mortensen and Lemoine, 2008).

Despite the challenges of creating innovation in third-party logistics (TPL) provider–customer relation- ships, little is known about how TPL providers and customers engage in joint innovation projects and the benefits that can be obtained from such innovation activities. The analysis shows that such innovation projects allow the TPL providers to upgrade their positioning, intensify customer relationships and lead to higher performance (Wagner and Sutter, 2012).

2.3.10. Logistics

Logistics can be viewed as a logical extension of transportation and related areas to achieve an efficient and effective goods distribution system. A definition of logistics management can be 'Design and Operation of the Physical, Managerial and informational systems needed to allow goods to overcome time and space (from the producer to be consumer). The Definition implies that on integrated view of a number of different activities or functions may be required (Raghuram, 1992). Physical distribution management is the generic term widely used for the management of the

flow of goods and services from the point of origin to the point of consumption. Physical distribution consists of all the activities concerned with moving the right amount of the right products to the right place at the right time. Logistics management encompasses the total flow of materials from acquisition of raw materials to the delivery of the finished product to the ultimate consumer and the counter flow of information that controls and records the material movement.

Market logistics involves planning implementing and controlling the physical flow of materials and final goods from points of origin to points of use to meet customer requirements at a profit. Business logistics is therefore, the study of flow management that can best provide a profitable level of distribution services to customers through effective planning, organizing and controlling of the stock movement activities that facilitate product flow. It is the set of facilities, equipment, people and operating policies that makes this flow of the goods and the related flow of information from acquisition of raw materials through production and distribution possible. The key word here is flow in a real sense logistics management consists of the design, operation control and coordination of that flow on an ongoing basis. Business logistics is vital to the economy and individual firms. It is a key factor in encouraging international and regional trade. Efficient and effective logistics systems means, higher standards of living for all people. In the wake of changing business environment, Managers have begun to see that new approaches to designing and managing the logistics chain are required. Logistics involving inward materials procurement is called inbound logistics and that involving supply of finished products to the customers is called outbound logistics (Raghuram, 1992). Logistics services can also be analyzed on the basis of factors involved such as service user, service provider and service regulator. In the national context, government acts as the regulator of logistics services. As a case in point, the motor vehicles Act, 1988, serves to regulate overloading of trucks and ensures safe and orderly driving. The main purpose of logistics is to ensure availability of product and services. Logistics cost form a significant proportion of controllable costs. Some representative elements logistics costs can be product inventory at source, pipeline inventory, finished inventory at warehouse, storage losses, insurance, material handling, package, transposition etc.

Effective management of the logistics can improve cash flow as well as reduce working capital requirements (Raghuram, 1992).

Integrated Approach to Logistics Management: - A complex logistics (Physical Distribution) system cannot be managed on, fragmented basis with each functional area being handled independently (Runyon, 1982) Uncoordinated logistics activities make it impossible to achieve a flow of products that satisfies the firm's goals. An integrated approach to logistics can bring together the individual activities in a unified way (Stanton *et. al*., 1994) Many organization have realized that improving the efficiency of individual logistics operations such as warehousing or transportation is useless if the efficiency of the individual function throws the total system out of balance. An integrated approach will facilitate better coordination among the various physical distribution function, remove the sub-optimization in the system and enable the firm to achieve its distribution objectives with ease (Ramaswami and Namakumari, 1996). Integrated logistics management can be useful to maximize the performance of entire distribution; the management can coordinate the activities of the entire supply chain to deliver maximum value to the customers.

2.3.11. Information Technology (IT)

The performance of an enterprise depends much on the performance of its partners in the value chain. It has been recognized that high transactional cost will be involved if information cannot effectively and efficiently communicate with customers externally and with suppliers internally (Choy, *et. al*., 2004). Value in a supply chain is generated by lowering the firm's or partner's cost of sourcing or sales or increasing the service level. This can be achieved by using information technologies designed to manage complex information flows within or between firms (Biehl, 2005). The use of information technology to share data between buyers and suppliers has resulted in the growth of virtual supply chains (Yusuf *et. al*., 2004; Christopher, 2000). In a virtual supply chain the main driver would be "information" rather than the actual physical flow of goods. In recent time along with the physical supply chain, there is an emergence of information supply chain. This information sub-chain focuses on the management of information flows and represents a philosophy of managing technology and processes in such a way that the enterprise optimizes the delivery of

goods services and information from the supplier to the customer (Burca *et. al*., 2005). Supply chains can be viewed as an example of an IT enabled inter organizational configuration, where the coordination of logistics processes between organizations is the key to good performance (Lewis and Talayevsky, 2004). Use of IT has facilitated the following major processes in a supply chain: Information sharing, Better integration, and Access to global markets, Global partnerships, Changed production methods, Improved customer service, Enhanced collaboration, Reduced transaction costs, Product and service customization, Increased agility, Real time information capture. (Sabki *et. al.,* 2004; Davenport and Brooks, 2004; Stockdale and Standing, 2004; Shore 2003; Brandyberry and White,1999). Managing information in an inter-organizational context has become critical and the emergence of the internet and the range of related e-business technologies have created new opportunities and threats (Moller, 2005). Information technology (IT) and information systems (IS) are widely acknowledge as one of the major enablers of business change (Iran *et. al.,* 2002).

Harland *et .al.,* (2003) provides a list of risks, but misses the information risks. Four basic approaches that a firm could employ to mitigate risks through a collaborative and coordinated mechanism are supply management, demand management, product management and information management (Tang, 2006). Information risk can be defined as "the probability of loss arising because of incorrect, incomplete or illegal access to information" and information risk management as "the management of information risk in supply chain through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity". Risks associated with information have a wide variety of impacts. While the impact of information security breakdown risks are very evident and immediate on supply chain operations, the impact of risks like intellectual property are not immediate but are critical for overall supply chain viability in the long term. Based on the type of impact that different information risks have on the supply chain, they can be broadly classified as: Information security/break down risks, Forecast risks, Intellectual property rights risks, IT is outsourcing risks. Information based collaborative supply chains are emerging in industries as diverse as automobiles, grocery retailing and apparel manufacturing (Christopher and Lee, 2004) and the next phase would be actual

system interoperability among suppliers customers, and other business (Daven port and Broaks, 2004).

2.3.12. Integration

The term "Supply Chain Integration" is not well defined constructs. They have different meanings to different people and organizations. Frohlich and Westbrook (2001) investigated supplier and customer integration strategies in a global sample of 322 manufacturing companies. The authors developed scales for measuring supply chain integration and identified five different strategies (arc of integration) in the sample; inward facing, periphery facing, supplier facing, customer facing and outward facing. The strategies identified by them represented upwards or down words integration and the degree of integration. The study showed that firms with broader. Supply chain integration with both suppliers and customer had the largest rate of performance improvement, compared to firms having narrow or biased integration with their suppliers or customers. Ragatz *et. al*., 1997 studied the 60 US companies about supplier integration in new product development. The responses indicated that supplier integration has led to significant performance improvements and competitive advantage for the firms. Direct cross functional, intercompany communication was the most extensively used technique in successful supplier integration.

Narasimhan and Kim (2002); Tan (2002) have studied the effect of supply chain integration on performance. Lambert *et. al.,* (1998) define the SCM concept as "Integration of Business Processes". Lee (2000) argues that a truly integrated supply chain does more than reduce costs. It also creates value for the company, its supply chain partners and its share holders. Prahalad and Hamel (1994) and Hammer (2001) suggest that vertical integration should be replaced by virtual integration where each participant concentrates on those processes that it performs best, leaving the result to others. Fine (1998) argues that clock-speed industries seem to follow a double helix oscillating between vertical integration and horizontal disintegration. Harland (1996) reports a trend of towards vertical disintegration in a range of industries. Bagchi *et.al.*, (2005) propose a contingency approach to supply chain integration arguing that factors such as dominance versus balanced power in the supply chain, the degree of competition in the industry, the maturity of the industry and the nature of the products

may determine the desired level of integration in a supply chain. This is also in line with Fisher (1997) seminal distinction between efficient and responsive supply chain depending on product and market characteristics.

"Supply chain integration as the comprehensive collaboration among supply chain network members in strategic, tactical and operational decision-making." Previously, integration had emphaized financial influence, corporate diversification, and evaluation and control of environmental factors. However by the early 1980's, firms turned their focus on efficiency and supply chain integration (Lalonde, 1994). Supply chain integration initially emphasized local optimization of separate activities. But optimization of one stage could notably impact other stages, thus, the "bullwhip effect" (Lee *et. al.*, 1997), which emphasizes balance of the entire supply chain. Lumnus add other reasons to balance the supply chain; increasing global competition forces extraction of supply chain efficiencies, increasing specialization of products and processes has generated an inefficient or disintegrating effect, which must be counter balanced by greater integration.

Recent studies have also underscored the multi-faceted and complex nature of the supply chain (Copper *et. al*., 1997) identified three basic supply chain decisions: Number and type of business processes to integrate, Horizontal and vertical network, Management processes used. The limit to supply chain integration is best captured in the concept of "Focus" which states that a production activity must focus on one or a small number of products (or product lines), one or a few production processes and one or two similar technologies if a production activity attempts many products, processes, or technologies, it would become "unfocused", ultimately ceding market share to more efficient, focused processes.

Supply chain integration (SCI) is conceptualized as a process of redefining and connecting entities through coordinating or sharing information and resources (Katunzi, 2011).

This includes collaboratively managing intra-and inter-organizational processes to achieve effective and efficient flows of products, services, Information, and money with the objective of providing maximum value to customers (Nayloretal.,1999; Zhao *et.al.*,2008). SCI is a multidimensional construct (Flynn *et.al.*, 2010). The literature

reveals consensus that there are mainly two types of SCI: external integration and internal integration (Narasimhanand and Kim, 2002; Swink,*et.al.,* 2007; Vijayasarathy,2010). External integration comprises supplier and customer integration (Droge *et. al.,* 2012). Internal integration is the coordination, collaboration and integration of functional areas within the firm (Stock *et .al.,* 1998). The aim of internal integration is that the departments and functions within a company function as a cohesive process. Internal integration significantly influences both dimensions of external integration, customer and supplier integration; and that supplier integration is significantly and positively related to financial performance (Yu, 2013).

2.3.13. Bullwhip effect

The bullwhip effect is an observed phenomenon in forecast-driven distribution channels. Because customer demand is rarely perfectly stable, businesses must forecast demand in order to properly position inventory and other resources? Forecasts are based on statistics, and they are rarely perfectly accurate. Because of forecast errors, companies often carry inventory buffer called "safety stock". Moving up the supply chain from end-consumer to raw materials supplier, each supply chain participant has greater or observed variation in demand and thus greater need for safety stock. In periods of rising demand, down-stream participants will increase their orders. In periods of falling demand, orders will fall or stop order to reduce inventory. The effect is that variations are amplified as one move upstream in the supply in the supply chain (further from the customer).

The Bullwhip effect can be defined as the phenomenon of variability magnification as we move from the customer to the producer in the supply chain (Chopra and Meindl, 2001). Bullwhip effect is also attributed to the separate ownership of different stages of the supply chain. Each stage in such a structured supply chain tries to amplify the profit of the respective stages, thereby decreasing the overall profitability of the supply chain.

Supply chain experts have recognized that the bullwhip effect is a problem in forecast drive supply chains, and careful management of the effect is an important goal for supply chain managers. The alternative is to establish demand-driven supply chain which reacts to actual customer orders. In manufacturing, this concept is called

Kanban. This model has been most successful implemented in Wal- Mart's distribution system. Individual Wal-Mart stores transmit point-of-sale (POS) data from the cash register back to corporate headquarters several times a day. This demand information is used to queue shipments from the Wal-Mart distribution center to the store and from the supplier to the Wal-Mart distribution center. The result is near-perfect visibility of customer demand and inventory movement throughout the supply chain. Better information leads to better inventory positioning and lower costs throughout the supply chain. Barriers to the implementation of a demand-driven supply chain include the necessary investment in information technology and the creation of a corporate culture of flexibility and focus on customer demand.

Factors contributing to the Bullwhip Effect are- Forecast errors, Lead time variability, Batch ordering, Price fluctuations, Product promotions, Inflated orders Methods intended reduce uncertainty, variability and lead time, Vendor managed inventory (VMI), Just In time replenishment (JIT), Strategic partnership.

Numerous studies focused on identifying the bullwhip effect in examples from individual products and organizations, The bullwhip effect represents the phenomenon of demand distortion where orders to supplier tend to have larger variance than sales to the buyer and this distortion propagates upstream in an amplified form (Buchmeister, 2014). Chen and Lee (2012), developed a set of formulas that describe the traditional bullwhip measure as a combined outcome of several important drivers (finite capacity, batch ordering, seasonality). They discussed the managerial implications of the bullwhip measurement and showed that an aggregated measurement over relatively long time periods can mask the operational-level bullwhip. Duc *et. al.,* (2008), quantified the bullwhip effect, the variance amplification in replenishment orders, for cases of stochastic demand and stochastic lead time in a two-stage supply chain. They investigated the behaviour of a measure for the bullwhip effect with respect to autoregressive coefficient and stochastic order lead time.

Sucky (2009), focused in his work on measuring the bullwhip effect taking into consideration the network structure of supply chains. He shows that the bullwhip effect is overestimated if just a simple (two stage) supply chain is assumed and risk

pooling effects are present. The strength of the effect depends on the statistical correlation of the demands. Ouyang and Daganzo (2008) presented a control framework to analyse the bullwhip effect in single-stage supply chain under exogenous Markovian uncertainty. They derived robust analytical conditions that diagnose the bullwhip effect and bound its magnitude. The results are useful for prediction of performance in uncertain operating environments. Agrawal *et. al.,* (2009), analyzed a two stage serial supply chain. They studied the impact of information sharing and lead time on bullwhip effect and on-hand inventory. It is shown that some part of bullwhip effect always remain after sharing both inter- and intra-stage data and that the lead time reduction is far more beneficial.

Bray and Mendelson analyzed the bullwhip by information transmission lead time based on public companies' data from years 1974-2008. Shorter reaction times cause significantly more troubles regarding bullwhip. Csik and Foldesi (2012) tested the problem of bullwhip effect by adoption of an inventory replenishment policy involving a variable target level, where all other common causes were excluded.

2.4. SUPPLY CHAIN PERFORMANCE

Petrovic-Lazarevic and Sohal (2002) define performance measurement as way to assess information regarding processes and products results, to allow evaluation and comparison in relation to goals, patterns, past results and to compare with other processes and products. Hausman (2000) refers to supply chain performance as "the extended supply chain's activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner."

The objectives of performance measurement are to improve the efficiency and effectiveness of a supply chain, capture the pertinent aspects of company performance, and provide the management with the feedback and information necessary for decision making and controls (Beamon 1999; Holmberg 2000; Gunasekaran *et. al.,* 2004).

A number of reasons exist for measuring and evaluating supply chain performance.

- **Support Better Decision Making:** Measurement can lead to better decisions by making performance and results visible. It is difficult to develop performance improvement plans without understanding the areas in which performance falls short. Measurement provides a track record of performance over time and directly supports decision making activity by management.
- **Support Better Communication:** Performance measurement can result in better communication across the supply chain, between all departments, and with executive management.
- **Provide Performance Feedback:** Measurement provides the opportunity for performance feedback, which supports the prevention or correction of problems identified during the performance measurement process.
- **Motivate and Direct Behavior:** Measurement motivates and directs behavior toward desired end results. A measurement system can accomplish this in several ways. First, the selection of performance categories and objectives indicates to those activities that an organization considers critical. Second management can motivate and influence behavior by linking the attainment of performance objectives to organizational rewards, such as pay increases.

2.4.1. Need for Supply Chain Performance

To determine what performance measures should be evaluated for the supply chain, the question why supply chain performance is needed should be addressed first. Several factors trigger the business firm's need for the performance measurement, including increasing competition which arises from greater customer expectations for cost reductions and value-added products or services (Neely, 1999). The need to minimize costs and increase profitability requires more efficient performance measurement (Gunasekaran *et. al.,* 2004), the need to differentiate firms from other competitors and gain their competitive advantage (Lambert and Pohlen, 2001). Many companies strive to find specific areas to increase their competitiveness and competency for differentiation, competition today is no longer simply company to company, but rather, supply chain to supply chain. The focus of supply chain performance measurement should go beyond firm focus (Lambert and Pohlen, 2001).

Aligning the organizational goals with the supply chain goals is vital to the overall performance success of the supply chain.

Unbalanced sets of one-dimensional performance measures can lead to a distorted picture of the performance of a firm (Hausman, 2000; Gunasekaran *et. al.,* 2001). Some companies focus on financial performance measures and others focus on operational measures. As some researchers have pointed out, narrowly defined performance measures are unable to provide supply chain members with a precise picture of the performance of the entire supply chain, or identify potential opportunities of improving firm competitiveness and customer service and value (Beamon, 1999; Lambert and Pohlen, 2001). Therefore, a clear picture of the performance across the entire supply chain is required for successful supply chain management.

2.4.2. Background about Performance Measurement

Performance measurement can be grouped into two phases. The first phase began in the 1880s and ended in the 1980s. This phase emphasized financial measures of performance such as profit, return on investment, and productivity. The second phase started in the early 1980s as a result of global competition that changed customer requirements and forced the implementation of new technologies and philosophies of production and management (i.e. CIM, FMS, JIT, OPT, and TQM). In order to compete manufacturing companies had to have high quality, dependable delivery, more variety, shorter lead times, and lower costs. The new customer requirements and associated technologies/philosophies clearly revealed the limitations of traditional performance measures. It became vital to develop new performance measurement systems for the success and prosperity of companies.

Traditionally, performance measurement is defined as the process of quantifying the effectiveness and efficiency of action. Performance measures are based on traditional accounting systems. Return on investment (ROI), return on assets (ROA), return on sales (ROS), purchase price variances, sales per employee, profit per unit production, and productivity are examples of traditional performance measures. However, such performance measures have many limitations. The most significant limitation of traditional performance measures is that they are based on management accounting

systems which focus on controlling and reducing direct labor costs. However, the labor cost component currently constitutes only an average only 12% in all industries while overhead comprises 50-55% of the manufacturing cost. Traditional measures are also limited because:

1. They are lagging metrics since financial reports are usually closed monthly and are a result of decisions that were made one or two months prior. The financial reports are usually too old to be useful.
2. They try to quantify performance and other improvement efforts solely in financial terms. Many improvement efforts are difficult to quantify in dollars, such as lead time reduction and adherence to production schedule, however they can have a significant impact on overall success.
3. They have a predetermined format that is used across all departments. Such reporting is inflexible and ignores the fact that each department within a company has its own unique characteristics, priorities, and contribution.
4. They tend to be inconsistent with the concept of continuous improvement.
5. They are not applicable to the new management techniques that give shop floor operators more responsibility and autonomy in the areas of quality, production, preventive maintenance, and scheduling. As a result of these limitations researchers have argued that a new set of performance measures should be developed.

Some of the new systems have answered these limitations by adopting the characteristics representative of non-traditional performance measures shown in Table 2.4. They have also focused on supporting the type of feedback that is relevant for each level of management, rather than provide the same feedback to all managers. The strategic measurement analysis and reporting technique (SMART) system was developed by Wang Laboratories, Inc. as a result of dissatisfaction with traditional performance measures. The SMART system consists of a four level pyramid of objectives and measures: Corporate vision/strategy, Business unit market and financial objectives, Business unit operational objectives and priorities, Departmental level operational criteria and measures.

Table 2.4: Comparison between traditional and SCM performance measures.

(Ref. Ghalayini, *et. al.*, 1997)

Characteristics	**Traditional Performance Measures**	**SCM Performance Measures**
Basis of system	Accounting standards	Supply chain strategy
Types of measures	Financial	Operational and financial of SC
Audience	Middle and top managers	All employees
Frequency	Lagging (weekly or monthly)	Real-time (hourly or daily)
Linkage with "reality"	Indirect, misleading	Simple, accurate, direct
Shop floor relevance	Ignored	Used
Format	Fixed	Flexible/variable
Local-Global relevance	Static, non-varying	Dynamic, situation structure dependent
Stability	Static, non-changing	Dynamic, situation timing dependent
Purpose	Monitoring	Improvement of supply chain
Support for new improvement (JIT, TQM, CIM, FMS etc.	Hard to adapt	Applicable

Effect on continuous improvement	Impedes	Supports and motivates

Dixion *et. al.,* (1990) developed the performance measurement questionnaire (PMQ) to help managers identify the improvement needs of their organization, to determine the extent to which the existing performance measures support improvements, and to establish an agenda for performance improvements. Kaplan and Norton (1992) developed the balanced scorecard approach to integrate strategic, operational, and financial measures. Goals are set by managers with regards to four perspectives: customer, internal, innovation/learning, and financial. Specific measures are specified in order to achieve each goal. Each of the integrated performance measurement systems has both relative strengths and weaknesses. The main strength of the SMART system is its attempt to integrate corporate objectives with operational performance indicators. However, the SMART system does not provide any mechanism to identify key performance indicators, nor does it explicitly integrate the concept of continuous improvement. The PMQ has the advantage of providing a mechanism for identifying the improvement areas of the company and their associated performance measures. In addition, it tries to determine the extent to which the existing measurement system supports such improvement areas. However, the PMQ cannot be considered a comprehensive integrated measurement system and does not take into account continuous improvement. The "balanced scorecard" attempts to integrate four important performance perspectives in one simple and easy to use management report. The main weakness of this approach is that it is primarily designed to provide senior managers with an overall view of performance. Thus, it is neither intended for nor applicable at the factory operations level. Gregory in his analysis of the state-of-threat integrated performance measurement systems concludes that there is a need for a system that takes a "process" approach and is capable of evolving with the company so as to be tailored to meet specific needs. To this "need list" we add that the state-of-the-art integrated measurement systems still have the following limitations that must be addressed:

1. They are mainly constructed as monitoring and controlling tools rather than improvement tools. Thus, they do not explicitly consider the integration of continuous improvement.
2. They do not provide any mechanism for specifying which objective should be met in a specific time horizon.
3. They are not dynamic systems. They do not allow any systematic revision of critical areas, performance measures, historical data, decisions, and outcomes.
4. They do not look ahead for predicting, achieving and improving future performance. They are only concerned with present performance.
5. Although some stress the importance of global optimization versus local optimization, they do not provide any mechanism to achieve this, particularly at the operational level.
6. Most systems do not stress the importance of time as a strategic performance measure.
7. None of the models provide a specific tool that could be used to model, control, monitor, and improve the activities at the factory shop floor.

2.5 BRIEF DESCRIPTION OF APPROACHES AND FRAME WORKS: To measure supply chain management performance, main approaches and frameworks are as follows:-

- **Strategic measurement analysis and reporting technique system:** Wang laboratories, inc. (Cross and Lynch, 1989) developed this system and it consists of a four-level pyramid of objectives and measures: corporate vision /strategy, business unit market and financial objectives, business unit operational objectives and priorities, departmental level operational criteria and measures.
- **Performance measurement questionnaire (Dixion, Nanni and Vollmann, 1990):** It involves a workshop to develop, revise, and refocus the set of performance measures. It has the advantage of providing a mechanism for identifying the improvement areas of the company and

their associated performance measures. However, it cannot be considered a comprehensive integrated measurement system and does not consider continuous improvement.

- **Frame work for time based competition (Azzone *et. al.*, 1991):** Three main areas of research and development, operations, sales and marketing are identified where time measures could be used, identifies appropriate metrics for performance measurement, could reflect the dynamics aspect of supply chain management and the contingency of the context in which supply chain management is adopted. Emphasize on time and do not consider other operational performance measures such as quality, cost and delivery.
- **Balance score card (Kaplan and Norton, 1992):** Identifies financial, customer, internal business and innovation, learning perspective integrating different classes of business, financial non-financial, internal and external measures could be appropriate to reflect the holistic approach of supply chain management. Very useful tool at the top management level, but it is applicability at shop floor level needs to be further investigated.
- **Strategic performance measurement system (1994):** Vitale, Mavrinac and Hauser presented an action-focused tool, which concentrated on the organization's strategies. The concepts and ideas developed by hands– on experience.
- **Brown's framework (1996):** Identifies differences among the input, process and output measures. Promotes a more horizontal and comprehensive approach to the management and measurement of operations and processes. Serious attempt to introduce a holistic approach to measure the three main elements of the operations process (input, transformation and output) but essentially through the use of a quantitative approach.

- **Integrated dynamic performance measurement system (1997):** Developed by Ghalayinin, Noble, and Crowe to achieve an integrated system by combining three main areas of the company- management, process improvement team, and factory shop floor.
- **Framework by Benita (1999):** Identifies use of resources, desired output and flexibility as components of effective supply chain performance measurement. It provides a quantitative approach for flexibility measurement, detailed list of performance measures, could be very effective for supply chain performance as it takes in to account flexibility (ability of the system to respond to uncertainties).
- **Kueng (2000):** Presented it, especially for modern process-based businesses. It assesses the performance of the processes for five aspects: View, Employee view, Customer view, Societal view, and Innovation view.
- **Frame work by Gunasekarn *et. al.*, (2001):** It identifies four links of supply chain: Plan, Source, Make, and Deliver. It provides a detailed list of metrics for strategic, operational and tactical level. It incorporates issues such as source performance and customer satisfaction. It could be very useful in performance evaluation of supply chains.
- **Frame work by Gunasekarn *et. al.*,(2004):** The metrics and measures are discussed in the context of the following supply chain activities/ processes: (1) Plan, (2) Source, (3) Make/assem-ble, and (4) Delivery/customer (Gunasekaran *et. al.*, 2001).In this paper some new metrics taken as: Metrics for order planning(order entry method, Order lead-time, customer order path), Evaluation of supply link as Evaluation of suppliers-(Strategic, Tactical, Operational) level measures.
- **Pache and Spalanzani (2007):** Have proposed five levels of maturity built around inter-organisational supply chain relation-ships, including any relevant societal aspects. Maturity models first appeared in early quality management studies, which tended to identify a number of different levels.

Identifying such levels has been one corollary of corporate performance improvement approaches. Level 1: intra-organisational maturity, Level 2: inter-organisational maturity, Level 3: extended inter-organisational maturity, Level 4: multi-chain maturity, Level 5: societal maturity.

- **AFNOR FD X50-605 (2008):** It offers general framework for strategic reflection and defines different logistics processes. It identifies performance levers associated with each process. Its model features six areas: Identification of needs and setting of objectives, Logistics system design and development, Production, sales and distribution, Logistics support and control over global logistics process.
- **Efficient Consumer Response (ECR, 2010):** Created in 1994 by an ECR Association of manufacturers and retailers. Evaluates good inter-organisational practices. Focuses on collaboration between industrialists and distributors in fast moving consumer goods sector. Degree of conceptualization-Establishes common language based on joint evaluation of performance by actors in the chain, 45 criteria structured into four areas: Consumer demand management, Supply chain management, Technological platforms and Integration. 13 Performance measurement indicators enabling inter-sectorial comparisons.
- **A fuzzy logic approach to supply chain performance management (2011):** A supply chain performance model based on fuzzy logic to predict performance based on causal relationships between metrics of the Supply Council Operations Reference Model (SCOR). The main contribution and originality of this proposal relates to the application of Fuzzy logic to predict performance based on performance metrics levels 1 and 2 of the SCOR model.

2.6. PROBLEMS WITH SUPPLY CHAIN PERFORMANCE MEASUREMENT AND EVALUATION

Measuring and evaluating performance, and supply chain performance historically has certain problems and limitations. Mark Brown, an expert on

performance measurement, argues that most managers and professionals today are like pilots trying to fly a plane with only half measure irrelevant data. He states that practically every organization has some type of problem with its measurement system. Too much data and wrong data, Measures that are short–term focused, Lack of detail, Drive the wrong performance, Measures of behavior versus accomplishments.

- **Supply Chain Performance Measurement Categories:** A Company focused Supply chain measurement approach, firms should follow a system a systematic process to maximize results and achieve vertical and horizontal alignment of purpose. Company objectives drive specific company strategies such as being the low-cost producer-or technology leader. These company strategies should then drive appropriate and supply chain objectives and specific strategies. Alignment of strategies, measures, and actions will bring together top-down direction and bottom-up targeting to produce positive contributions. In a single enterprise, this could deliver competitive advantage. Integrated supply chain management can also produce competitive advantage for the end-to –end supply chain level, improving effectiveness and reducing overhead.

  Number of supply chain measures is in existence. Perhaps the best way to summarize the vast number of separate measures are by developing performance measurement categories with in each category, many separate measures appear that relate to each general category.

- **Developing a Performance Measurement and Evaluation System:** The development of a measurement and evaluation system requires the leadership, support, and commitment of executive management, who must commit the financial resources necessary for system development. Development of an effective measurement and evaluation system follows a general sequence of activities. These include determining which performance categories to measure, developing specific performance measures, establishing performance standards for each measure, finalizing

system details, and implementing and reviewing the system and each performance measure.

Determine Which Performance Categories to measure

The first step of the development process requires identifying which measurement categories to emphasize. Also, a firm can weight its performance measures and categories differently. Management does not concern itself with specific performance measures during this phase of system development. The selected performance categories must relate broadly to organizational and supply chain goals and objectives. Selecting the performance measure categories is a critical step prior to developing specific performance measures**.**

Developing Specific Performance Measures

Specific performance measures begin once management identifies the measurement categories. It will emphasize certain features for successful supply chain performance measures. These are as follows-

Objectivity

Each measure should be as objective as possible. The measurement system should rely on quantitative data-instead of qualitative feelings and assessments group responsible for performance objective.

Clarity

Personnel must understand a performance measures requirements in order to direct performance toward the desired out-come and minimize misunderstandings.

Use of Accurate and Available Data

Well-defined measures use data that are available and accurate. If a measure requires data that are difficult to generate or unreliable, the probability of using the measure on a consistent basis declines. The cost of generating and collecting the required data should not outweigh the potential benefit of using the performance measure.

Creativity

A common misconception is that a performance evaluation system should measure every possible activity. A successful system measures only what is important while still promoting individual initiative and creativity, which may mean focusing on 5 or 6 important, clearly defined measures instead of 25 vague measures.

Directly Related to Organizational Objective

How corporate goals and objectives inference supply chain management (SCM) goals and objectives? Other functional objectives also can influence SCM Performance.

Joint Participation

Joint participation means that the personnel responsible for each measure participate in developing the measure or establishing the measure's performance objective. Joint participation can go a long way toward getting the support of the personnel responsible for achieving the measure.

Dynamic Over Time

A dynamic system is one that management reviews periodically, to determine whether existing measures still support goals and objectives, the possible needs for new performance measures, or if performance standards or objective require updating.

Non Manipulable

A non manipulable measure means that personnel cannot in appropriately influence performance results (i.e., the measure is cheat-proof). Ideally the individuals responsible for the measure should not be responsible for supplying the data to the reporting system. This becomes an issue of accountability and integrity. The measures output should be a true reflection of actual activity or performance results. Systems receiving their input from automated or computerized system are generally less susceptible to data manipulation.

Establish Performance Objectives for Each measure:

Establishing an objective for each performance measure is critical. Objectives quantify the desired performance target or goal. Management must not specify objectives that are too easy. The too easy objective can become an accepted

performance standard within a department. Performance standards or objectives must be realistic, which means the measure is challenging yet achievable through a solid effort. An objective should not be so easy that it requires minimal effort. It should not be so difficult that it discourages personnel from even attempting to achieve the objective. The objective must also reflect the realities of a firm's competitive environment. An objective that is challenging internally yet does not reflect the competitive environment is not part of a well-defined measure.

Firms commonly use three methods when establishing performance measure objectives: Historical data, Internal comparisons, External analysis.

Finalize System Details

The phase of implementation requires management to consider issues such as the frequency of performance reporting, the education and training of system users, and the final determination about how to use system output.

Performance reporting frequency

A sound measurement and evaluation system provides regular reporting of performance results. The actual reporting frequencies can differ from measure to measure. Management must determine what frequency supports the most effective use of each measure.

Education and Training

The measurement and evaluation system is a tool, and like all tools, it requires proper education and training in its use.

Using System output

Managers use the output of a performance measurement and evaluation system in a number of ways. Managers must give careful thought concerting how best to use system output.

Implement and Review System Performance and Measures

All system has an implementation phase, which may include pilot or trial runs to make sure the system performs as planned. The measurement and evaluation system, along with each performance measure, must be subject to periodic review. A system

that contains obsolete or in appropriate measure can be damaging than having no formal system at all.

2.7 SUMMARY AND GAPS IN THE LITERATURE

In this chapter, an attempt was made to review the literature on the issues related with supply chain management and practices of organizations in market. Major areas considered for this review are priorities for forming supply chain management attributes: Motivations for implementing supply chain management in the organizations, Investment priorities for supply chain management success, Hindrances in implementing supply chain management practices, Information sharing issues with supplier and customers, Customer satisfaction in organizations, Capabilities for organizations, Product design and development activates, Supplier selection criteria, Environmental issues in organizations, Supplier development activities, Efforts for supply chain management and performance measure of organizations in supply chain. In this regard more than three hundred fifty research papers were reviewed. Summary of literature review is given in table 2.5. Major journals from which these research papers were taken are International Journal of Supply Chain Management, International Journal of Production Economics, International Journal of Information Management, International Journal of Operation and Production Management (IJOPM), Technovation, Global Journal of Flexible Systems Management etc. As discussed earlier supply chain management attributes and practices are broad areas. For this, holistic approach considering different areas of supply chain management needs to be adopted. In spite of number of studies conducted on Indian organizations very few studies on supply chain management attributes and Best supply chain management practices are reported in Indian context. On the basis of this extensive literature review, the following gaps are identified.

- There has been lack of empirical research on Best supply chain management practices by organizations for supply chain management attributes as motivations for implementing SCM, investment priorities for SCM success, hindrances in implementing SCM practices, supply chain management practices, information sharing, customer satisfaction, supplier selection criteria, supplier development activities, efforts for supply chain management.

- Very few studies are done to analyze the Best supply chain management practices and supply chain management attributes issues of Indian organizations after globalization.
- Previous studies lack in motivations for implementing SCM in the organizations.
- No adequate framework was found to analyze the SCM practices of organizations.
- There is no enough work to analyze capabilities for SCM in organizations.
- Very few studies mentioned to analysis the financial support to supplier, providing training to the staff of the supplier for supplier development activities**.**
- Most of the studies have considered the relationship of a particular SCM practices with certain financial parameters only, not with overall performance.
- In view of the above gaps identified, present research will try to analyze supply chain management practices and attributes of SCM in Indian organizations in present scenario with questionnaire based survey methodology supported with case studies and interpretive structural modeling. Details of research methodology will be discussed in chapter-3.

Table 2.5 Summary of Literature Review.

S.No.	Issues	Referances
i	Motivations for Implementing SCM	Humphreys *et,al.*,(1988); Duguay *et.al.*, (1997); Benito and Spring (2000); Amasaka (2002); Zsidisin *et.al.*, (2004); III (2011); Glock (2012); Kim and Glock (2013); Prashar (2014)
ii	Investment Priorities for SCM Success	Krause *et.al.*, (1998); Sahay *et.al.*, (2005); Ahmed and Hendry (2012); Mortensen and Arlbjørn (2012); Maier *et.al.*, (2014); Routroy and Pradhan (2014);

		Pradhan(2014)
iii	Hindrances in Implementing SCM Practices	Makridakis and Wheelwright(1977); Laeequddin *et.al.*, (2010); Karlaftis *et.al.*, (2011); Ramanathan (2012), Nakano *et.al.*, (2012); Singh(2013); Ibrahim *et.al.*, (2012); Tan and Cross(2012); Bryan and Srinivasan (2014); Chen *et.al.*,(2014); Kembro and Naslund (2014)
Iv	Supply Chain Management Practices	As given in Table 2.3.
v	Information Sharing Issues, Suppliers and Customers	Yu *et.al.*, (2001); Byrne and Heavey (2006); Li and Lin(2006); Zhou and Benton(2007); Cho and Lee(2013); Lotfi *et.al.*, (2013); Ye and Wang(2013); Wu *et.al.*, (2014)
vi	Customer Satisfaction	Piercy (1996); Chang and Huang(2000); Adebanjo(2001); Madu(2005); Yadav and Goel(2008); Lin *et.al.*, (2011); Chiu *et.al.*, (2011); Yu *et.al.*, (2013)
vii	Capabilities	Day (1994); Teece *et.al.*, (1997); Gruber *et.al.*, (2010); Rexhausen *et.al.*, (2012); Liozu and Hinterhuber (2013b); Leeuw(2013); Blome(2013); Liozu *et.al.*,(2014); Spring(2014)
viii	Product design and Development Activates	Zipkin(2001);Krishnan and Ulrich (2001); Squire *et.al.*, (2004); Wadhwa *et.al.*, (2006);Forza *et.al.*, (2008); Sundin *et.al.*, (2009); Yamamoto and Abu Qudeiri (2010); Lin and Zhou (2011); Qrunfleh(2013); Meybodi(2013); Caridi(2014)

ix	Supplier Selection Criteria	Boer *et.al.*, (2001); Bhutta and Huq(2002); Soeini *et.al.*, (2012); Mushanyuri(2012)
x	Environmental Issues	Klassen and McLaughlin(1996); Lin *et.al.*, (2001); Govindarajulu and Daily(2004); Chiang and Lightbody(2004); Zhu *et.al.*, (2005); Shih *et.al.*, (2006); Johansson *et.al.*, (2007); Gonza´lez(2008), Shaw and Grant(2010); Johansson and Winroth(2010); Diabat and Govindan(2011); Hitchcock(2012); Laosirihongthong *et.al.*, (2013); Palsson(2013); Niemela-Nyrhinen (2013); Frizelle(2014); Lo(2014); To and Tang(2014)
xi	Supplier Development Activities	Robson and Rawnsley (2001); Rudberg *et.al.*, (2002); Barratt(2003); Wagner(2006b); Soosay *et.al.*, (2008); Routroy and Pradhan (2013); Finne(2013)
xii	Efforts for Supply Chain Management	Yu *et.al.*, (2001); Batt(2003); Welker *et.al.*, (2008); Melo *et.al.*, (2009); Ding *et.al.*, (2011).
xiii	Performance Measurement	As given in Table 2.3.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

As mentioned in Chapter-1, major objective of the research is to study on impact of best supply chain management practices on the performance of organizations in India. To achieve these objectives, research identifies major supply chain attribute and practices while forming supply chain strategy, problems faced by organizations during implementation of supply chain management and risks organizations feel while working in supply chain. In addition to this, present research also identifies the importance of different attributes for improving supply chain management practices in supply chain organizations, motivations for implementing SCM, investment priorities for SCM success, hindrances in implementing SCM practices, information sharing Issues, suppliers and customers, customer satisfaction, capabilities, product design and development activates, supplier selection criteria, environmental issues, supplier development activities, efforts for supply chain management used and critical success attributes for implementation of SCM in organizations. Finally it will try to analyze the effect of different SCM issues on performance under criterions such as sales growth, profit growth, return on investment, deliver on time, responsiveness, reduction in lead time, reduction in inventory cost, reduction in manufacturing cost and reduction in product rejection rate. For studying these issues, input data were collected from industry by questionnaire based survey. Detailed methodology adopted for analysing industry data is explained in present chapter.

In this chapter, first research methodology and its justification will be described. After this, development of questionnaire and its administration will be discussed. In following sections, description of research methodology and statistical tools being used for analysis of data and finally framework for measuring overall performance is also discussed.

3.2 RESEARCH METHODOLOGY

In this study, empirical research methodology is used to analyze various issues related with supply chain management practices on the performance of organizations in India. Adopted research methodology is given in Figure 3.1.

On the basis of literature review and gap analysis, issues for present study are identified. After identification of these issues, preliminary framework for developing the questionnaire is prepared. Questionnaire was finalized on the basis of pilot survey of fifty organizations, discussion with academicians and professionals from industries during visits and inputs from literature. Questionnaire was mailed to about one thousand and five hundred organizations of different categories, sectors (Plastics and Chemicals, Electronics, Automotive, Light Engineering, Any other), and regions for collecting responses. Response was received from 257 organizations. It gives 17% response rate. Data collected from survey are analysed by using various statistical tools such as one sample t-test, two sample t-tests, and correlation and regression analysis. For statistical testing SPSS (Version.17.0) software is used. For analyzing various issues of SCM in depth, two case studies from different sectors are carried out.

On the basis of the results from survey and discussion with experts from industry and academics, different factors of supply chain management practices are identified.

After this enablers for effective SCM, were identified from literature, then Interpretive structural modelling (ISM) has been performed to develop a structural framework for effective SCM in organizations. Finally all results from different approaches were synthesised.

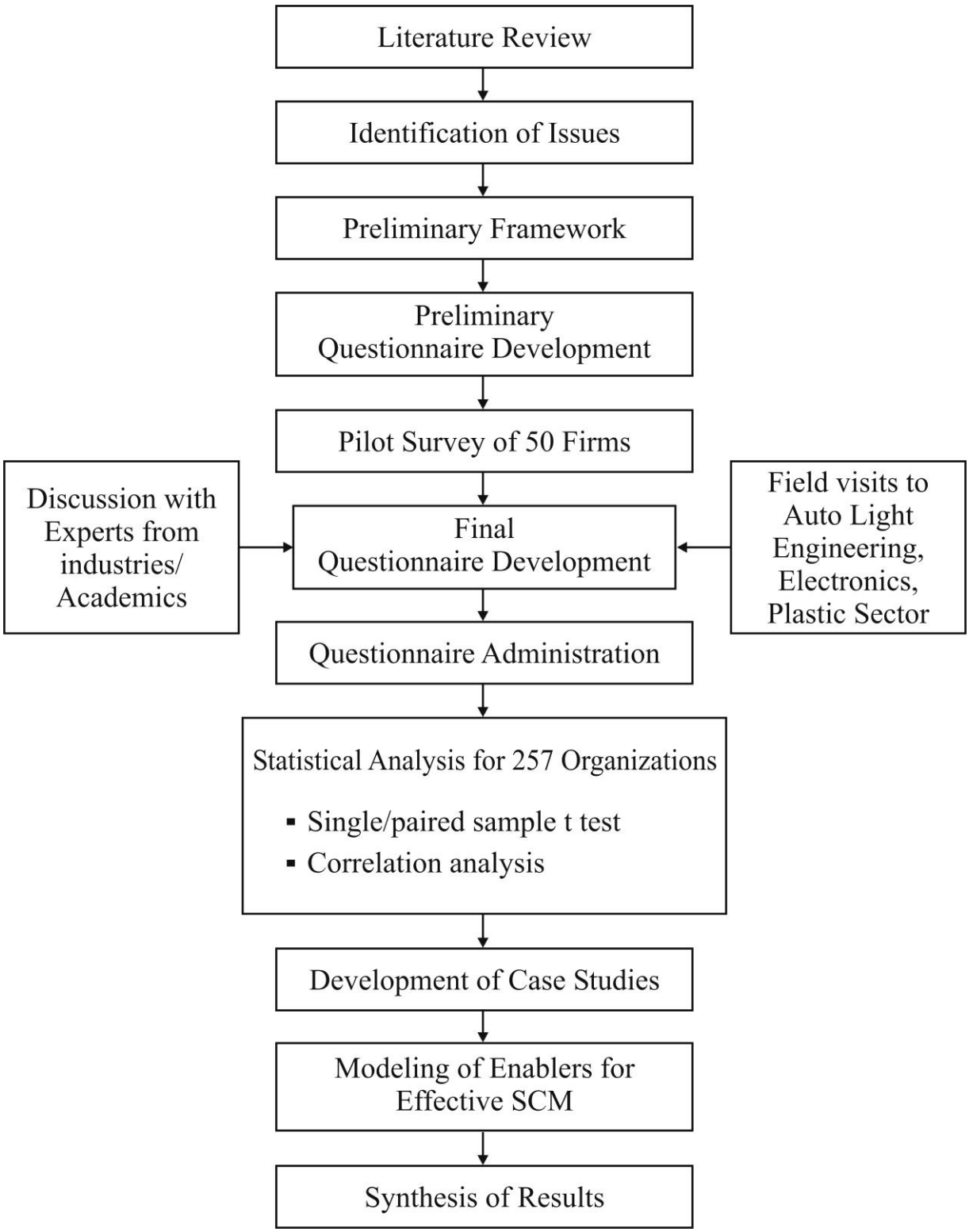


Fig 3.1: Flow Chart for Research Methodology.

3.3 JUSTIFICATION OF CASE RESEARCH

Case research has effective methodology for research in fast changing market. According to Lewis (1998), to cope with the growing frequency and magnitude of changes in technology and managerial methods, operations management researchers have been calling for greater employment of field based research methods. There are several challenges in conducting case research: it is time consuming, it needs skilled interviewers, and care is needed in drawing generalisable conclusions from a limited set of cases and in ensuring rigorous research. Despite this, the results of case research can have very high impact. Unconstrained by the rigid limits of questionnaires and models, it can lead to new and creative insights, development of new theory and have high validity with practitioners-the ultimate user of research (Voss *et. al.,* 2002). Meredith (1998) cites following advantages of conducting case research.

- The phenomenon can be studied in its natural setting and meaningful, relevant theory can be generated from the understanding gained through observing actual practice.
- The case method allows the questions of why, what and how, to be answered with a relatively full understanding of the nature and complexity of the complete phenomenon.
- The case method lends itself to early, exploratory investigations where the variables are still unknown and the phenomenon not at all understood.

Various research have used case study for their research (for example: Taylor *et. al.,* (2004), Al-Najjar and Alsyouf (2004), Singh *et. al.,* (2004), Gunasekaran *et.al.,* (2001), Dangayach and Deshmukh, (2001), Gunasekaran and Cecile, (1998). For present research SAP-LAP approach has been used. It is discussed in detail in chapter five.

3.4 DEVELOPMENT OF QUESTIONNAIR

On the basis of discussions with industry professionals and literature review, preliminary questionnaire was developed for survey of fifty organizations. Final questionnaire is framed on the basis of information obtained from survey, interactions

with industry professionals and experts from academic institutions. The questionnaire contained two sections, i.e. section A and section B. Section A dealt with general information about organization, kind of supply chain management and sections B focused on identification of best supply chain management practices and effect of best supply chain management practices on the performance of organizations. This section has got thirteen questions (A to M). It contained guidelines for responses and terminology used in questionnaire to avoid unknown bias. The final questionnaire is presented as Annexure A1. Brief about various questions of survey are given in Table 3.l.

In this study, executives were asked to rate the intensity of each factor for their respective organization on a five point Likert scale (1-Very low, 5-Very high). Reason for adopting this interval scale is that it can be ranked. Interval scale indicates the relative amount of trait. Interval measures may be added or subtracted and compatible with various statistics (Flynn *et. al.*, 1990)

Table 3.1: Brief of Survey Questions.

S.No.	Question No.	Variable	No. of Items
1.	A	Motivations	10
2.	B	Investment areas	10
3.	C	Hindrances in implementing supply chain management	11
4.	D	Supply Chain Management Practices	14
5.	E	Information sharing	07
6.	F	Customer satisfaction	09
7.	G	Capabilities	09
8.	H	Product design and development activates	09

9.	I	Supplier selection criteria	08
10.	J	Environmental issues	07
11.	K	Supplier Development Activities	09
12.	L	Efforts for supply chain management	08
13.	M	Performance Measure	09

3.5. VALIDITY AND RELIABILITY

Flynn *et. al.*, (1990) and Malhotra and Grover, (1998) identified some norms for survey research.These norms were followed for present study also.This study is exploratory cross sectional in nature since data collection is done at one point of time and it is focussed on analyzing issues of competitiveness. The unit of analysis in this study is an organization. As suggested by Malhotra and Grover, (1998) to reduce sampling error, random sample of organizations were drawn and response rate was 20%. It is important that the questionnaire instrument be valid and reliable. The validity measures two things. First, does the item/scale truly measure what it is supposed to measure? Second, does it measure nothing else? Reliability measures the extent to which a questionnaire repeatedly administered to the same people will yield the same results. Thus it measures the ability to replicate the study (Flynn *et. al.*, 1990).

(a) **Content Validity**

Content analysis is a judgment by experts, of the extent to which a scale truly measures the concept that it intended to measure (Flynn *et. al.*, 1990). To assess the content validity a "dry run" was made and few questionnaires were pilot tested with leading practitioners, consultants and academicians. Based on their feedback, final questionnaire has been evolved.

(b) Construct Validity

Construct validity measures whether a scale is an appropriate operational definition of a concept (Flynn *et. al.*, 1990). Most of the contents of the

questionnaire were taken from the literature (Noble, 1997, Morita and Flynn, 1997, Dangyach and Deshmukh, 2001, Gordan and Sohal, 2001, Chaston *et. al.*, 2001 etc.). These contents are tested for construct validity.

(c) Reliability/Internal consistency

Inter item analysis is used to check the scales for internal consistency or reliability Cronbach's coefficient alpha is calculated for each scale, as recommended for empirical research in operation management (Flynn *et.al.*, 1990, Malhotra and Grover 1998). SPSS software is used for calculation of Cronbach's alpha. Cronbach's alpha values of each item are calculated 256 responses received. Items having Cronbach's alpha less than 0.5 were excluded. According to Nunally (1978), Cronbach's alpha values more than 0.5 are considered adequate for an exploratory study like this.

3.6 SURVEY ADMINISTRATION

About one thousand five hundred organizations from different sectors, categories and regions were contacted for collecting responses. These organizations were selected from various directories available at Confederation of Indian Industries (CII), Auto Component Manufacturers Association (ACMA) of India, Federation of Indian Chambers of Commerce and Industry (FICCI) and Department of Industries, Government of India. A covering letter, which describes the objectives of the research and guidelines for completing the questionnaire, was enclosed. Reminder through e-mail, phone calls and postal service was sent to non-respondents three weeks after the questionnaires were mailed. Two hundred fifty one responses were obtained. Detail profile of responding organizations is given in Table 3.2. Out of 257 respondents, 80% belongs to SMEs and remaining 20% were LSEs. Majority of respondents were from auto component, plastic and electronics sector. Figure 3.2 shows graphical representation of respondent's profile.

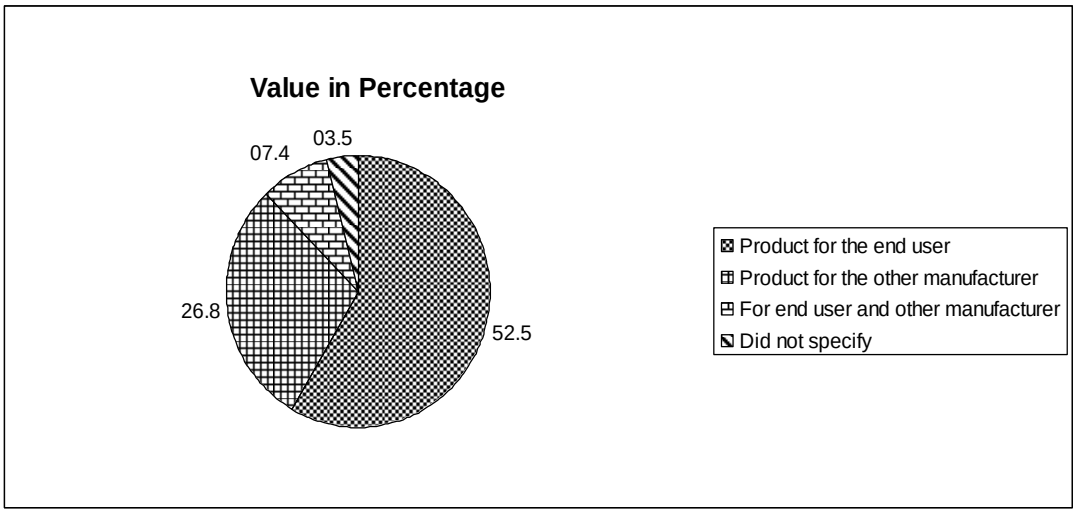
Table 3.2: Profile of Responding Organizations

Category	Number	Percentage
Product Nature		
Product for the end user	135	52.5
Product for the other manufacturer	69	26.8
For end user and other manufacturer	19	7.4
Did not specify	09	3.5
Sector		
Plastic and chemicals	15	5.9
Electronics	22	8.7
Automotive	88	34.8
Light engineering	71	28.1
Others	57	22.5
Total	253	100.0
Kind of Supply Chain(SC)		
Responsive SC	99	39.8
Efficient SC	75	30.1
Strategic SC	50	20.1
Risk sharing SC	12	4.8
Agile SC	12	4.8
Total	249	100.0
Missing System	8	3.1
Total	257	100.0
Sales Turnover (Rs Carore)		
Less than 10	12	5.5

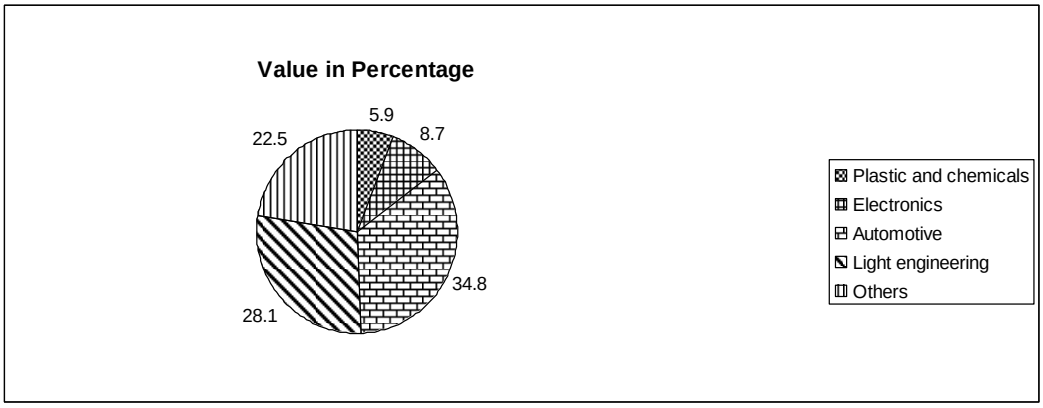
10-50	17	7.8
50-100	07	3.3
100-500	34	15.7
More than 500	146	67.8
Total	217	100
Missing System	40	15.6
Total	257	100
Number of Employees		
Less than 50	14	5.7
50-200	15	6.1
200-300	22	9.2
300-400	6	2.4
More than 400	188	76.7
Total	245	100.0
Missing System	12	4.7
Total	257	100

*Some of the firms are overlapping and cover more than one sector

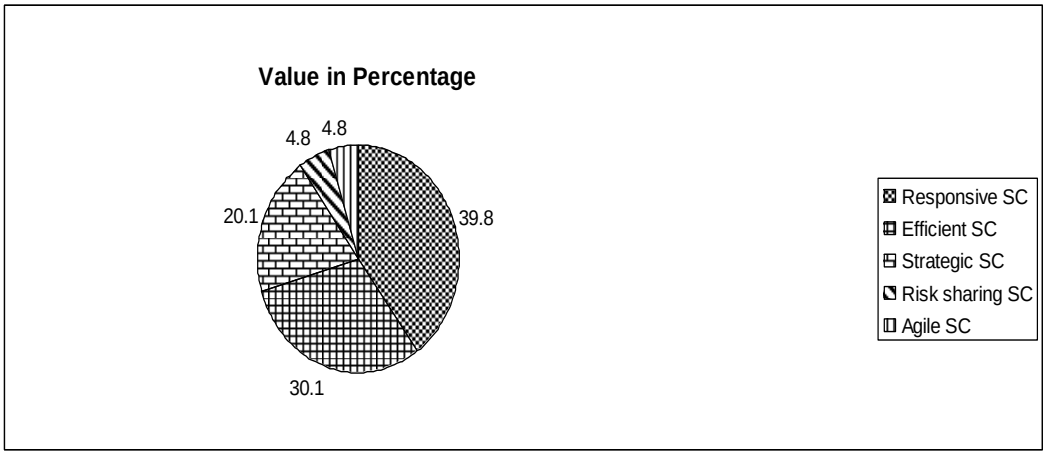
** One US$= 56 Rs



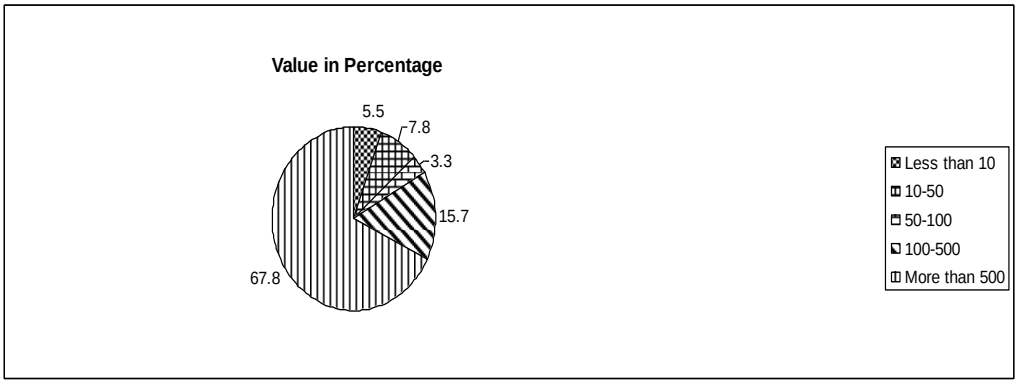
(a) Product nature



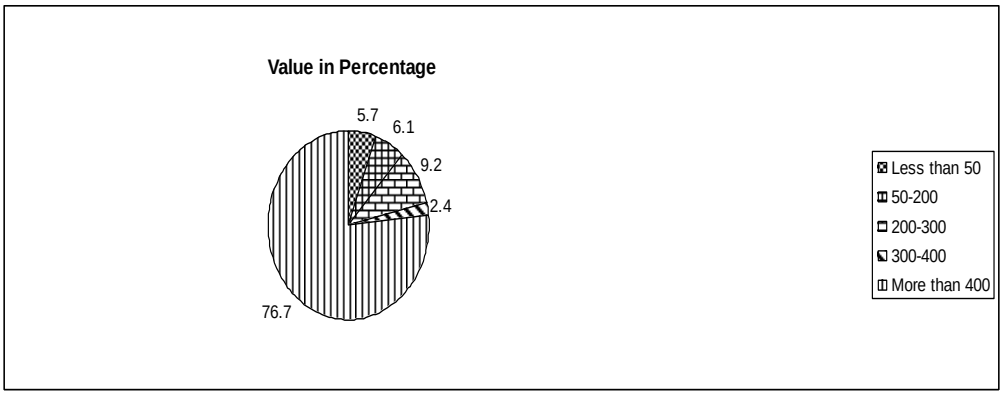
(b) Sector



(c) Kind of supply chain



(d) Sales turnover



(e) Number of Employees

Figure 3.2. Profile of responding organizations.

3.7 STATISTICAL TOOLS USED FOR ANALYSIS OF DATA

Both quantitative and qualitative tools are used in this research for analysis of data. Quantitative tools include descriptive statistics, reliability analysis, and correlation analysis. Results were obtained using SPSS (version 17). Qualitative tools are based on development of case studies.

3.7.1 Descriptive Statistic

Descriptive statistics include mean, standard deviation, standard error etc. This is used for computing sector wise and overall statistics for various issues of supply chain management practices. For this purpose, different types of t- tests are used. Different types of t- tests used in this study are one sample t- test, independent sample t- test and paired sample t- tests.

3.7.2 Correlation Analysis

Correlation analysis is performed to assess the correlation between supply chain management practices and the performance measure of organization. The Pearson correlation coefficient (r) is calculated. The Pearson correlation coefficient describes the extent to which an increase or decrease in one variable is accompanied by a corresponding increase or decrease in other variable (Sharma, 1996).

3.7.3 Regression Analysis

Regression relates a factor or factors to a specific outcome (Sharma, 1996). For each performance factor, the technique of least squares was used to estimate the simple regression coefficient (bi) and multiple regression coefficients.

3.8 CONCLUDING REMARKS

The importance of supply chain management and practices of supply chain has been growing among Indian organizations after globalization of market. The supply chain management issues related with Indian organizations have been captured through questionnaire based survey methodology. The data analysis has been done with the help of statistical tools such as t- test, correlation analysis. For depth understanding of supply chain management practical issues, case study approach has been adopted. For modelling of supply chain management enablers, interpretive structural modelling approach has been considered. The next chapter will focus on descriptive analysis of various issues related with supply chain management issues in Indian organizations.

CHAPTER 4

OBSERVATION AND ANALYSIS OF SUPPLY CHAIN MANAGEMENT PRACTICES

4.1 INTRODUCTION

Supply chain is a linked set of resources and processes that begins with the sourcing of raw materials and extends to the delivery of end items to the final customer. In essence, Supply chain management integrates supply and demand management within and across companies. Organization can compete in the global market only if its supply chain is competitive.

In this chapter survey responses received from different organizations on different supply chain issues have been analyzed with the help of SPSS (version 17.0) software. Objectives of the study have been already identified in Chapter 1, but for clarity these objectives are once again reproduced below:

- To study different issues of SCM such as information sharing among different members, Motivation for SCM implementation and major hindrances in it, Product design and development, Environmental issues, Performance measures etc.
- Identification of best SCM practices followed by Indian organizations.
- Identification of investment priorities for successful SCM.
- To find supplier selection criteria and supplier development activities.
- To develop case studies for validating the empirical findings.
- To identify enablers for effective SCM and develop a structural model for successful implementation.

Descriptive analysis for first four objectives will be done in this chapter. Remaining two objectives discussed separately in next two chapters i.e. Development of Case Studies (Chapter 5) and Interpretive structural Modelling will be done in Chapter 6. In this chapter results have been derived through statistical tests such as reliability

analysis, one sample and two sample t-tests, correlation analysis. For conducting the statistical tests, SPSS (version 17.0) software is used.

In this study, attempt has been made following the principles of Miles and Huberman (1984), which state that analysis of data requires three kinds of activity:

1. Data Reduction- The process of organizing, selecting and transforming raw data in such a way that inferences may be drawn and corroborated.
2. Data Display- A methodological and organized marshalling together of information which then makes itself amenable to the drawing of conclusions.
3. Conclusion Drawing- Taking cognizance of regularities and patterns and the particular configuration of dimensions, on the basis of which meaningful theories and propositions can be postulated.

4.2 DESCRIPTIVE ANALYSIS

Descriptive analysis is done to find mean, standard deviation, standard error etc. This is used to find overall statistics for various issues of best supply chain management (SCM) practices. Before doing this analysis reliability analysis is performed for each scales /question used in the questionnaire. Inter item analysis is used to check the scales for internal consistency or reliability. Cronbach's coefficient analysis alpha is calculated for each scale, as recommended for empirical research. It is an integral part of any survey research. The results of reliability analysis for all issues of questionnaire are shown in table 4.1.

Reliability analysis of data shows that Cronbach's alpha value for all variables is more than minimum acceptable value of 0.5 (Nunnally, 1978), which indicates high level of internal consistency among items. In the following sections, descriptive analysis and correlation analysis of different issues such as motivations for implementing SCM, investment priorities for SCM success, hindrances in implementing SCM practices, supply chain management practices, information sharing, customer satisfaction, supplier selection criteria, supplier development activities, efforts for supply chain management and performance analysis will be done.

Table 4.1: Issues of Survey Questionnaire.

S.N.	Q.N.	Issues for study	No of items	Cronbach' s alpha
i	A	Motivations for Implementing SCM	10	0.697
ii	B	Investment Priorities for SCM Success	10	0.763
iii	C	Hindrances in Implementing SCM Practices	11	0.889
iv	D	Supply Chain Management Practices	14	0.828
v	E	Information Sharing Issues, Suppliers and Customers	07	0.767
vi	F	Customer Satisfaction	09	0.911
vii	G	Capabilities	09	0.814
viii	H	Product design and Development Activates	09	0.857
ix	I	Supplier Selection Criteria	08	0.773
x	J	Environmental Issues	07	0.847
xi	K	Supplier Development Activities	09	0.839
xii	L	Efforts for Supply Chain Management	08	0.721
xiii	M	Performance Measurement	09	0.828

4.2.1 Motivations for Implementing Supply Chain Management

In this study, on the basis of expert's opinion and literature review, ten factors of motivation for implementing SCM, were identified. The respondents were asked to indicate the degree of importance for these motivations on five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). In table 4.2 statistical results (i.e. mean, standard deviation, correlation with performance) of motivation for implementing supply chain management are shown. These results are also shown in Figure 4.1 in graphical form. The Cronbach's alpha for ten item construct is 0.697, which is higher than the minimum requirement of 0.5.

On the basis of survey results it is observed that major motivation factors for SCM implementation are reduction of delivery lead time, reduction of product cost and reduction of inventory cost.

It is also observed that except reducing number of suppliers and sharing of risk with suppliers and customers, all other factors have significant correlation with performance. Reduction of product cost, reduction of delivery lead time and accurate forecasting are most important factors in terms of correlation with performance. Therefore organizations should give more focus on product cost reduction, delivery lead time reduction and accurate forecasting of demand.

Table: 4.2 Factors of Motivation for Implementing SCM.

S.N.	Motivations for implementing supply chain management	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Reduction of product cost	3.94(2)	1.012	0.362**
ii	Reducing delivery lead time	3.96(1)	0.869	0.360**
iii	Buying form JIT suppliers	3.19(9)	1.083	0.272**
iv	Reducing inventory cost	3.88(3)	0.947	0.272**
v	Reducing product rejection rate	3.62(7)	1.071	0.305**
vi	Improving flexibility of production system	3.41(8)	1.065	0.248**
vii	To reduce number of suppliers	2.94(10)	0.962	0.113
viii	Accurate demand forecasting	3.74(5)	1.025	0.354**
ix	Meet changing customer demands	3.88(4)	1.026	0.266**
x	Share the risk with suppliers and customers	3.67(6)	1.013	0.105

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

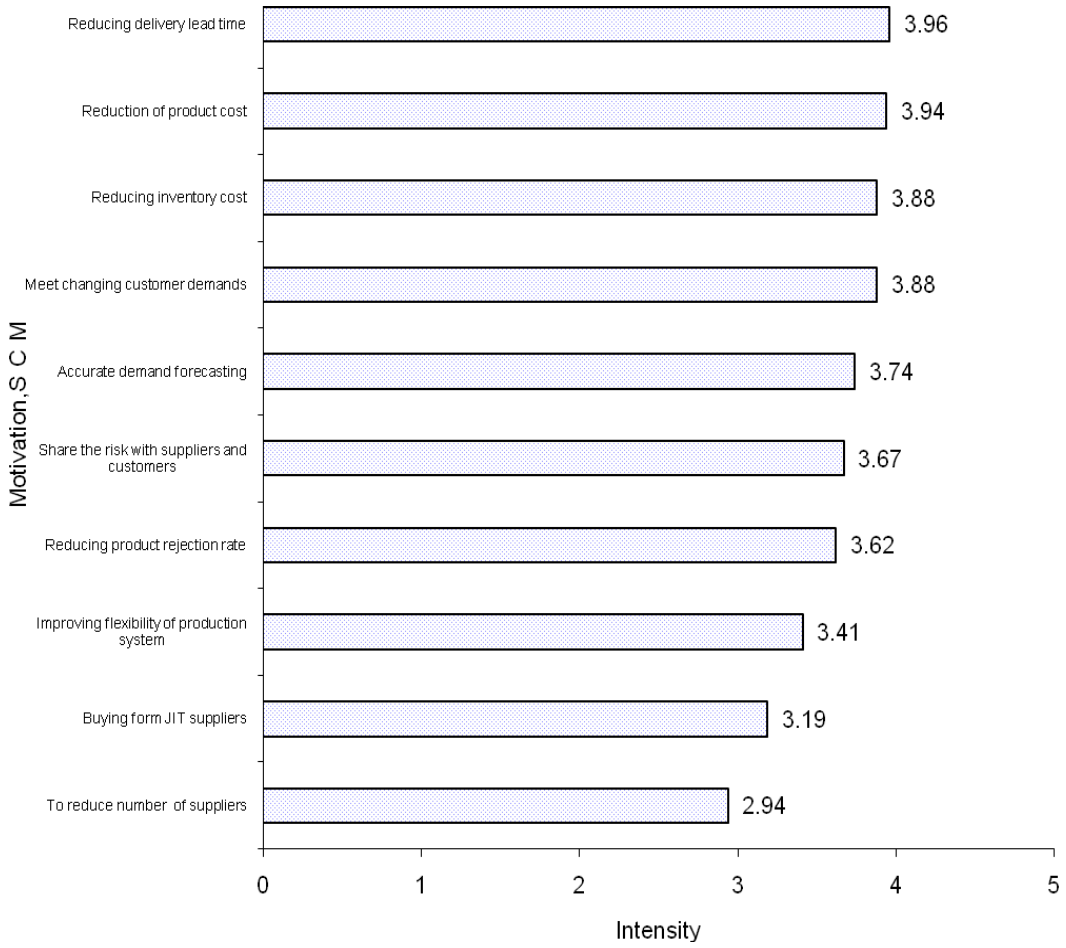


Figure 4.1: Motivations for Implementing Supply Chain Management.

4.2.2 Investment Priorities for Supply Chain Management Success

On the basis of literature review, ten investment priorities were identified for this study. The respondents were asked to indicate the degree of importance given by respective organization to ten priorities while making investment, on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). Focus on these Priorities will decide effectiveness of strategy development. It is expected that, organizations will decide their investment priorities on the basis of their supply chain strategy. In table 4.3 statistical results (i.e. mean, standard deviation, correlation with performance) of investment priorities for supply chain management success are shown. These results are also shown in Figure 4.2 in graphical form. On the basis of survey results it is observed that major investment priorities for supply chain

management success are quality management, quick response and sales forecasting and planning.

It is also observed that all the ten factors of investment priorities for supply chain management success have significant correlation with performance. Information technology applications, sales forecasting and planning and quick response are most important factors in terms of correlation with performance. Therefore organizations should give more focus on Information technology applications, sales forecasting and planning and quick response.

Table: 4.3 Investment Priorities for Supply Chain Management Success.

S. No.	Investment Priorities for Supply Chain Management Success	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Information technology applications	3.87(5)	1.072	0.413**
ii	CAD/CAM	2.86 (10)	1.192	0.228**
iii	Supplier development	3.68(6)	1.004	0.253**
iv	Research and Development	3.63(9)	1.093	0.262**
v	Quality management	4.11(1)	0.861	0.311**
vi	Quick response	4.11(2)	0.873	0.354**
vii	Flexible manufacturing system (FMS)	3.67(7)	0.984	0.236**
viii	Sales forecasting and planning	3.94(3)	0.917	0.377**
ix	Market developments	3.88(4)	0.848	0.319**
x	Human resources development	3.66(8)	0.935	0.179**

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

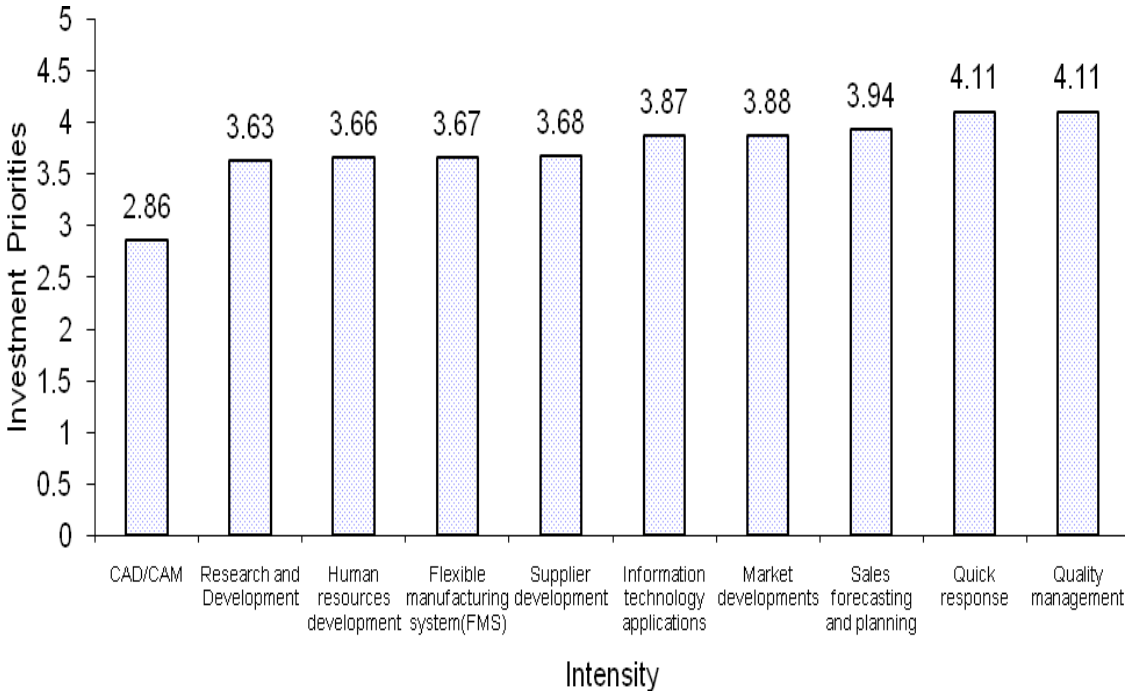


Figure 4.2: Investment Priorities for SCM Success.

4.2.3 Hindrances in Implementing Supply Chain Management

On the basis of literature review, eleven hindrances in implementing supply chain management were identified for this study. The respondents were asked to indicate the degree of importance given by respective organization to hindrances in implementing SCM, on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high).

On the basis of survey results it is observed that major hindrances in implementing SCM are location of suppliers and customers, poor demand forecast system and lack of coordination among supply chain members. Therefore organizations should give more focus on removing these hindrances. The Cronbach's alpha for eleven items construct is 0.889, which is higher than the minimum requirement of 0.5. In table 4.4 statistical results (i.e. mean, standard deviation) of hindrances in implementing SCM are shown. These results are also shown in Figure 4.3 in graphical form.

Table: 4.4 Hindrances in implementing SCM.

S.N.	Hindrances in implementing supply chain management	Mean (rank)	Standard Deviation
i	Lack of top management commitment	2.69(9)	0.984
ii	Lack of resources and funds	2.77(7)	0.947
iii	Poor transportation facilities	2.70(8)	0.896
iv	Lack of coordination among S C Members	2.95(3)	0.942
v	Lack of use of modern technologies	2.85(4)	0.971
vi	Poor demand forecast system	3.00(2)	0.992
vii	Lack of sharing information with suppliers	2.84(5)	0.932
viii	Poor quality of raw materials	2.49(11)	0.835
ix	Lack of sophisticated information system	2.78(6)	0.990
x	Lack of trust among S C Member	2.60(10)	0.883
xi	Location of suppliers and customers	3.11(1)	0.982

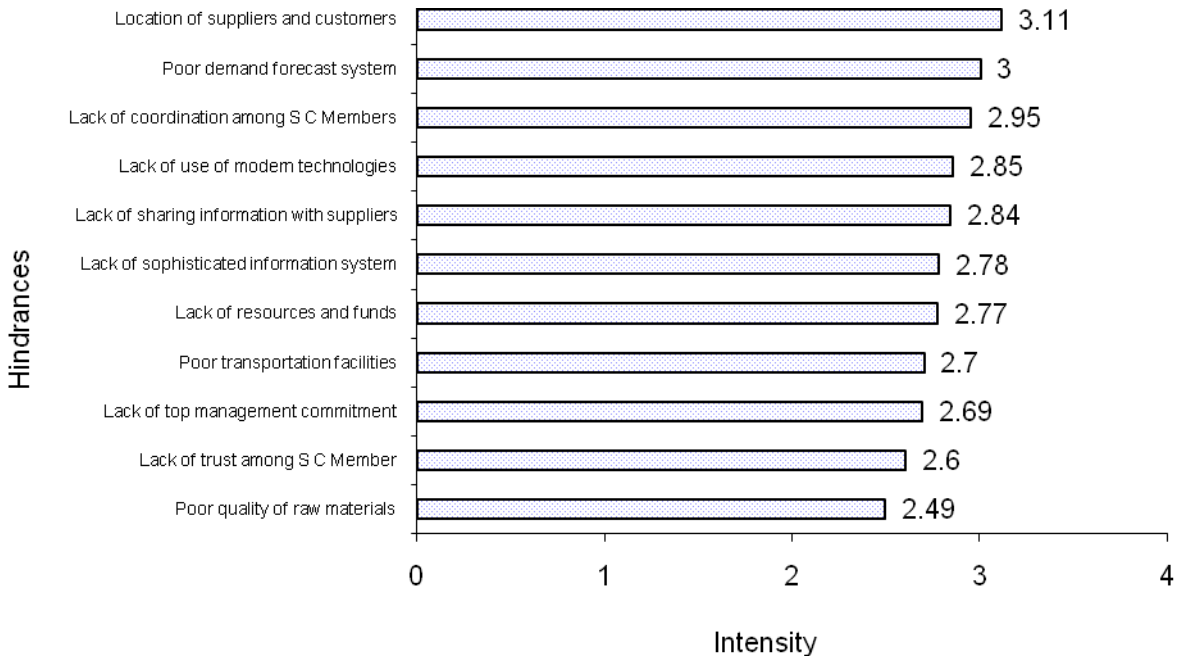


Figure 4.3: Hindrances in Implementing Supply Chain Management.

4.2.4 Supply Chain Management Practices

On the basis of literature review fourteen supply chain management practices were identified for this study. The respondents were asked to indicate the level of importance given for these fourteen supply chain management practices in their respective organizations on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). In table 4.5 statistical results (i.e. mean, standard deviation, correlation with performance) of supply chain management practices are shown. These results are also shown in Figure 4.4 in graphical form.

On the basis of survey results it is observed that major SCM practices are customer relationship management, enterprise resource planning (ERP), integrated inventory management and third party logistics (3PL).

It is also observed that except cross docking other thirteen supply chain management practices have significant correlation with performance. It implies that Indian organizations are not able to manage their logistics system effectively. Integrated inventory management, enterprise resource planning, vendor managed inventory and lead time management are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these supply chain management practices.

Table: 4.5 Supply Chain Management Practices.

S. No.	Supply Chain Management Practices	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Outsourcing	3.22(12)	0.981	0.159*
ii	Integrated inventory management	3.64(3)	0.923	0.396**
iii	Barcode/RFID/Other automatic identification tool	3.36(10)	0.954	0.286**
iv	Third party logistics(3PL)	3.63(4)	0.995	0.213**
v	Design for logistics	3.44(8)	0.916	0.233**
vi	Sharing of point of sale information with the partners	3.36(11)	0.945	0.166*

vii	Customer relationship management(CRM)	3.85(1)	1.040	0.244**
viii	Dynamic pricing	3.45(7)	0.893	0.232**
ix	Enterprise resource planning(ERP)	3.75(2)	0.891	0.396**
x	Collaborative planning and forecasting replenishment(CPFR)	3.54(6)	1.027	0.335**
xi	Vendor managed inventory(VMI)	3.42(9)	0.789	0.337**
xii	Lead time management	3.63(5)	0.953	0.355**
xiii	Bullwhip effect analysis	3.09(13)	1.091	0.225**
xiv	Cross docking	3.08(14)	0.873	0.039

**Correlation is significant at the 0.01 level (2-tailed),*Correlation is significant at the 0.05 level (2-tailed).

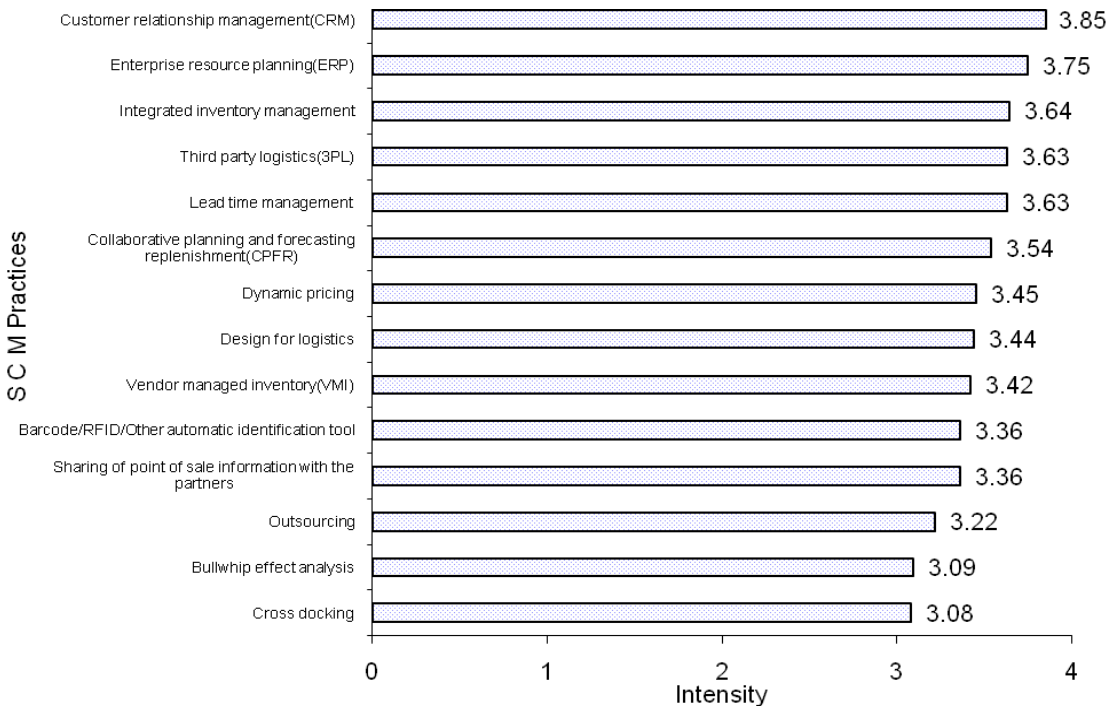


Figure 4.4: Level of applications of various supply chain management practices in organizations.

4.2.5 Customer Satisfaction

In today's highly connected world, maintaining good relations with customer is very important. One unhappy customer can use technology to air his grouse for spoiling other customers. The customer is very strong and can make or break corporations. In this context, present study has tried to analyze major strategies adopted by them to satisfy customers.

For analyzing customer satisfaction strategies nine attributes were identified by literature review. The respondents were asked to indicate the degree of importance on nine attributes of customer satisfaction on a five point Likert scale (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high). Cronbach's alpha for nine item construct is 0.911, which is higher than the minimum requirement of 0.5.

In table 4.6 statistical results (i.e. mean, standard deviation, correlation with performance) of customer satisfaction practices are shown. These results are also shown in Figure 4.5 in graphical form.

On the basis of survey results it is observed that major practices to improve customer satisfaction are commitment to continuous improvement in products and processes, successful resolution of customer complaints and interaction with customers to set reliability, responsiveness and other standards.

It is also observed that all the nine customer satisfaction practices have significant correlation with performance. Use of quality control techniques, employing routine follow-up procedures for customer inquiries or complaints and use of electronic data interchange are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these customer satisfaction practices.

Table: 4.6 Practices to Improve Customer Satisfaction.

S. No.	Practices to Improve Customer Satisfaction	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Use of quality control techniques	3.87 (6)	0.924	0.582**
ii	Commitment to continuous improvement in products and processes	4.22 (1)	0.771	0.489**
iii	Successful resolution of customer complaints	4.08 (2)	0.747	0.458**
iv	Entering into long term contract arrangement	3.94 (5)	0.914	0.539**
v	Being flexible to meet customer's changing needs	4.00 (4)	.762	0.423**
vi	Employing a customer satisfaction measurement system	3.87 (7)	0.889	0.371**
vii	Use of electronic data interchange(EDI)	3.53 (9)	1.170	0.545**
viii	Employing routine follow-up procedures for customer inquiries or complaints	3.68 (8)	0.947	0.558**
ix	Interaction with customers to set reliability, responsiveness and other standards	4.08 (3)	0.938	0.477**

**. Correlation is significant at the 0.01 level (2-tailed).

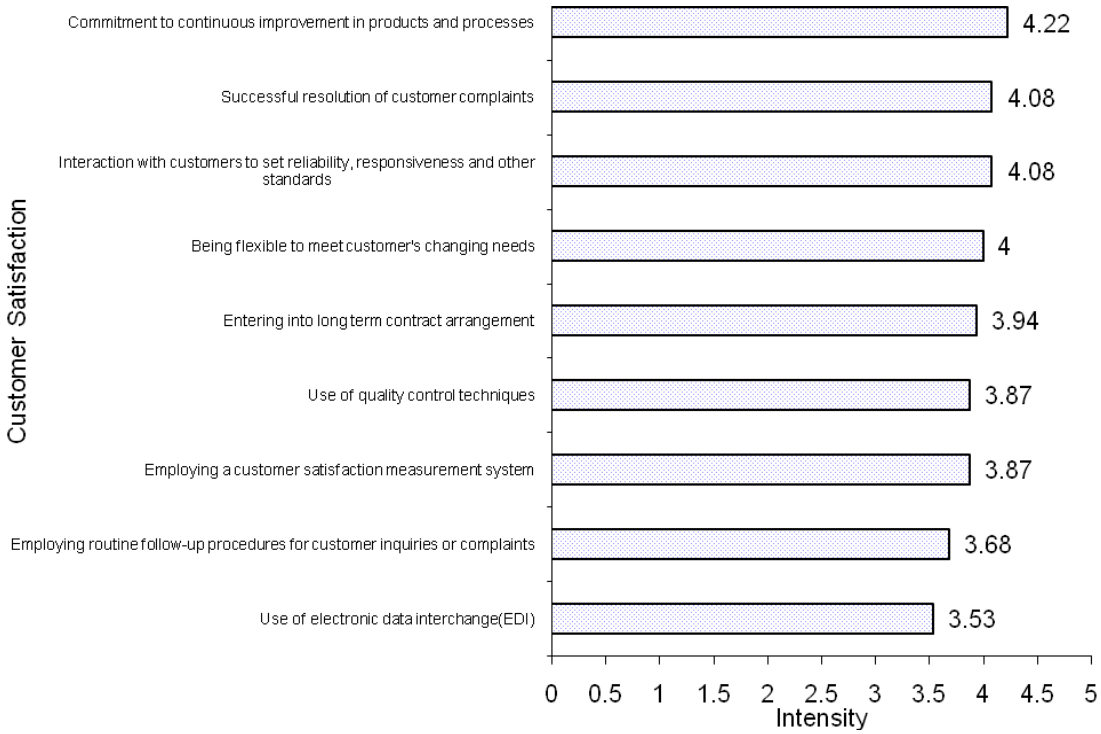


Figure 4.5 Practices to Improve Customer Satisfaction.

4.2.6 Capabilities for successful SCM

To achieve supply chain excellence, organizations need to develop certain capabilities. On the basis of literature review total nine capabilities were identified for this study. The respondents were asked to indicate the level of importance given for developing these capabilities in their respective organizations on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). Cronbach's alpha for nine item construct is 0.814, which is higher than the minimum requirement of 0.5. In table 4.7 statistical results (i.e. mean, standard deviation, correlation with performance) of capabilities are shown. These results are also shown in Figure 4.6 in graphical form.

On the basis of survey results it is observed that major capabilities for successful SCM are managing distribution network, delivery on time and quality control. It is also observed that all the nine capabilities for successful SCM have significant correlation with performance. Capability to control quality, product design and development flexibility and demand forecast accuracy are most important factors in

terms of correlation with performance. Therefore organizations should give more focus on these capabilities for successful SCM.

Table: 4.7 Capabilities for successful SCM.

S.N.	Capabilities for successful SCM	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Quality control capability in process	3.86(3)	0.881	0.477**
ii	The capability to forecast accurate demand	3.51(9)	0.896	0.405**
iii	On-time delivery capability	3.90(2)	0.854	0.322**
iv	The capability to deliver products quickly	3.78(4)	0.966	0.395**
v	After-sales service capability	3.61(8)	0.981	0.240**
vi	The capability to advertise and promote the product	3.70(6)	1.053	0.376**
vii	The capability to utilize innovative marketing technique	3.78(5)	0.876	0.403**
viii	The capability to manage distribution network	3.93(1)	0.968	0.379**
ix	Product design and development flexibility	3.69(7)	0.928	0 .460**

** Correlation is significant at the 0.01 level (2-tailed).

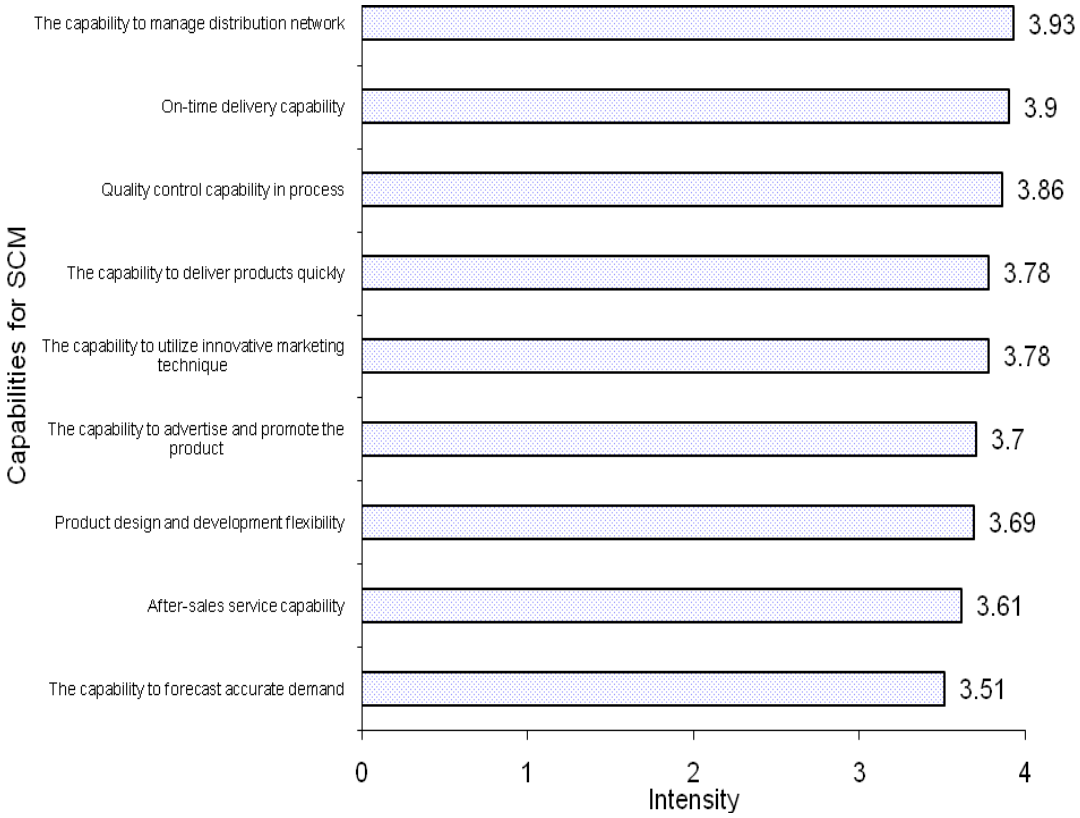


Figure 4.6: Capabilities for successful SCM.

4.2.7 Product design and development

Product design is an essential aspect of the process of innovation and new product development. It can be seen as important factor in improving competitiveness and organization performance. Product design is the process by which a product is developed while considering any requirements concerning function, use, manufacture and communication. This implies not only an act of creation but also the conjunction of technical, strategic and market aspects.

The respondents were asked to indicate the importance of nine product design and development factors in their respective organizations on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high) Cronbach's alpha for nine item construct is 0.857, which is higher than the minimum requirement of 0.5.

In table 4.8 statistical results (i.e. mean, standard deviation, correlation with performance) of product design and development attributes are shown. These results are also shown in Figure 4.7 in graphical form.

On the basis of survey results it is observed that major factors for product design and development are the use of value analysis/value engineering, standardization of component parts and involvement of customers. It is also observed that all the nine factors of product design and development have significant correlation with performance. The use of value analysis/value engineering, simplification of component parts and the use of concurrent engineering are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these factors for product design and development.

Table: 4.8 Product design and development attributes.

S. No.	Product design and development attributes	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Modular design of parts	3.29(6)	1.230	0.305**
ii	Early supplier involvement	3.19(8)	1.081	0.277**
iii	The use of concurrent engineering	3.34(5)	1.120	0.333**
iv	Simplification of component parts	3.41(4)	1.135	0.397**
v	Standardization of component parts	3.65(2)	1.101	0.345**
vi	The use of value analysis/value engineering	3.67(1)	1.104	0.402**
vii	Involvement of customers	3.43(3)	1.127	0.251**
viii	Use of CAD and rapid prototyping	3.22(7)	1.317	0.231**
ix	Postponement and customization	3.09(10)	1.100	0.174**

**. Correlation is significant at the 0.01 level (2-tailed).

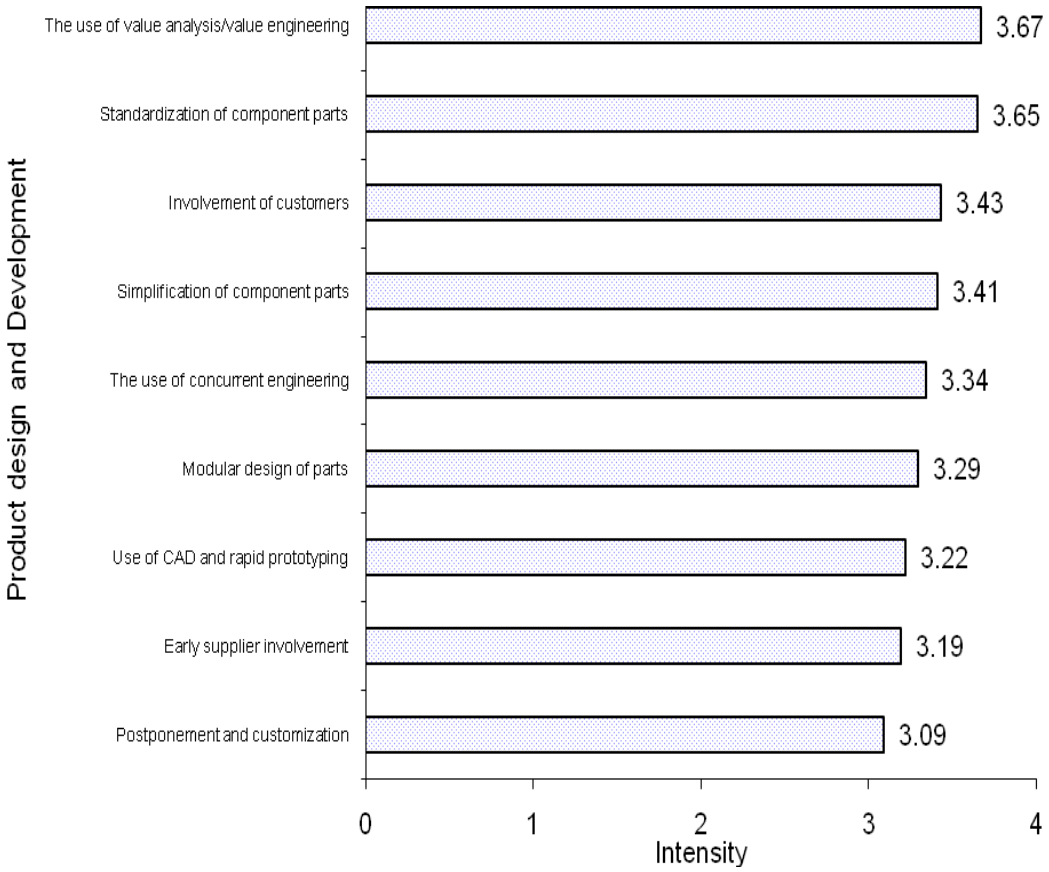


Figure 4.7: Product design and development attributes.

4.2.8 Issues of Information sharing with suppliers and customers

For analyzing information sharing with suppliers and customers by organizations, seven main areas were identified from literature. The respondents were asked to mention the level of information sharing in different areas on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high).

In table 4.9 statistical results (i.e. mean, standard deviation, correlation with performance) of information sharing issues are shown. These results are also shown in Figure 4.8 in graphical form.

On the basis of survey results, it is observed that major areas of information sharing with suppliers and customers are employing a company's production costs, order tracking and sales forecasting. It is also observed that all areas of information sharing except company's future plane have significant correlation with performance. Company's production costs, Order tracking, and sales forecasting are most important

factors in terms of correlation with performance. Therefore organizations should give more focus on these factors for information sharing with suppliers and customers.

Table: 4.9 Issues of information sharing with suppliers and customers.

S. No.	Information sharing issues with suppliers and customers	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Inventory status	3.59(4)	0.988	0.342**
ii	Order tracking	3.85(2)	0.943	0.389**
iii	Product development	3.54(6)	1.030	0.380**
iv	Sales forecasting	3.68(3)	0.953	0.368**
v	Company's future plans	3.57(5)	1.037	0.106
vi	Company’s production costs	3.87(1)	0.889	0.218**
vii	Technology know-how	3.14(7)	1.158	0.241**

**. Correlation is significant at the 0.01 level (2-tailed).

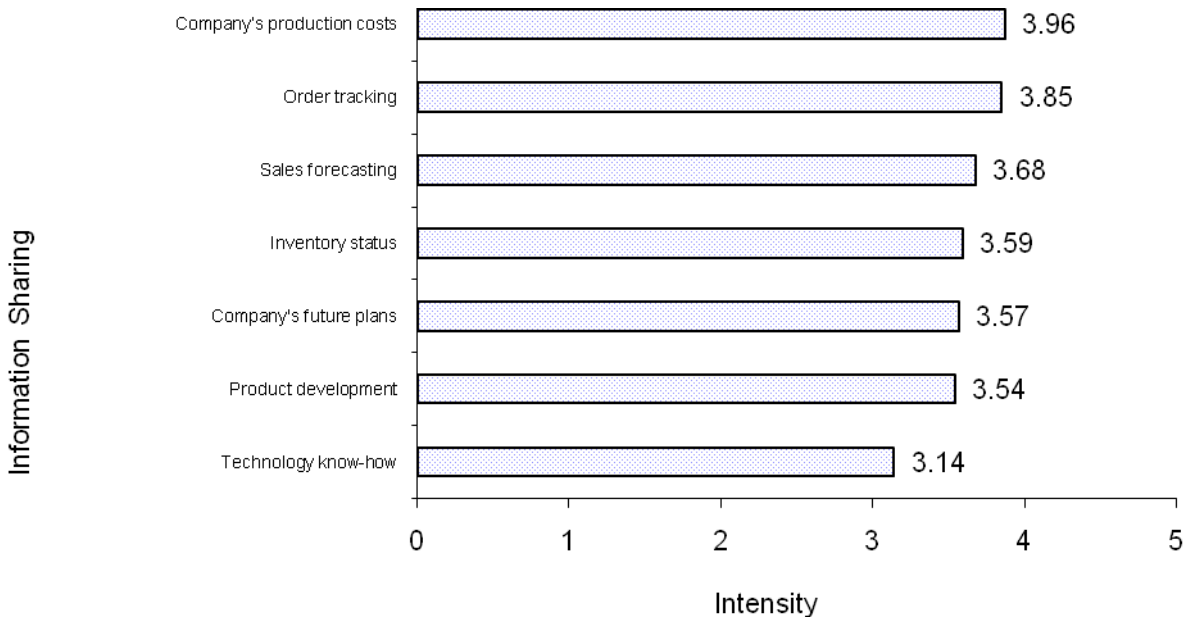


Figure 4.8: Issues of information sharing with suppliers and customers.

4.2.9 Supplier selection criteria

All suppliers can satisfy the buyer's requirements on quantity, quality, delivery, etc. The buyer only needs to make one decision, "which supplier is the best?" and "How much should be purchased from each selected supplier?"

Suppliers play an influential role to the overall success of the buying organization. Nowadays, supplier selection is firmly positioned as an alternative source for competitive advantage for organizations with regards to offering low cost, high quality products and services or achieving reliability to customers. As organizations become more dependent on suppliers, the direct and indirect consequences of poor decision making on supplier selection will become more critical. With the increasingly important role of suppliers in supply chain management, the selection process strategy has changed. Apart from scanning a series of pricelists only, qualitative, quantitative and environmental criteria have now been incorporated into the process.

Supplier selection is a multi-criteria decision making problem which includes both qualitative and quantitative factors. In order to select the best suppliers it is necessary to make a trade-off between these tangible and intangible factors some of which may

conflict. The majority of previous supplier selection techniques do not consider strategic perspective. Besides, uncertainty is one of the most important obstacles in supplier selection.

The respondents were asked to indicate the level of importance given for eight supplier selection criteria in their respective organizations on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). Cronbach's alpha for eight factors construct is 0.773, which is higher than the minimum requirement of 0.5. In table 4.10 statistical results (i.e. mean, standard deviation, correlation with performance) of supplier selection criteria are shown. These results are also shown in Figure 4.9 in graphical form.

On the basis of survey results it is observed that major criteria for supplier selection are quality of products, supplier delivery lead time and supplier's ability to cost saving initiatives. It is also observed that all the criteria of supplier selection have significant correlation with performance. Supplier delivery lead time, product rejection rates and suppliers ability to cost saving initiatives are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these factors for improving supplier's selection criteria.

Table: 4.10 Supplier selection criteria.

S.N.	Supplier Selection Criteria	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Quality of products	4.24(1)	0.902	0.455**
ii	Suppliers ability to cost reduction	3.97(3)	0.965	0.468**
iii	Supplier delivery lead times	4.09(2)	0.879	0.519**
iv	Supplier capacity	3.94(4)	0.832	0.424**
v	Volume flexibility	3.83(5)	0.863	0.308**
vi	Cultural compatibility	3.22(8)	1.211	0.167*

vii	Geographical proximity	3.62(7)	0.936	0.304**
viii	Product rejection rates	3.74(6)	1.062	0.498**

** Correlation is significant at the 0.01 level (2-tailed).

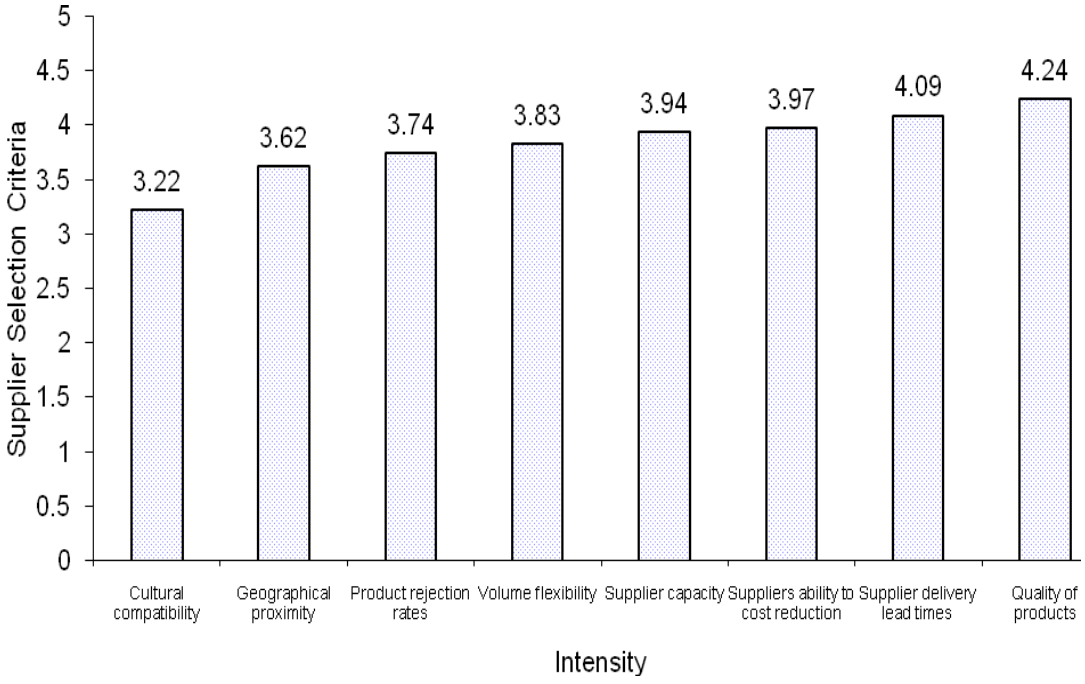


Figure 4.9: Supplier Selection Criteria.

4.2.10 Environmental Issues

Environmental issues encompass all efforts to minimize the negative environmental impact of manufacturing operations of an organization products or services throughout the entire life cycle. Environmental concerns in supply chain management deal with an assortment of issues, such as: Co-operation with customers for green packing, environmental audit for suppliers, ISO1400 certification, design for environment, design of products for reduced consumption of material/energy, design of products for recycle and reuse, buy back.

The International Organization for Standardization (ISO) has promulgated the international ISO-14000 series of environmental management standards, the most evident development being a complete "environmental management system." The

respondents were asked to indicate the level of importance of environmental factors in their respective organizations on a five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high). Cronbach's alpha for seven factor construct is 0.847, which is higher than the minimum requirement of 0.5.

In table 4.11 statistical results (i.e. mean, standard deviation, correlation with performance) of environmental issues are shown. These results are also shown in Figure 4.9 in graphical form.

On the basis of survey results, it is observed that major environmental issues are cooperation with customers for green packing, environmental audit for suppliers and ISO1400 certification. It is also observed that all the environmental factors have significant correlation with performance. Design of products for reduced consumption of material/energy, environmental audit for suppliers and ISO1400 certification are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these environmental factors.

Table: 4.11 Environmental Issues.

S. No.	Environmental Factors	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Buy back	2.82(7)	1.150	0.163*
ii	Design of products for recycle and reuse	3.37(6)	1.183	0.226**
iii	Design of products for reduced consumption of material/energy	3.60(3)	1.088	0.351**
iv	Design for environment	3.72(2)	1.091	0.270**
v	ISO1400 certification	3.81(1)	1.220	0.315**
vi	Environmental audit for suppliers	3.39(5)	1.203	0.327**

vii	Cooperation with customers for green packing	3.40(4)	1.206	0.255**

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

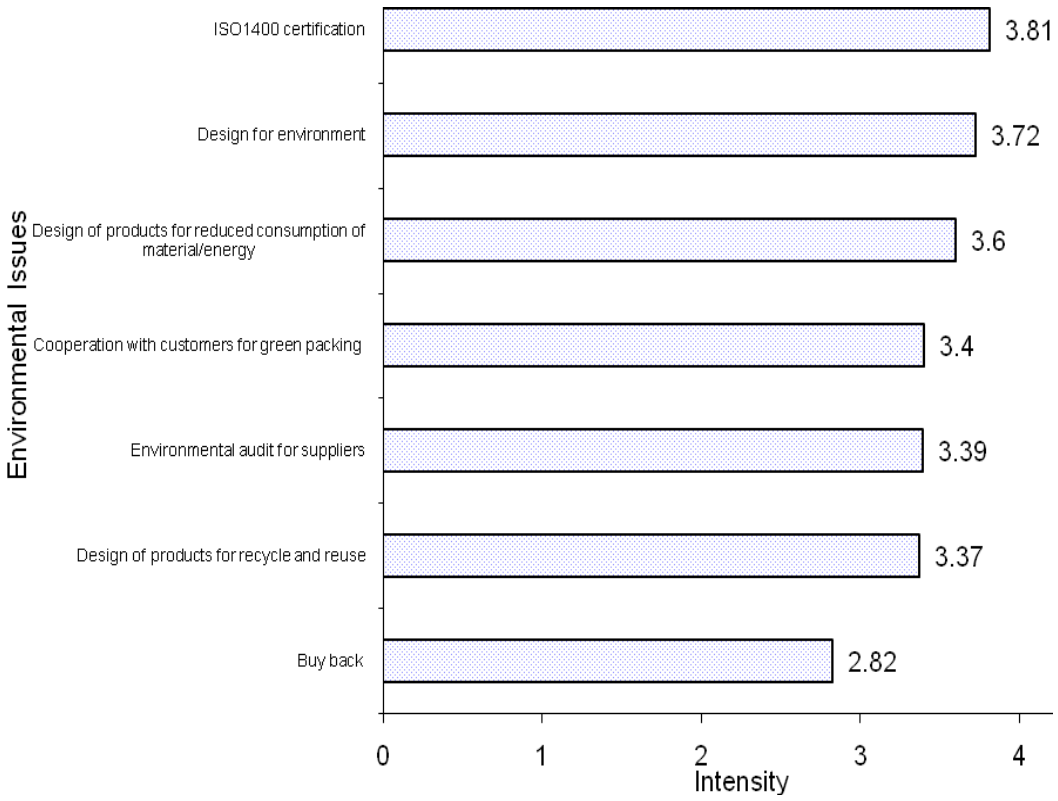


Figure 4.10: Environmental Issues.

4.2.11 Supplier Development Activities

Supplier development can be defined as any activity that a buying firm undertakes to improve a supplier's performance and capabilities to meet the buying firm's supply needs.

Buying organizations use a variety of activities to improve supplier performance such as: assessment of suppliers activities, supplier certification, providing incentives to suppliers for improvement, providing training to the staff of the supplier, technology support to supplier, financial support to supplier, managerial support in planning and

control of production system, close partnership with supplier for product design, collaborative planning for forecasting and replenishment.

The respondents were asked to indicate the level of importance of nine supplier development activities in their respective organizations on a five point Likert scale (1- Very low, 2- Low, 3-Medium, 4-High, 5-Very high). Cronbach's alpha for nine activities construct is 0.839, which is higher than the minimum requirement of 0.5.

In table 4.12 statistical results (i.e. mean, standard deviation, correlation with performance) of supplier development activities are shown. These results are also shown in Figure 4.11 in graphical form.

On the basis of survey results it is observed that major supplier development activities are supplier certification, assessment of supplier activities and managerial support in planning and control of production system. It is also observed that all the supplier development activities have significant correlation with performance. Managerial support in planning and control of production system, supplier certification and assessment of supplier activities are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these supplier development activities.

Table: 4.12 Supplier Development Activities.

S. No.	Supplier development activities	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Assessment of suppliers activities	3.63(2)	0.872	0.393**
ii	Supplier certification	3.64(1)	0.931	0.432**
iii	Providing incentives to suppliers for improvement	3.49(6)	0.941	0.274**

Iv	Providing training to the staff of the supplier	3.25(8)	1.069	0.220**
v	Technology support to supplier	3.30(7)	1.054	0.319**
vi	Financial support to supplier	2.99(9)	1.063	0.217**
vii	Managerial support in planning and control of production system	3.61(3)	0.953	0.435**
viii	Close partnership with supplier for product design	3.52(5)	0.973	0.355**
ix	Collaborative planning for forecasting and replenishment	3.60(4)	0.917	0.365**

**. Correlation is significant at the 0.01 level (2-tailed).

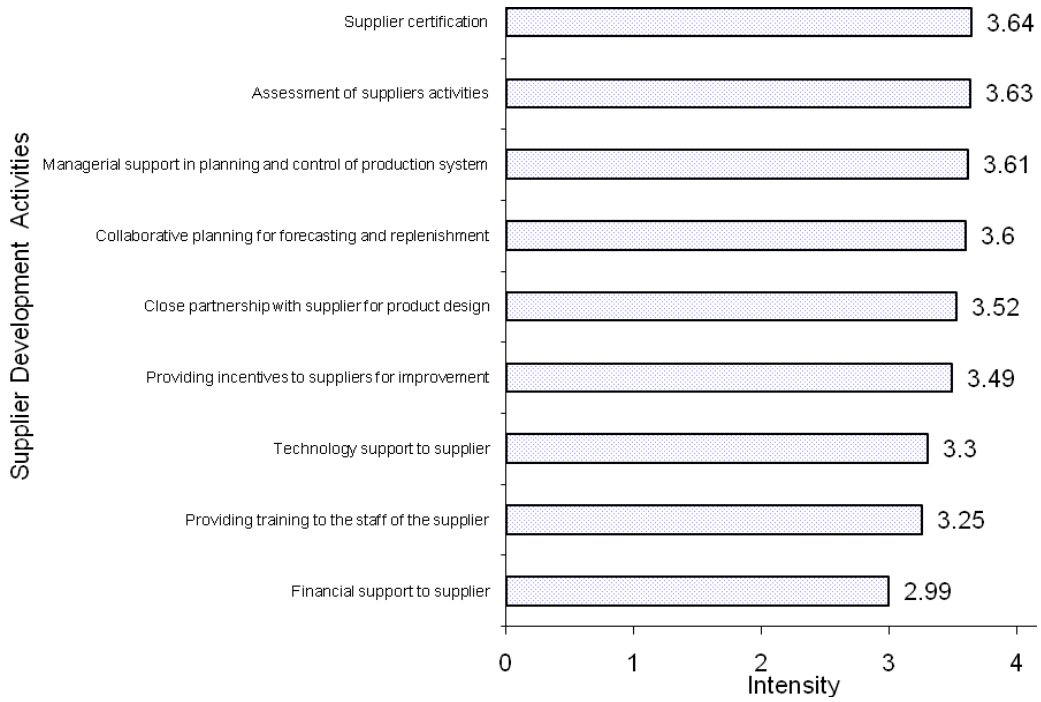


Figure 4.11: Supplier Development Activities.

4.2.12 Efforts for Supply Chain Management Implementation

In this study, on the basis of expert's opinion and literature review, eight initiatives for supply chain management implementation, were identified. The respondents were asked to indicate the level of importance of these initiatives on five point Likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high).

In table 4.13 statistical results (i.e. mean, standard deviation, correlation with performance) of supply chain management initiatives are shown. These results are also shown in Figure 4.12 in graphical form. On the basis of survey results it is observed that main initiatives toward supply chain management implementation are reducing response time across the supply chain, networking with suppliers and customers and development of transparency and information sharing mechanism.

It is also observed that all the initiatives for supply chain management implementation have significant correlation with performance. Development of cross functional teams and quality circles, reducing response time across the supply chain and to organize training programs are most important factors in terms of correlation with performance. Therefore organizations should give more focus on these initiatives for supply chain management implementation.

Table: 4.13 Supply Chain Management Initiatives.

S. No.	Supply chain management initiatives	Mean (rank)	Standard Deviation	Correlation with performance (Average)
i	Locating closer to your customers	3.58(6)	1.114	0.224**
ii	Locating suppliers closer to your firm	3.56(7)	0.952	0.205**
iii	Development of transparency and information sharing mechanism	3.80(3)	0.950	0.244**
iv	Networking with suppliers and customers	3.98(2)	0.812	0.321**

v	Integrate departments within the organization	3.77(4)	0.872	0.267**
vi	Development of cross functional teams and quality circles	3.73(5)	1.017	0.381**
vii	Reducing response time across the supply chain	4.09(1)	0.844	0.354**
viii	To organize training programs	3.52(8)	1.060	0.327**

**. Correlation is significant at the 0.01 level (2-tailed).

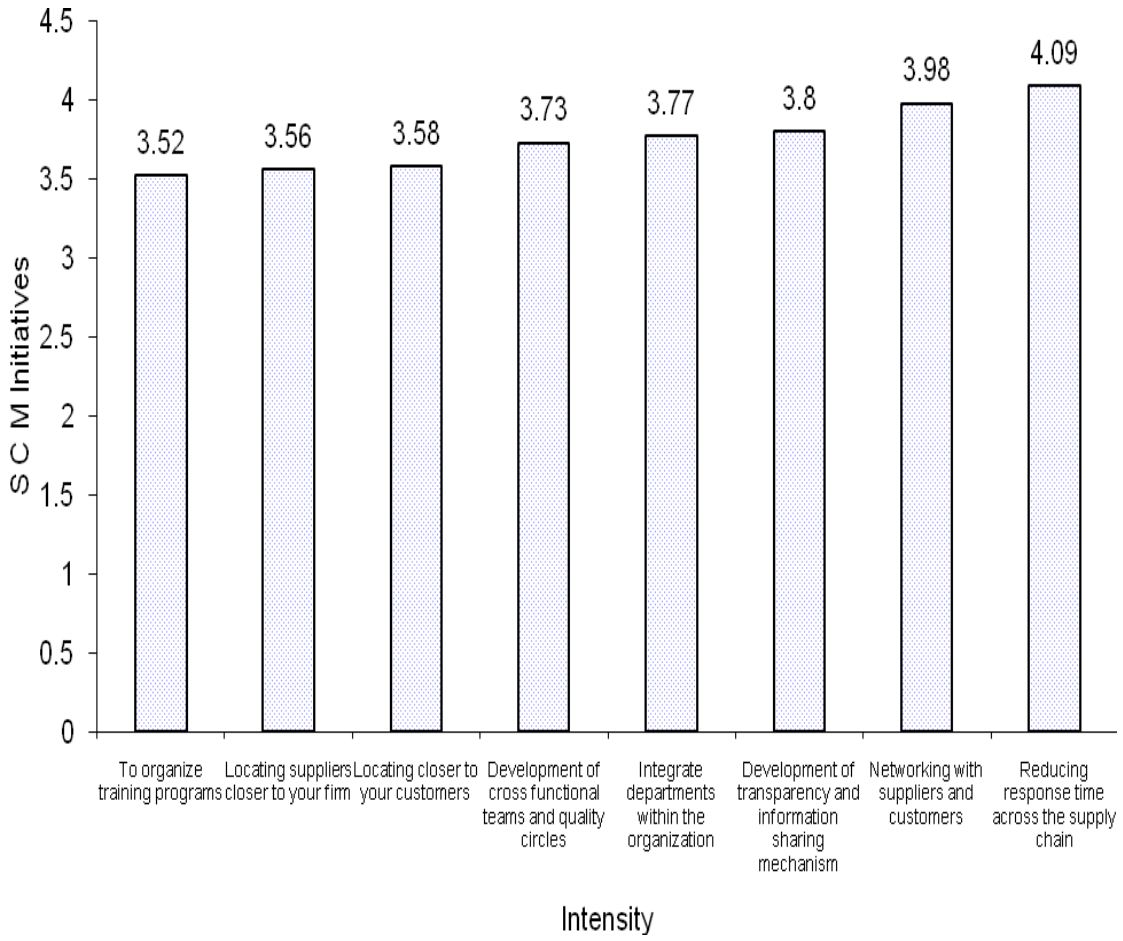


Figure 4.12: Supply Chain Management Initiatives.

4.2.13 Performance Measurement

In this study, on the basis of expert's opinion and literature review, nine performance parameters were identified. The respondents were asked to indicate the impact of supply chain management practices on performance parameters, on five point Likert scale (1-Significant decrease, 2- Decrease, 3-Same as before, 4-Increase, 5-Significant increase).

In table 4.14 statistical results (i.e. mean, standard deviation) of performance measurement are shown. These results are also shown in Figure 4.13 in graphical form.

It was observed that the impact of Supply Chain Management is maximum on performance measures such as deliver on time, responsiveness and growth of profit.

Table: 4.14 Parameters of Performance Measurement

S. No.	Parameters of performance measurement	Mean (rank)	Standard Deviation
i	Sales growth	3.92(4)	0.826
ii	Profit growth	4.05(3)	0.758
iii	Return on investment	3.92(4)	0.798
iv	Deliver on time	4.14(1)	0.859
v	Responsiveness	4.10(2)	0.847
vi	Reduction in lead time	3.86(5)	0.909
vii	Reduction in inventory cost	3.81(6)	0.882
viii	Reduction in manufacturing cost	3.66(8)	0.980
ix	Reduction in product rejection rate	3.74(7)	1.082

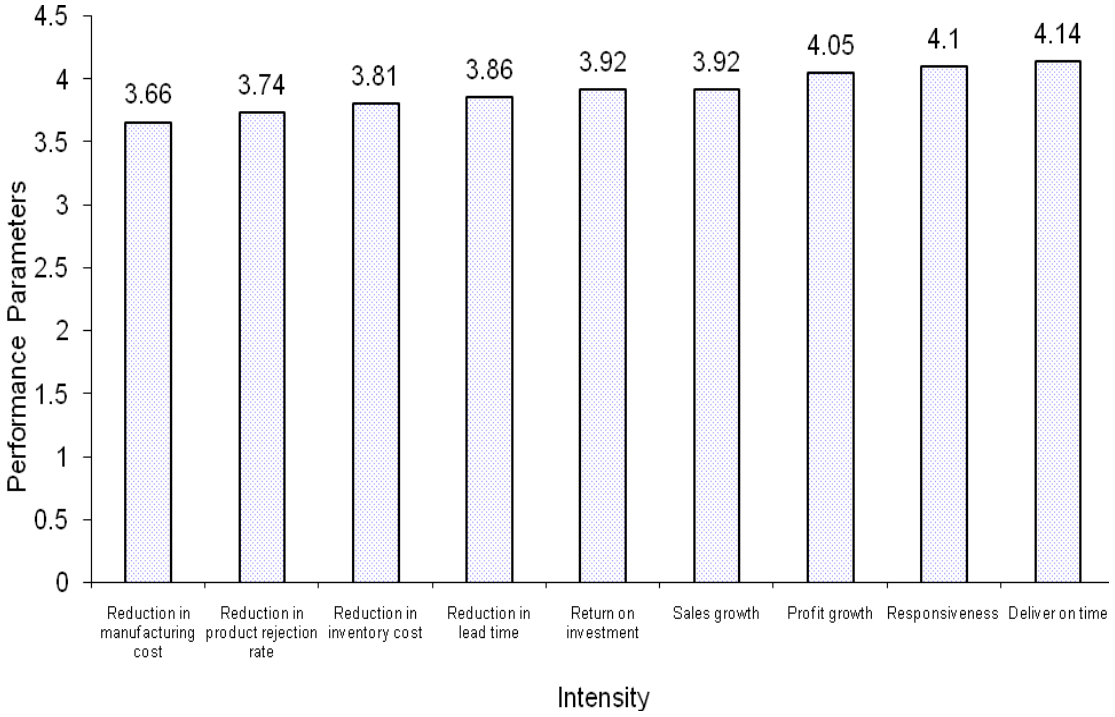


Figure 4.13: Performance Parameters.

4.3 SECTOR WISE ANALYSIS FOR RESPONDING ORGANIZATIONS

The survey responses were analyzed to identify major issues related with best supply chain management (SCM) practices and attributes. Major Sector wise research findings are given in Table 4.15, 4.16, 4.17.

4.3.1 Automotive Sector: Top three factors of different issues for Automotive Sector are summarized in table 4.15.

Table: 4.15 – Research findings for Automotive Sector.

S. No.	Issue	Automotive organizations (SCM Attributes)	Mean (rank)	Standard Deviation
i	Motivations for Implementing SCM	Reduction of product Cost, Reducing delivery lead time, Reducing inventory cost	4.14 4.07 4.03	0.750 0.657 0.869
ii	Investment Priorities for	Quick response,	4.21	0.869

	SCM Success	Information technology applications, Quality management	4.16 4.03	0.852 0.887
iii	Hindrances in Implementing SCM Practices	Location of suppliers and customers Poor demand forecast system, Lack of coordination among SC Members	2.92 2.88 2.82	1.217 1.257 1.215
iv	Supply Chain Management Practices	Customer relationship management(CRM), Enterprise resource planning(ERP), Integrated inventory management	4.02 3.92 3.77	0.897 0.950 0.727
v	Information Sharing Issues, Suppliers and Customers	Order tracking, Sales forecasting, Product development	4.05 3.81 3.79	0.775 0.779 0.914
vi	Customer Satisfaction	Commitment to continuous improvement in products and processes, Interaction with customers to set reliability, responsiveness and other standards, Successful resolution of customer complaints	4.36 4.36 4.25	0.683 0.639 0.604
vii	Capabilities	Quality control capability in process, The capability to manage distribution network, On-time delivery capability	3.93 3.92 3.90	0.712 0.967 0.807
viii	Product design and Development Activates	The use of value analysis/value engineering, Standardization of component parts, Simplification of component parts	4.10 4.01 3.77	0.801 0.852 0.876
ix	Supplier Selection	Quality of products, Supplier delivery lead times,	4.36 4.15	0.769 0.790

	Criteria	Supplier capacity	4.13	0.647
x	Environmental Issues	ISO1400 certification, Design for environment, Design of products for reduced consumption of material/energy	4.26 3.84 3.70	0.877 0.862 0.894
xi	Supplier Development Activities	Managerial support in planning and control of production system, Assessment of suppliers activities, Supplier certification	3.85 3.83 3.80	0.775 0.785 0.749
xii	Efforts for Supply Chain Management	Networking with suppliers and customers, Reducing response time across the supply chain, Development of cross functional teams and quality circles	4.17 4.14 3.99	0.719 0.689 0.739
xiii	Performance Measure	Deliver on time, Responsiveness, Reduction in product rejection rate	4.25 4.24 4.16	0.738 0.781 0.895

4.3.2 Electronics Sector:

Top three factors of different issues for Electronics Sector are summarized in table 4.16.

Table: 4.16 Research findings for Electronics Sector.

S.N.	Issue	Electronics organizations (SCM Attributes)	Mean (rank)	Standard Deviation
i	Motivations for Implementing	To meet changing customer demands, Reduction of Product Cost, Reducing inventory cost	4.00 3.91 3.77	0.873 0.967 0.871

	SCM			
ii	Investment Priorities for SCM Success	Information technology applications, Quick response , Quality management	4.00 4.00 3.95	0.98 0.97 0.899
iii	Hindrances in Implementing SCM Practices	Lack of coordination among S C Members, Lack of resources and funds, Lack of use of modern technologies	3.05 2.77 2.73	0.991 0.990 0.827
iv	Supply Chain Management Practices	Customer relationship management(CRM), Lead time management, Third party logistics(3PL)	3.91 3.73 3.68	0.921 0.703 0.945
v	Information Sharing Issues, Suppliers and Customers	Company's production costs, Product development, Order tracking	2.77 3.59 3.55	1.020 0.959 0.858
vi	Customer Satisfaction	Interaction with customers to set reliability, responsiveness and other standards, Being flexible to meet customer's changing needs, Use of quality control techniques	4.67 4.33 4.33	0.577 0.577 0.577
vii	Capabilities	Product design and development flexibility, Quality control capability in process, On-time delivery capability	3.85 3.73 3.68	0.813 0.827 0.716
viii	Product design and Development Activates	The use of value analysis/value engineering, Involvement of customers, The use of concurrent engineering	3.90 3.86 3.84	0.788 0.941 0.765

ix	Supplier Selection Criteria	Quality of products, Suppliers ability to cost saving initiatives, Supplier delivery lead times	4.36 3.95 3.77	0.848 0.982 0.971
x	Environmental Issues	Design for environment, ISO1400 certification, Design of products for recycle and reuse	3.73 3.73 3.55	0.985 1.077 0.912
xi	Supplier Development Activities	Supplier certification, Assessment of suppliers activities, Close partnership with supplier for product design	3.65 3.43 3.41	0.671 0.978 1.141
xii	Efforts for Supply Chain Management	Reducing response time across the supply chain, Development of transparency and information sharing mechanism, Networking with suppliers and customers	3.86 3.77 3.68	0.889 0.973 0.894
xiii	Performance Measure	Responsiveness, Profit growth, Deliver on time	4.18 4.00 3.95	0.733 0.690 0.844

4.3.3 Light Engineering Sector: Top three factors of different issues for Light Engineering Sector are summarized in table 4.17

Table: 4.17 Research findings for Light Engineering Sector.

S. No.	Issue	Light Engineering organizations (SCM Attributes)	Mean (rank)	Standard Deviation
i	Motivations for Implementing	To meet changing customer demands, Reducing delivery lead time,	4.04 3.97	0.984 0.996

	SCM	Reduction of Product Cost	3.96	0.981
ii	Investment Priorities for SCM Success	Quality management, Quick response, Market developments	4.27 4.10 3.96	0.815 0.903 0.939
iii	Hindrances in Implementing SCM Practices	Location of suppliers and customers, Lack of sharing information with suppliers, Lack of coordination among S C Members	2.82 2.77 2.72	0.991 0.996 0.891
iv	Supply Chain Management Practices	Customer relationship management(CRM), Enterprise resource planning(ERP), Lead time management	3.90 3.69 3.66	0.932 0.891 0.912
V	Information Sharing Issues, Suppliers and Customers	Order tracking, Company's production costs, Inventory status	3.82 3.23 3.58	0.976 0.982 0.981
vi	Customer Satisfaction	Use of quality control techniques, Successful resolution of customer complaints, Commitment to continuous improvement in products and processes	4.11 4.11 4.11	1.054 0.782 0.928
vii	Capabilities	Quality control capability in process, The capability to manage distribution network, On-time delivery capability	4.00 4.00 3.89	0.917 0.993 0.910

viii	Product design and Development Activates	The use of value analysis/value engineering, Standardization of component parts, Modular design of parts	3.54 3.48 3.37	0.891 0.981 0.987
ix	Supplier Selection Criteria	Quality of products, Supplier delivery lead times, Suppliers ability to cost saving initiatives	4.31 4.20 4.03	0.855 0.768 0.956
x	Environmental Issues	Design for environment, Cooperation with customers for green packing, ISO1400 certification	3.81 3.64 3.62	0.872 0.879 0.912
xi	Supplier Development Activities	Supplier certification, Collaborative planning for forecasting and replenishment, Assessment of suppliers activities	3.64 3.60 3.57	0.985 0.964 0.795
xii	Efforts for Supply Chain Management	Reducing response time across the supply chain, Networking with suppliers and customers, Development of cross functional teams and quality circles	4.11 3.90 3.75	0.903 0.864 1.079
xiii	Performance Measure	Profit growth, Deliver on time, Sales growth	4.21 4.20 4.01	0.773 0.786 0.837

4.4 CONCLUDING REMARKS

In this chapter, questionnaire based survey responses were analyzed for various issues related with supply chain management implementation in organisations. Major issues considered in this chapter are motivations for implementing SCM, investment priorities for SCM success, hindrances in implementing SCM practices, major supply chain management practices, information sharing issues, capabilities for SCM , product design and development activates, supplier selection criteria, environmental issues, supplier development activities, efforts for supply chain management implementation and performance measurement. Sector wise analysis of different issues is given in Table 4.15, 4.16, 4.17. Major overall findings of the study are summarized in table 4.18.

Table: 4.18 Summary of Key Findings.

Issues	Key Findings
Motivations for Implementing SCM	• Reducing delivery lead time • Reduction of product cost • Reducing inventory cost
Investment Priorities for SCM Success	• Quality management • Quick response • Sales forecasting and planning
Hindrances in Implementing SCM Practices	• Location of suppliers and customers • Poor demand forecast system • Lack of coordination among S C Members
Supply Chain Management Practices	• Customer relationship management(CRM) • Enterprise resource planning(ERP) • Integrated inventory management
Information Sharing Issues with Suppliers and Customers	• Company's production costs • Order tracking • Sales forecasting
Customer Satisfaction	• Commitment to continuous improvement in

	products and processes • Successful resolution of customer complaints • Interaction with customers to set reliability, responsiveness and other standards
Capabilities	• The capability to manage distribution network • On-time delivery capability • Capabilities to control quality
Product design and Development Activates	• The use of value analysis/value engineering • Standardization of component parts • Involvement of customers
Supplier Selection Criteria	• Quality of products • Supplier delivery lead times • Supplier ability to cost reduction
Environmental Issues	• Cooperation with customers for green packing • Environmental audit for suppliers • ISO 1400 certification
Supplier Development Activities	• Supplier certification • Assessment of suppliers activities • Managerial support in planning and control of production system
Efforts for Supply Chain Management	• Reducing response time across the supply chain • Networking with suppliers and customers • Development of cross functional team across the supply chain
Performance Measures	• Deliver on time • Responsiveness • Profit growth

CHAPTER 5

DEVELOPMENT OF CASE STUDIES

5.1 INTRODUCTION

A case study is a descriptive or explanatory analysis of a person, group or event. Thomas (2011) offers the following definition of case study: "Case studies are analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems that are studied holistically by one or more methods.

There are several challenges in conducting case research: It is time consuming, it needs skilled interviewers, and care is needed in drawing generalisable conclusions from a limited set of cases and in ensuring rigorous research. Despite this, the results of case research can have very high impact.

Many research have used case study for their research (Gunasekaran and Cecille, 1998, Gunasekaran *et.al.,* 2001, Dangayach and Deshmukh, 2001, Al-Najjar and Alsyouf, 2004, Taylor *et.al.,* 2004, Cassel *et.al*.,2006, Arshinder *et.al.,* 2007, Thakkar *et.al.,* 2008, Singh *et.al.,* 2012 and Pradhan and Routroy, 2014).

In the present research, the case study methodology followed the exploratory survey. The case study and survey approach provides a strong foundation for understanding various issues of supply chain management practices. Case study method is used in conjunction with survey research to develop explanations for some of the findings on a more comprehensive basis (Eisenhardt, 1989, Beach *et.al.,* 2000, Spring and Dalrymple, 2000).

In this research, two case studies are developed to get understanding of different supply chain management issues in depth and the performance of organizations in India. Brief description of these case companies are as follows.

Case I: Manufacturer of automotive light industry.

Case II: Manufacturer of automotive original equipment manufacturer.

The selection of companies was based on two criteria. First, the consent for detailed study and the second criteria was geographical location. Both organizations were located in close proximity (i.e., NCR Delhi).

5.2 METHODOLOGY FOR CASE STUDY

The research methodology adopted for these case studies is given in Table 5.1. Major components of this approach are literature review and discussion with executives of organization. Proposed framework for selection of best SCM practices is shown in figure 5.1.

Table 5.1 Case Study Methodology.

Case Study of Methodology	
Steps	**Comment**
1. Definition of Research Question	What are the issues related with supply chain management practices on the performance of organizations in India.
2. Objectives	The case methodology will seek answers to two specific questions? • How to implement supply chain management practices? • What are the supplier selection criteria? • What are the environment related issues? • What strategies are followed for customer satisfaction? • Which SCM practices are being followed? • What are SCM performance measures in organizations?

3. Selecting the case	Two organizations were selected on basis of their investment in plant and machinery and belonging to automotive light component, automotive original equipment manufacturer.
4. Crafting research instruments	A structured questionnaire was used to capture major issues of supply chain management practices and observations followed it.
5. Entering the field	Organizations were contacted via telephonic conversation, then data collection using the survey questionnaire, interviews, and observations etc. were started. The target respondent in each company was the manufacturing / operations manager/owner.
6. Analyzing the data	Data collected from cases were used to analyze concepts of best practices of supply chain management.
7. Reaching closure	Based on learning from the survey and case studies, SAP-LAP carried out and recommendations are proposed for Indian organization.

The literature review and experts opinion enabled to identify various issues related with firm level practices and develop a framework for analyzing various issues of SCM. Both organizations were visited at least five times. Discussions with executives helped in identifying different issues and collection of data in real scenario. Discussions were not restricted to questionnaire rather open ended interaction and other sources of information like annual reports, control charts, documentation of various processes and its website also used.

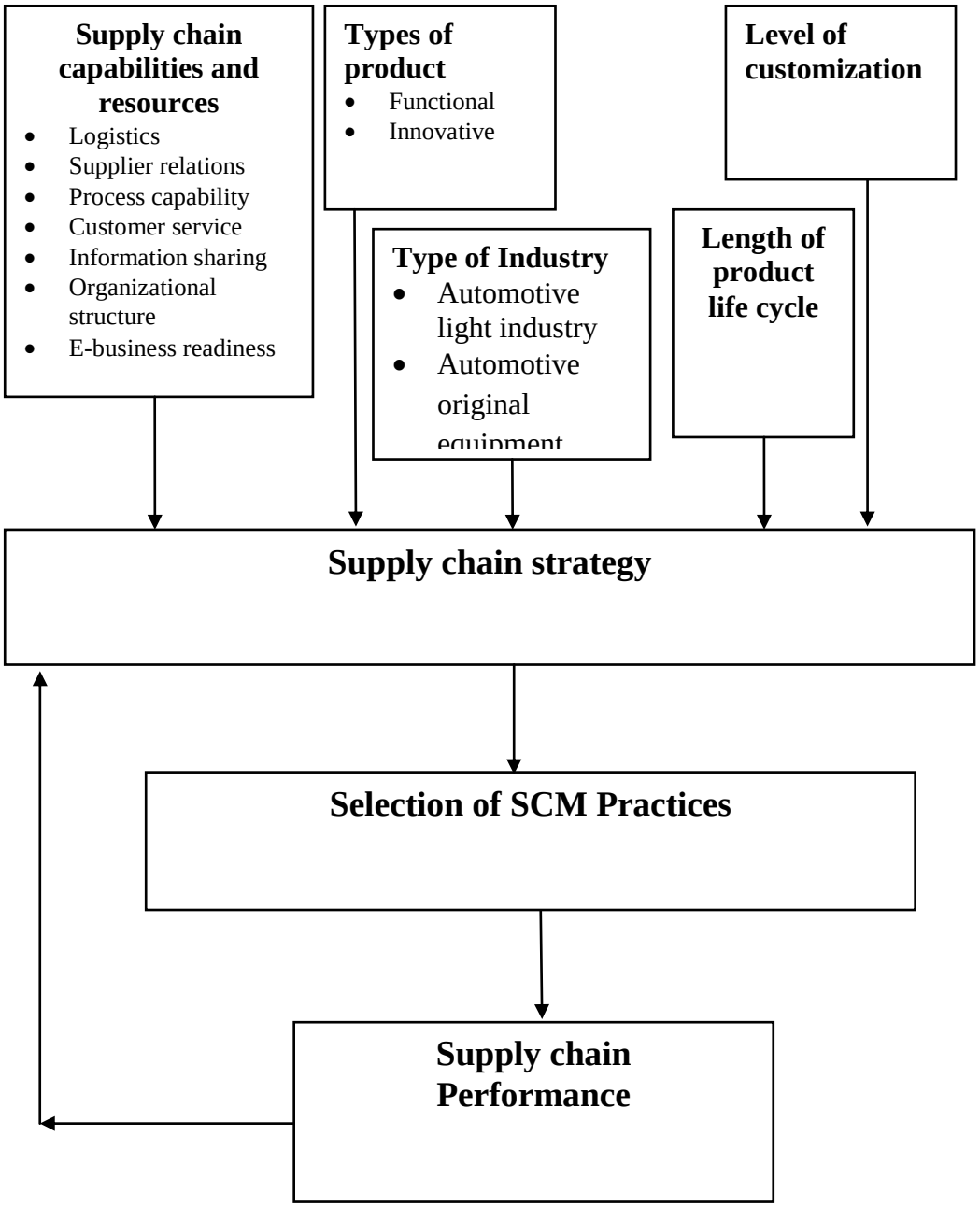


Figure 5.1: Frame work for selection of best supply chain management practices.

Case study has been developed by collecting data from primary and secondary sources. Primary data and information have been collected, mainly through semi-structured interviews of the concerned managers in the organization. Interviews focused on the perspectives of the decision makers of the technology management

function. The relationship of the effective technology management to organizational growth was emphasized. Secondary information has been collected through published sources and websites. In the development of these case studies, the published material mainly consists of business dailies, business weekly, corporate magazines, and the material available on the website of the company. As requested by the companies, to maintain the confidentiality of information, the names of companies are not revealed in this chapter. The discussed case is of company AL1 from auto sector. The case was analyzed applying the situation–actor–process–learning–action–performance (SAP-LAP) paradigm (Sushil, 2000).

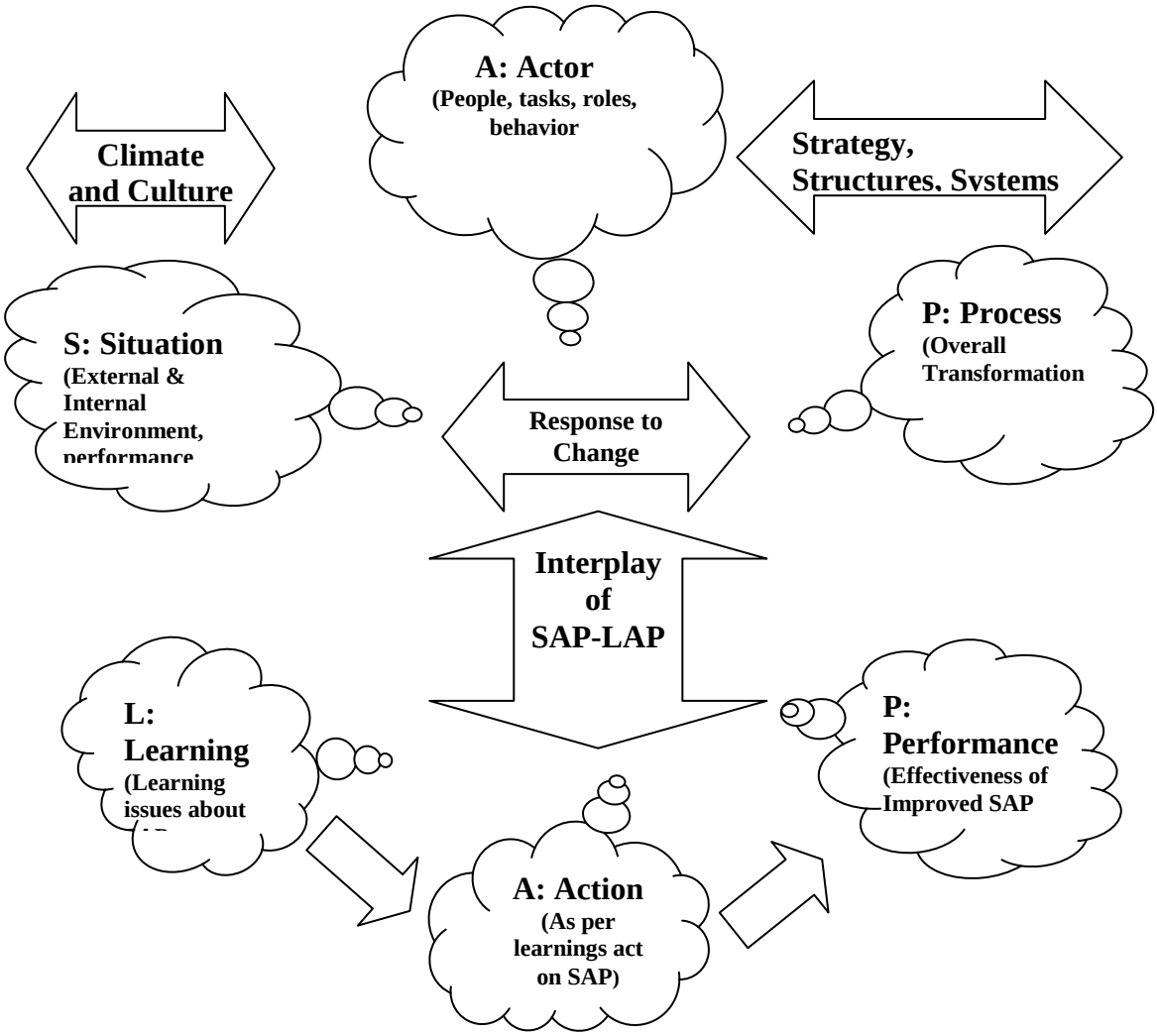


Figure 5.2: Model of SAP-LAP (adopted from Sushil, 2000).

This model will help in covering all the issues (soft and hard) of supply chain management with respect to the company. Framework adopted for case preparation is shown in figure 5.3.

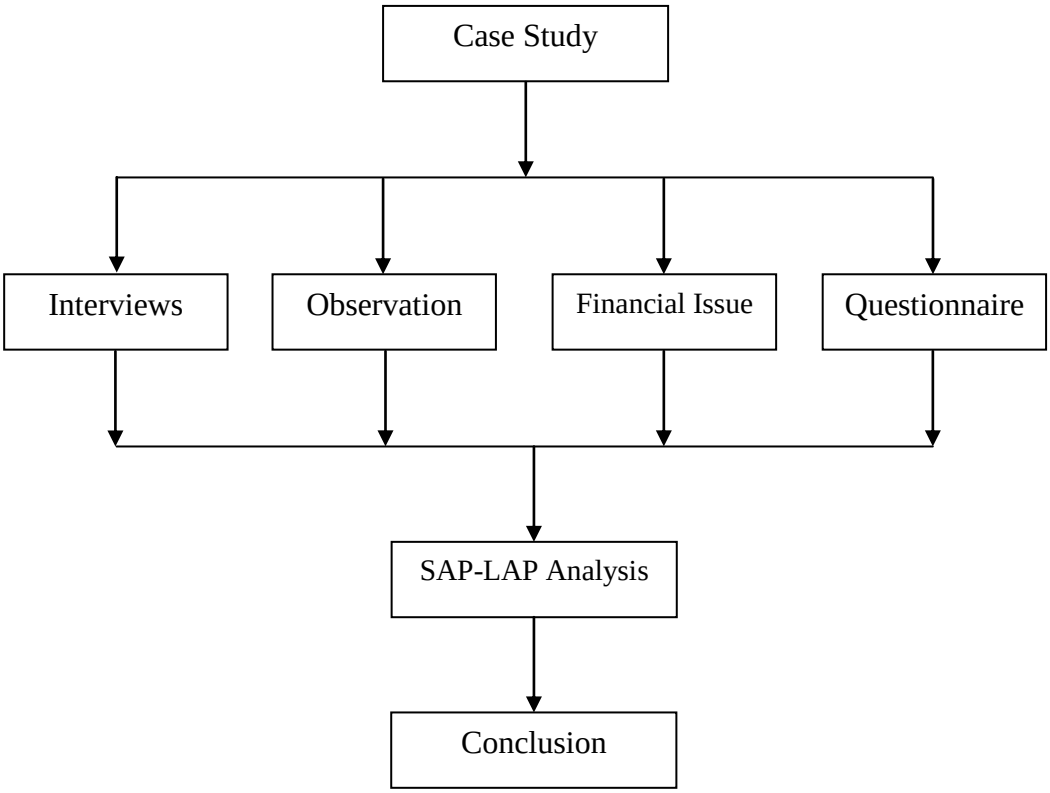


Figure 5.3: Frame work adopted for the case preparation.

Sushil (2000) has recommended the use of SAP-LAP methodology for critically examining a case organization. This methodology consists of two steps. In the first step, the SAP analysis, the dynamic parameters of a case are highlighted through the three dynamic interface of any business system. These interfaces are situations (S), actors (A), and processes (P). The next step is LAP synthesis. LAP has three components. These are learning issues (L), actions recommended (A), and anticipated improvement in performance (P). The actors consistently evaluate the situation, follow processes, and take actions to improve their performance and depending on the results of performance either the processes are modified or same processes are followed in future.

The SAP-LAP paradigm incorporates both learning and action in a symbiotic manner coupled with performance. It is not only takes into consideration optimization of processes, but also incorporates multiple perspectives of various participating actors in a managerial process. Thus, SAP-LAP analysis offers a learning and interpretive framework of inquiry into the problem under consideration. Therefore, for the organizations, which are in the process of adopting new and complex technologies, SAP-LAP framework provides one of the most useful methodologies of analysis and synthesis. To improve supply chain performance organizations are not only adopting latest manufacturing and IT technologies, but also adopt supply chain best practices.

A SAP-LAP model should be developed by framing critical questions about the situation, actor, process, learning, action, and performance. The SAP-LAP model enquires about what is happening in the situation, what are the relevant characteristics of the actor that relate it with the situation as well as process, and what is to be questioned about the process. Further, it enquires into the major areas of learning, key fronts of suggested actions, and their implications on the performance (Sushil, 2000).

The situation is treated like a journey and examines the past, present, and the expected trends in future. For the various actors under consideration, it inquires about their worldviews, roles and capabilities, and their respective freedom of choice. The process is examined in terms of three seminal questions, i.e. what, why, and how? The basic purpose of the process is questioned and then the questions are asked to generate the alternatives (Sushil, 2000).

The key learning issues about the SAP are to be identified synthesizing into overall learning issues. This will lead to key suggested actions to improve the situation, actor and process respectively. Finally, the impacts of these actions on the performance of the situation, actor, and process are explored (Sushil, 2000).

5.3 CASE I: AUTOMOTIVE LIGHT INDUSTRY (AL1)

5.3.1 Profile of organization

AL1 Ltd was established in 1980. It is one of the leading automotive lamps manufacturers in India and is growing at a consistent rate of 25% CAGR (Compounded annual growth rate) per annum. With approximately 980 employees,

lighting division operates out of different locations across the country- Pantnagar, Haridwar, Sonepat, Manesar and two locations in Pune, catering to most original equipment manufacturer (OEM) customers like Yamaha, Suzuki, Swaraj Mazda, New Holland, Eicher, Mahindra, Tafe, Royal Enfield, Maruti, General Motors, Fiat, Volkswagen, Toyota, Tata, Ford etc. It has design centers and customer support offices in Taiwan, Japan and a strategic sourcing unit in China. International customer base includes Daihatsu, Mbk, Suzuki, Piaggio, Kawasaki, Torica, Volkwagen etc. One of the biggest strengths of the company is the self reliancse model, they have chosen to adopt. With the opening of a state-of-the-art design centre in Taiwan, the division has extended its engineering wing for designing and developing automotive lighting products.

The design centre has given the necessary fillip to the company's expertise in optical and mechanical designing of automotive lamps, in addition to capitalizing on the strategic advantage of Taiwan as an established and high quality, yet cost effective, destination for tooling. As with most successful companies, AL1 industries limited - lighting division intends to grow both organically and inorganically and many new initiatives are being taken.

AL1 industries limited - lighting division has received awards for the quality, promptness, diligence, cost efficacy and innovation of its products. These awards are- **"**Amrit – Award" for Quality Circle Competition (2012) by ACMA, "Gold -Award" in QCFI (2011), "Kaizen-Hangama, NCR" Trophy (2011), "Kaizen -Hangama Trophy" At Group Level (2010), "Gold -Award" in QCFI (2010), "Vendor Performance – Gold Award"(2009) from MSIL, "Excellence -Award" in QCFI (2009), "Par-Excellence -Award" in QCFI (2008).

The following are driving factors for AL1 to become one of the largest in the India: quality, industrial innovation, leadership, high professionalism, area wide network of dedicated sales and service outlets, solution providing capability.

Interestingly, even after the entry of many automotive light manufacturers in India since the mid-1990s, which intensified the competition within the Indian market, AL1 continued to remain dominant.

This organization has performed as per the expectations in the year 2010-11 and consistently on the growth track with renewed focus on serving the customer better and providing best quality at reasonable price. The sales and operating revenue of the company stood at Rs. 91231 lacs during the FY 2010-11. i.e., a growth of 52%, export sales of the company stood at Rs. 3725 lacs having a growth over 14%.

The profit after tax of the company stood at Rs. 3484 lacs as compared to Rs. 2287 lacs in the previous year, a growth of 52%.

On the domestic front, owing to the high interest rates and increasing fuel prices, the overall domestic vehicle sales have shown 15% growth in first quarter of FY2011-12 as compared to the same period last year. The rise in global cost of commodities and energy has resulted in inflation which has increased the interest rate in the domestic market. These factors continue to cause some concerns on the growth of the automobile market in the current year.

5.3.2 Products of organization

AL1 industries limited - lighting division manufactures a wide range of lamps for 2/3/4 wheeler and off road vehicles. It is a leading OE supplier, catering to almost all vehicle manufacturers in INDIA. AL1 lighting has consistently endeavoured to keep abreast of the latest trends in technology and production techniques. Their manufacturing facilities are equipped with latest machines such as vibration welding, BMC molding, dual color molding and ultrasonic welding.

The lighting division offers a variety of products with several variants characteristics as follows:

Four Wheelers: Lamp assy front com., front turn signal lamp, high mount stop lamp, spot lamp, reflex reflector, warning triangle, lamp assy. side turn signal, licence lamp assy., lamp assy. trunk room, lamp assy rr. fog, head lamp assy., tail lamp assy, fog lamp

Two Wheelers: Body cowling, number plate lamp, tail lamp assy, head lamp assy, indicator.

Off Road: Plough lamp assy., tail lamp assy., head lamp assy., rear fender lamp, front fender lamp, plough lamp (rectangle).

5.4. SAP-LAP ANALYSIS

In this section, we analyze the AL1 case using SAP-LAP framework. The analysis is conducted in the context of the supply chain initiatives in the organization.

5.4.1. Situation

The sub-section describes the present status of AL1 in terms of its market share, technology, research and development, responsiveness, agility, competitive advantage, and performance measures.

AL1 is the leader of Indian automotive light industry with more than 30% of the market in year 2012. The high volume of production allows it the benefits of economies of scale in procurement, production and distribution. The supply chain of AL1 is global in the sense that its main collaborators and many vendors are from outside India.

An intense competition exists due to presence of more than 10 players in this segment of the automotive light. There is increasing pressure to maximize the efficiency, responsiveness, agility and adaptability of the supply chain. AL1 is focusing on reducing costs and new product development time.

The competitors are offering the product at far lower price. AL1 is committed to use of e-Business technologies to enhance cost competitiveness of its product.

Environmental related concerns in AL1 are such as ISO 1400 certification, environmental audit for suppliers, design for environment and high design of products for reducing consumption of material/energy, cooperation with customers for green packing.

It is observed that for this organization major hindrances in implementing SCM practices are such as location of suppliers and customers, lack of co-ordination among supply chain members and forecasting inaccuracies. These observations validate empirical findings with respect to hindrances in SCM implementation.

5.4.2. Actors

The views about supply chain performance presented in this research are based on semi-structured interviews with different actors and interlocutors during field visits. Those approached included top and middle level managers, employees in supply chain and information technology departments apart from consultants, suppliers, dealers, and customers of AL1.

5.4.3. Process

Inbound logistics involves more than "45" components from about "50" suppliers. The company uses a mix of various strategies to manage its inbound logistics. The hub and spoke and the milk run systems are its mainstay. The use of vendor managed inventory (VMI) approach by AL1 has helped it reduce its inventory carrying costs and stock outs. The initiatives of supply chain such as standardization of parts, Third Party Logistics (TPL) also help AL1 in reducing cost and inventory.

The internet and extranet help AL1 keep in touch with its customers, dealers and with other members of the business community. The information sharing with the suppliers is mostly extranet-based. The order processing time has reduced from five days to fifteen minutes due to complete online transaction with its dealers on the extranet. The production forecasts of AL1 are based on market research and dealer bookings. All dealers are online through extranet for transferring real time market information. The tracking of finished goods on outbound side is being done mainly by phone and fax. AL1 has introduced a concept of "Reduction in lead time" for dealer performance measurement and management. It is observed that this organization is giving maximum focus on CRM, integrating inventory management, and selection of third party logistic provider. In this case top two findings are same as in empirical findings.

5.4.3.1. Technology management

With an integrated vision of becoming the best supplier in technology, service and support for automotive lamps, AL1 industries limited - lighting division is a well known name amongst the OEMs for its technical edge.

Apart from setting up the Taiwan design centre, the self reliance strategy permeates all 'technology' decisions the lighting division makes; be it a constant innovation in product development, concurrent engineering concepts, customized and collaborative engineering, stream of investments in upgrading machinery and manufacturing plants. Up skilling people is another major component of this strategy.

The technology paradigm starts from the engineering arena where optical, thermal and feasibility studies are initiated at the conceptual stage, and then extend to styling, product designing, DFMEA (Design Failure Mode and Effect Analysis) and prototyping.

The development of the product involves an array of qualitative processes including production engineering, tooling, quality engineering and lab management. Joint DFMEA and vehicle level analysis (PFMEA- Process Failure Mode and Effect Analysis) are conducted with customers to ensure a robust development process.

AL1 lighting undertakes many design processes, such as joint DFMEA and PFMEA processes, multi color injection molding, bezel metalizing facility and prototyping soft tooling; not offered by any other auto lighting manufacturer in India.

Collaborative engineering involves customers from vehicle design stage; concept development, computer graphics, CAD modelling, VA/VE ideas, simulations and rapid prototyping. The value analysis and value engineering (VA/VE) proposals to customers at the time of development provide them cost effective solutions.

The manufacturing assembly line includes many advanced machines like CNC milling machine (Deckel Maho), EDM machines (Electronika), CNC wirecut (Makino), spark machines (Electronika), sealing techniques through German machines and other conventional machines.

Product validation procedures are incorporated to maintain excellence benchmarks viz; Illumination tests, vibration test rig, environment testing, endurance tests, high voltage Insulation tests, fatigue test chamber, salt sprays tests and photometric testing.

Stringent quality control processes like Poka Yoke and Red Bin quality review systems, Daily review meetings at Gemba and Sendai checks are built-in, to ensure lowest defective parts per million. AL1 focused on customer, 3P (People,

Processes and Products), innovation, networking including partnership, and open learning environment.

This organization is trying to have optimal use of IT for integrating its supply chain. Major areas of IT applications are in taking customer feedback/complains, order tracking and sales forecasting.

5.4.3.2. Vendor development strategy

Vendor development of AL1 was one of the key factors for reducing production costs, and thereby a key factor for the firm's remarkable growth. Most of the vendors are located in close vicinity such as Gurgaon, Fridabad, and Noida . The supplies from the vendors located in south and western India are on a daily basis through a buffer inventory level of 4-7 days is maintained for these vendors. AL1 maintains an average inventory level of 20 days for the imported components, less than one day for the domestic components.

Major vendor development activities are supplier certification, assessment of supplier activities, and managerial support in planning and control of production system. While selecting vendors this organization gives focus on product quality, delivery lead time and product cost.

5.4.3.3. Vendor quality control

Quality management system such as ISO 9000/ QS 9000/ TS 9014 forms the basis for producing a quality product. In 1995 AL1 adopted a cluster approach wherein vendors are grouped together. They are trained in quality management and are assisted in obtaining ISO 9000 certification. This cluster approach was extended to help vendors in attaining QS 9000 certification. Periodic vendor quality system audits are conducted in order to ensure that quality standards are sustained.

5.4.3.4. Logistics, sales and distribution

AL1 manages its logistics activities in-house. Compared to its outbound logistics, it observes inbound logistics as more complicated.

The organization has classified its vendors located in a particular area according to their production pattern and has arranged transportation accordingly.

In selling about 14,000 Lamps/day, and 42 Lacks lamps yearly through a dealers' network across the country, outbound too plays an important role in its supply chain.

5.4.4. Learning

To deal with complex situations as of Case company supply chain should be integrated and efficient. This may be achieved through extensive and strategic use of information technology and through measurement of supply chain performance on the basis of supply chain oriented metrics. The disparity in trading partner's capabilities and lack of performance metrics with supply chain orientation are the main barriers in the supply chain improvement efforts.

The total material costs in the finished product are between 45 and 60 percent. The organization outsourced about " 25" percent of its raw materials and components requirement. Therefore, efficient management of inbound logistics and materials procurement are the critical issues for better management of its supply chain.

AL1 needs to improve its vendor managed inventory (VMI) system. The availability of real-time data leads to improvement in forecasting and thereby enables production to be more in tune with the market demand. In absence of real-time information sharing about delivery status with the logistics operator or transporter lead to uncertainties. It also results in high transportation costs or last moment changes in the delivery schedule with advancements in IT and its strategic use by the 3PLs.

5.4.5. Action

Since AL1 is a leading OE supplier, catering to almost all vehicle manufacturers in INDIA, it makes use of its dominance in the supply chain and asks the vendors to use the latest IT tools and industrial engineering practices for supply chain performance improvement. The organization develops a system for measuring the performance

of its supply chain. This way AL1 benchmark its supply chain practices with the best in the business. It should periodically review its supply chain policy.

Vendor management is made the thrust area. The vendor performance is measured on supply chain oriented metrics. The numbers of vendors are brought down to one or two vendors per component from the prevailing three to five vendors per component. For VMI system to improve, AL1 focus on accurate data-sharing with its vendors, utilize business intelligence systems to support automated replenishment, and make its collaborative planning, forecasting and replenishment system more mature. The strategic use of IT in vendor management improves supply chain performance. Incentives are provided to the vendor for information sharing and for use of IT tools in the supply chain. These incentives are terms of technological assistance, long-term contracts, status of most preferred vendor etc.

The modularization and postponement strategy have been made effective through use of real-time information sharing with dealers With the emergence of 3PL and their competency in using advanced IT and supply chain tools, the organization think of outsourcing its logistics activities in a phased manner.

5.4.6. Performance

Petrovic-Lazarevic and Sohal (2002), define performance measurement as way to assess information regarding processes and products results, to allow evaluation and comparison in relation to goals, patterns, past results and to compare with other processes and products. Hausman (2000) refers to supply chain performance as "the extended supply chain's activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner."

AL1 measures its vendor on quality, cost, delivery and new product development parameters. The parameters like adaptability, agility and alignment can be added to the process of vendor-selection. This will result is selecting vendors who can better deal with uncertainty. The performance measurement and benchmarking of supply chain would provide AL1 an opportunity to identify the gaps in its supply chain practices. The reduced vendor-base is

likely to add to the smooth and reliable functioning of its supply chain. This will help in development of strategic relationship, lowering of expenses in IT deployment, reducing work-burden on people and the system. The periodic discussion with the employees and the supply chain partners will help achieve better supply chain integration. The website needs to be made customer-focused to the extent that the customers may choose the good idea of their product within technical and economic constraints.

5.5. CASE II

AUTOMOTIVE ORIGINAL EQUIPMENT MANUFACTURER (AL2)

5.5.1. Profile of organization

The foundation day of organization is February 24, 1981. Major products are Passenger Cars i.e. 800 cc, Alto, Estilo, WagonR, A Star, Ritz, Swift, Dsire, SX4; MPV: Omni, Versa; Utility Vehicles i.e. Gypsy.

AL2 is a subsidiary of Suzuki Motor Corporation, Japan. AL2 has been the leader of the Indian car market for over two decades. The company's manufacturing facilities are located in Haryana (Gurgaon and Manesar) and have a combined annual capacity of a million units.

Suzuki motor corporation, Japan (SMC) is making AL2 India as the research and development hub for Asia . The company recently took possession of 700 acre land in Rohtak for developing a research and development complex. Over the years, MSIL's research and development have evolved from localization of parts to product facelift to upgrading of engines and also developing alternate fuel options, independently. AL2 is now moving towards developing full body change.

Just a year back, AL2 inaugurated its state–of-the-art K-series engine plant at Gurgaon. This new technology plant churns out engines that are more fuel efficient and environment friendly. The introduction of new technology future ready engines is in line with the company's commitment towards environment.

Customers ranked AL2 as 1 in customer satisfaction index for the 10th consecutive year. In the "Business Today" most valuable company's study 2009, AL2 has ranked no. 1 among automobile companies and 18th overall.

Company has a network of over 681 sales outlets spread over 454 cities and over 2767 service workshops across more than 1314 cities and is further reaching closer to customer. The company has commenced exports to Europe via a newly developed car handling export terminal at Mundra.

AL2, unveiled its National Road Safety Mission Programme, recently. Under this AL2 would trained 500,000 people in safe driving in the next 3 years across India out of which at least 100,000 will be from underprivileged section of society. While utilizing the existing 2 Institutes of Driving Training and Research (IDTR) in Delhi and over 55 AL2 Driving Schools across the country, the company will enter into partnerships with state governments for more IDTRs and with its dealers for more AL2 Driving Schools. The company will continue to support to government and industry in their efforts for road safety.

Company was established in February, 1981 through an Act of Parliament, to meet the growing demand of a personal mode of transport caused by the lack of an efficient public transport system. It was established with the objectives of modernizing the Indian automobile industry, producing fuel-efficient vehicles to conserve scarce resources and producing indigenous utility cars for the growing needs of the Indian population. A license and a Joint Venture agreement were signed with a Japanese automaker in October 1982, by which that company acquired 26% of the equity and agreed to provide the latest technology as well as Japanese management practices. The Japanese automaker was preferred for the joint venture because of its track record in manufacturing and selling small cars all over the world. There was an option in the agreement to raise Japanese automaker's equity to 40%, which it exercised in 1987.

Five years later, in 1992, the government's share of equity was reduced from 60% to 49.9%, in accordance with government policy change that allowed state enterprises to form joint ventures (Okada, 2004), thus making it a non-government company. Later in 2002, Japanese automaker increased its stake to 54%. However, the government

recently announced its policy to disinvest from company, allowing it to become Japanese automaker's subsidiary firm.

It was the first modern assembly plant in India, as it was a close copy of Japanese automaker's Kosai plant in Japan, in terms of plant layout, equipment, the organization of production and the operating principle. The firm started its production by 1983. In 2008, it started its new plant at Manesar, spread over 600 acres. It has since emerged as the largest car manufacturer in India, by initially focusing on the small car segment, which had been virtually untapped in the Indian market until company entry. Company cars were 21 percent cheaper than the lowest-priced existing passenger car produced by domestic manufacturers, yet offered much higher quality, more safety features and greater fuel efficiency. In response to the increased variety in consumer tastes, in the early 1990s, the firm also diversified its product range, introducing new middle-sized passenger cars.

According to company's vision statement, its goals include maintaining leadership in the Indian automobile industry, creating customer delight, increasing shareholder wealth and being "a pride of India." Customers have shown their approval, ranking company high in customer satisfaction for a decade (1999 to 2009) in a row according to the J.D. Power Asia Pacific India customer satisfaction index (CSI) Study. The company has also ranked highest in the India sales satisfaction study.

Interestingly, even after the entry of many foreign car manufacturers in India since the mid-1990s, which intensified the competition within the Indian market, company continued to remain dominant. In 2007-08, it had a market share of 54.6%. Company has a sales network of 802 outlets in 555 locations, and provides maintenance support to the customers at 2,740 workshops in over 1,335 towns and cities. Since inception, they have produced and sold over 7.5 million vehicles, including almost 552,000 units in Europe and other export markets. In 2009-10, AL2 sold more than a million units (10, 18365 units), thus becoming the first Indian company to do so.

5.6. SAP-LAP ANALYSIS

In this section, we analyze the AL2 case using SAP-LAP framework.

The analysis is conducted in the context of the supply chain performance initiatives in the organization.

5.6.1 Situation

The sub-section describes the present status of AL2 in terms of its market share, technology, R and D, responsiveness, agility, competitive advantage, and performance measures.

AL2 is the leader of Indian car industry with more than 50% of the market in year 2008. The high volume of production allows it the benefits of economies of scale in procurement, production and distribution. The biggest strength of AL2 lies in its vast and strong service network. The supply chain of AL2 is global in the sense that its main collaborators and many vendors are from outside India.

An intense competition exists due to presence of more than 11 players in this segment of the automobile industry. The continual decrease in its market share is a matter of concern for AL2. There is increasing pressure to maximize the efficiency, responsiveness, agility and adaptability of the supply chain. AL2 is focusing on reducing costs and new product development time.

The competitors are offering the product at far lower price. The Nano from Tata Motors Limited is an example of this challenge. In this context, AL2 is committed to use of e-business technologies to enhance cost competitiveness of its vehicles and services.

This organization is facing lot of challenges to meet environmental norms of globalised market. It is focusing on use of right materials from green supply chin perspective, ISO 1400 certification for vendors, design of products for recycle and reuse. Major hindrances observed by this organization are lack of coordination with few vendors and delay in raw materials supply.

5.6.2. Actors

The views about supply chain performance presented in this research are based on semi structured interviews with different actors and interlocutors during field visits. Those approached included top and middle level managers, employees in supply

chain and information technology departments apart from consultants, suppliers, dealers, authorized service stations and customers of AL2.There is team of managers and middle management, but all decisions are taken by top management.

5.6.3. Process

Inbound logistics, which involves more than 8000 components from about 220 suppliers is quite complex. AL2 has entered into a long-term transportation contract for imported materials that are received at Nhava/Sheva or Kandla port and Delhi airport. The company uses a mix of various strategies to manage its inbound logistics. The hub and spoke and the milk run systems are its mainstay. The use of vendor managed inventory (VMI) approach by AL2 has helped it to reduce its inventory carrying costs and stock outs. The initiatives of supply chain like standardization of parts, just in time (JIT), and third party logistics (3PL) also help AL2 in reducing cost and inventory.

The internet and extranet help, AL2 keep in touch with its customers, dealers and with other members of the business community. The information sharing with the suppliers is mostly extranet-based. The order processing time has reduced from five days to fifteen minutes due to complete online transaction with its dealers on the extranet. The production forecasts of AL2 are based on market research and dealer bookings. All dealers are online through extranet for transferring real time market information. The extension of extranet to sales outlets has eliminated the mess of manual booking and confirmation. The tracking of finished goods on outbound side is being done mainly by phone and fax. The call centers provide 24-hour customer service in the major cities of India.

AL2 has introduced a concept of “Balanced Scorecard” for dealer performance measurement and management. The “Balanced Scorecard” serves as an effective incentive for dealers to enhance their performance.

For fulfillment of its vision, AL2 focused on customer, 3Fs (fast, flexible and first mover), innovation, networking including partnership, and open learning environment. To back these initiatives, there was always a strong supply chain orientation, involving alignment of suppliers, employees and dealers to execute its

core supply chain practices. Therefore, realizing the growing importance of SCM in the global car market, in the year 2001 its purchase department was renamed as supply chain department.

Major supply chain practices followed are integrated inventory management, CRM, integrated IT enabled supply chain.

5.6.3.1. Vendor development strategy

AL2's vendor development is one of the key strategies for reducing production costs, and thereby a key factor for the firm's remarkable growth. AL2 source 75 to 80 percent of its about 8000 number of components requirement from the vendors. The replenishment from the joint ventures inside/near AL2 plant (about 22 percent) are on a two-hourly basis, whereas the vendors located in close vicinity such as Gurgaon, Fridabad, and Noida (about 45 percent) supply on a half-day to daily basis. The supplies from the vendors located in south and western India are on a daily basis through a buffer inventory level of 3-6 days is maintained for these vendors. AL2 maintains an average inventory level of 18 days for the imported components, less than one day for the domestic components and 45 days for steel sheets.

At AL2 the role of the vendors has gradually evolved from being tactical to being strategic where the vendors work in close coordination with AL2 to meet its long-term goals in terms of component development, quality, delivery, and cost control. In order to improve quality and generate economies of scale, AL2 has reduced the number of vendors of components in India from 370 as of March 31, 2000 to 299 in March 2003 and further to 220 by the end of 2003-04. Presently, they have about 100 key vendors. In case of repair and replacements, costs of defective components supplied are borne by the vendor. For developing its vendors it focuses on location of suppliers, regular assessment of suppliers processes and technological support to vendors from time to time.

5.6.3.2. Supplier selection criteria

Company focuses on the elimination of wasteful activities in their manufacturing processes. Similarity, yield improvement programme (YIM) and integration with world-wide purchase (WWP) system has helped in cost reduction.

Supplier Selection Criteria are Quality of products, Supplier delivery lead times and Supplier ability to cost saving initiatives, high Cultural compatibility. ISO 9000/QS 9000/TS 9013 forms the basis for producing a quality product.

In 1995, company adopted a cluster approach wherein vendors are grouped together and are trained in quality management as well as assisted in obtaining ISO 9000 certification. The cluster approach was also extended to help vendors to attain QS 9000 certification. Periodic vendor quality system audits are conduct in order to ensure that quality standards are sustained. For suppliers selection major criteria adopted by this case company are product quality, delivery lead time and ability to change with demand.

5.6.3.3. Capabilities for successful SCM

For SCM the organization need to develop certain capabilities such as after-sales service capability and capability to manage distribution network, On-time delivery capability, capabilities to control quality. It has a standardized package from i2 technologies. It provides many points accessibility, which are tightly integrated with the core system.

With the huge manufacturing set-up, the organization realized the need of integrating its manufacturing activities. Therefore in 1993, AL2 initiated the development of its in-house ERP package, which became fully operational within the next 2 years. In 2002, AL2 added finance, leasing, insurance, and pre-owned car businesses to its portfolio, increasing the scale of its operations and prompting a review of its processes and systems. For SCM the organization has a standardized package from i2 technologies. It provides many points accessibility, which are tightly integrated with the core systems. This organization is giving due focus to optimize its distribution network, quality control system and just in time systems.

5.6.3.4. Dealer management system (DMS)

AL2 joined hands with Wipro Infotech, the Asia Pacific and Middle East information technology arm of Wipro Limited, for a nationwide dealer management system (DMS). The system has been developed with the support of WIPRO at a cost of about Rs. 220 million. It integrates AL2 operations planning with the market through its 700

strong dealer base, out of which 398 are connected to this system. Its generates the entire information starting from customer enquiry to sales and post-sales activities.

The complete history of car during and after the sales, including detail of last service is available through this system. The DMS system provides total integration platform of the outbound of AL2's supply chain. It is integrated with AL2's ERP system. These dealers provide real-time information about market conditions and demand. Based on the sales forecast and dealers orders, production plans are formulated. For managing its dealers, organization has integrated all its dealers through dealers management system and inventory of spare parts is managed and controlled by OEM itself by integrating all dealers with centralized system.

5.6.3.5. Logistics, sales and distribution

Company manages its logistics activities in-house. Compared to its outbound logistics the inbound logistics are more complicated from about 100 key vendors across the country and Japan. This is managed through a mix of spoke and hub, milk run system and pooling supplies of various vendors of one area in a truck.

In selling about 30,000 cars a month through a dealer's network across the country, outbound too plays an important role in its supply chain. For outbound, it has three year rate contract with truckers and due to high volume it gets very competitive prices.

AL2 manages its logistics activities in-house. Compared to its outbound logistics the inbound logistics are more complicated from about 100 key vendors across the country and Japan. This is managed through a mix of spoke and hub, milk run system and pooling supplies of various vendors of one area in a truck. The organization has classified its vendors located in a particular area according to their production pattern and has arranged transportation accordingly. In selling about 30,000 cars a month through a dealers' network across the country, outbound too plays an important role in its supply chain. For outbound, it has a three-year rate contract with the truckers and due to high volume it gets very competitive prices.

5.6.3.6. Product lifecycle management (PLM)

Since implementing the PLM solution, engineering change notice (ECN) time at AL2 has decreased by 50 percent. Factory simulation functionality had equally beneficial results. Digital 3D plant layouts reduce errors and have cut personnel costs for accommodating new product introductions.

From the business perspective, all this means vehicles get to market sooner. The organization has experienced a reduction in design-to-launch time of 25 percent, and expects a further reduction of 15 percent as more and more of the collaboration between AL2 its suppliers is done electronically in real time. From the customers' perspective, the move to the PLM solution is seen in lower prices. Since the implementation of PLM, AL2 has reduced prices for five car models.

5.7. Learning

In order to retain its leadership, cost cutting is important but not at the cost of customer satisfaction. Therefore, it has to make the supply chain more integrated and efficient. This may be achieved through extensive and strategic use of information technology and through measurement of supply chain performance on the basis of supply chain oriented metrics. The disparity in trading partner's capabilities and lack of performance metrics with supply chain orientation are the main barriers in the supply chain improvement efforts.

The total material costs in the finished product are between 65 and 70 percent. The organization outsourced about 75 percent of its raw materials and components requirement. Therefore, efficient management of inbound logistics and materials procurement are the critical issues for better management of its supply chain. The steel procurement has major import composition from Japan and Korea. It uses large number of vendors as compared to the global industry standards.

The standardization of parts at AL2 has helped to achieve risk pooling which, in turn, reduces average inventory as well as overall inventory levels. A majority of its models have common parts that have significantly helped its vendors and logistics service providers as it gives them the benefit of economies of scale and risk management. The

modularization in product structure can result in reducing the average inventory levels.

AL2 needs to further improve its vendor managed inventory (VMI) system. With growing tierisation, a number of small loyal vendors are attached to a large vendor. The increasing tierisation has resulted in shift of a part of the assembly process to the auto component suppliers.

A supply chain is as strong as its weakest link. Therefore, the maximization of the benefits of IT in a supply chain requires all the suppliers and dealers to be willing to invest in the IT sector. The e-commerce has created new opportunities and challenges in the sales and procurement of the product and its components. Trust is necessary for information sharing among the various partners of a supply chain.

The availability of real-time data leads to improvement in forecasting and thereby enables production to be more in tune with the market demand. In absence of real time information sharing about delivery status with the logistics operator or transporter lead to uncertainties. It also results in high transportation costs or last moment changes in the delivery schedule. With advancements in IT and its strategic use by the 3PLs, supply chain of AL2 can be extended around the world. The supply chain is bound to be global in nature through e-marketplace and use of global logistics companies. AL2 has not deployed e-business technologies to such areas and processes where it could come out with products and services that are distinctly different from others and difficult to imitate.

The website needs to be made customer-focused to the extent that the customers may choose the configuration of their cars within technical and economic constraints. The IT-based real time information sharing towards modularization and postponement will reduce inventory as well as working capital requirement.

5.8. Action

Since AL2 is the original equipment manufacturer (OEM) as well as a major stakeholder in its supply chain, it make use of its dominance in the supply chain and ask the vendors to use the latest IT tools and industrial engineering practices for supply chain performance improvement. The organization has developed a system for

measuring the performance of its supply chain. This way AL2 benchmarks its supply chain practices with the best in the business. It periodically reviews its supply chain policy. Software is developed to identify the gray areas in its supply chain. Change-management and e-learning is used to address organizational and human resources issues.

The cost of material alone accounts for 65-70 percent of the total cost of a car and the vendors supply about 75 percent of the total components used in a car. Therefore, vendor management needs to be made the thrust area. The vendor performance needs to be measured on supply chain oriented metrics. The number of vendors are brought down to one or two vendors per component from the prevailing three to five vendors per component. For VMI system to improve, AL2 focus on accurate data-sharing with its vendors, utilize business intelligence systems to support automated replenishment, and make its collaborative planning, forecasting and replenishment system more mature. The strategic use of IT in vendor management has improved supply chain performance. Incentives are provided to the vendor for information sharing and for use of IT tools in the supply chain. These incentives are in terms of technological assistance, long-term contracts, status of most preferred vendor etc.

E-business technology for on-line management has been extended to the entire value chain. This is necessary for upholding its leadership position and also for delivering value for money to its customers and stakeholders. The modularization and postponement strategy have been made more effective through use of real-time information sharing with dealers. With the emergence of 3PL and their competency in using advanced IT and supply chain tools, the organization should think of outsourcing its logistics activities in a phased manner. The e-business technologies are being used to involve customers, components suppliers, dealers and other stakeholders for improving vehicle design.

5.9. Performance

Sales growth and Production growth depends upon the market demand. Yearly growth in domestic sales of company from the year 2009-2012 is 19.63%, 21.02%, 21.46% and 22.53% respectively. On the other hand, yearly growth from 2009- 2012 in production of the company was recorded 20.70%, 21.68%, 29.55% and 21.06%.

AL2 measures its vendors on quality, cost, delivery and new product development parameters. The parameters like adaptability, agility and alignment can be added to the process of vendor-selection. This will result is selecting vendors who can better deal with uncertainty. The performance measurement and benchmarking of supply chain would provide AL2 an opportunity to identify the gaps in its supply chain practices. The reduced vendor-base is likely to add to the smooth and reliable functioning of its supply chain. This will help in development of strategic relationship, lowering of expenses in IT deployment, reducing work-burden on people and the system. The periodic discussion with the employees and the supply chain partners helps to achieve better supply chain integration.

Connectivity of authorized service centres to the organizations extranet serves dual purpose. First, it provides the organization a database of the nature of complaints in its products and accordingly it can analyse these complaints and further improve the design of the product. Second, it boosts up the faith of its customers in the organization and its product.

The reduction in number of vendors, deployment of e-business technologies and processes all across the value chain result in satisfied partners in the supply chain. By introducing B2C transactions, the organization has an opportunity of disintermediation in its supply chain, which can generate some incentive to the customer.

The deployment of 3PL in logistics has helped in further streamlining of the logistic activities. The tracking of the goods has been upgraded. It will help AL2 focus better on its core area.

5.10. CONCLUDING REMARKS

For analyzing different issues of supply chain management attributes and practices of of Indian organizations, two case studies are developed in this chapter. Both organizations are among the leaders in the automobile sector and have strong supply networks. Marketing and sales department of organizations is quite enthusiastic to use e-business technology to increase efficiency of sales and delivery systems. Organizations have got ability to manufacture and deliver quality products and

services at a low cost. Production departments have on line production planning, scheduling and controlling systems.

The implementation of SCM system in an enterprise is an extremely complicated and its benefits should be taken from a long-term perspective. In this study, research is limited to the automobile industry. The research findings can be quite useful to practitioners who are implementing SCM system.

It is observed that by implementing best SCM practices such as integrated inventory management system, CRM, and effective use of IT across value chain, organizations can get maximum benefits of supply chain. Organizations need to overcome on different hindrances by effective strategy formulation. From these case studies, an in-depth insight has been gained about various issues of supply chain management attributes and practices followed by Indian organizations. Most of the findings from these case studies are similar to empirical findings. It validates results of research. Based on this knowledge and research findings, enablers for supply chain management implementation have been identified and Interpretive Structural Modeling(ISM) has been used to develop a structural relationship model in the next chapter.

CHAPTER 6

INTERPRETIVE STRUCTURAL MODELING OF ENABLERS FOR EFFECTIVE SUPPLY CHAIN MANAGEMENT

6.1 INTRODUCTION

Globalisation has forced the companies to look towards new trends across the world in order to compete in the global market. It has led to rapid change in technology which mounts immense customer service pressures. It leads to intense competition among the organisations. In order to fulfil the current requirements executives must be able to go beyond functional excellence. Nowadays, supply chain management is becoming a basic business model. A key feature of present business is the idea that it is supply chains that compete, not companies (Christopher and Towill, 2001; Pandey and Garg, 2009). Today, the challenge for firms is not just to take up a supply chain management (SCM) initiative but to implement it successfully. In order to achieve this, it is necessary to gain thorough knowledge about the issues (eg. enablers, practices, etc.) that are required for implementation of supply chains.

SCM is defined as the integration of key business processes from end user through original suppliers that provides products, services, and information and hence adds value for customers and other stakeholders (Gunasekaran *et. al*., 2004).

Effective supply chain management requires partners to build and maintain close-long term relationships. Tummala *et.al*., (2006) posit that the implementation of effective SCM involves reducing channel inventory, increasing channel cost-efficiencies, maintaining long-term relationship, encouraging interfirm cooperation and sharing risk and rewards among the members. Information sharing between the supply chain members is also essential for an effective supply chain (Stanley *et.al*., 2009). Information sharing may be of sharing of the inventory data, demand data and product quality data.

Implementation of a supply chain requires proper integration among the enablers. There are a number of enablers namely top management commitment, information sharing, collaborative planning, strategy development, cost reduction, buyer supplier

relationship, etc. Enablers support the functioning of supply chain and also influence each other (Jharkharia and Shankar, 2004). It is therefore important to understand their mutual relationship so that

those enablers which support other enablers (called "driving enablers") and those which are most influenced by others (called "driven enablers") are identified. As a result, top management may direct appropriate attention to these enablers for effective management and implementation of the supply chain.

The main objectives of this chapter are:

- To identify and rank the enablers of effective supply chain management;
- To establish relationships among the identified enablers using ISM; and
- To understand the managerial and practical implications of findings from this study.

The organisation of the chapter is as follows: the next section discusses the literature review part for the identification of enablers of effective supply chain management. It is followed by the discussion of the ISM methodology and classification of factors on the basis of driving power and dependency power. Lastly, the result and discussion of the chapter are presented which are followed by conclusion.

6.2 IDENTIFICATION OF ENABLERS OF EFFECTIVE SUPPLY CHAIN MANAGEMENT

The foundation of effective supply chain management is put into place by top management. It is the most important part as it monitors and formulates the working of the other departments. According to Gunasekaran *et. al.*, (2004) it is important to have top management support, for cross functional training, networking of processes and departments within the organization, information sharing which are necessary for an effective supply chain. Managers are required to be efficient team leaders by effectively monitoring the independent activities of multifunctional teams made up of engineering, manufacturing, marketing and financial personnel (Singh *et. al.,* 2007). According to Ou *et. al.,* (2010), management leadership is an important factor in determining SCM's effectiveness because it improves performance by influencing employee implementation of other SCM practices. Management leadership is the

main driving force behind initiating a change towards concentrating a firm's efforts on mobilizing human resources and improving operating processes. By effecting this change, firms can increase the probability of successful SCM implementation.

Strategy development is a prerequisite for implementing SCM in any firm. Strategy is crucial since it gives direction to any program. The goal of strategy development is to arrive at the most efficient, highly profitable supply chain system that serves customers in a market (Hicks, 1999). According to Mehrjerdi (2009), inventory, transportation, operating facilities, and information flows in the SC are all part of SC strategy. Top performers have a clear supply chain strategy aligned with overall business objectives and customer requirements (Geary and Zonnenberg, 2000). According to Sun *et.al.,* (2009), success of the supply chain depends on the effective strategies for the supply chain management.

Resource allocation is defined as allocating available resources (i.e., money, time, technology, manpower, material) in a economic way to achieve the desired objectives of the organization. According to Wu *et. al.,* (2009), top management is responsible for allocating resources in order to achieve an organization's purpose. In organizations, the decision-making function is the responsibility of management. A manufacturing process includes the input, the process, and the output. Thus, the input to the supply chain demands a further investigation. The inputs to a manufacturer include raw materials, the equipment or machines, human resources, energy resources, warehouse space, etc. The best supply chain is obtained by using all these resources in a well-organised and optimum way (Chan, 2003). Proper allocation of resources helps in improving productivity, reducing cost and lead-time associated with the product, finally all leads to effective supply chain management (Wu *et. al.*, 2009).

According to Jharkharia and Shankar (2005), top management should use their influence for up gradation of the IT facilities in SC to make them more effective, efficient and integrated. As the development of IT infrastructure in a supply chain is a strategic and capital-intensive issue, many researchers have highlighted the importance of mutual trust for long-term relationships and the confidentiality of information among partners (Kilpatrick and Factor, 2000; Agarwal and Shankar,

2003). Thus the effective use of information and communication technology is essential in developing an IT infrastructure that operates quickly and efficiently. The infrastructure includes the hardware and software and the nature and type of systems required for IT system in a supply chain environment (Gunasekaran and Ngai, 2004). Information and Communication Technology (ICT) is a very important strategic factor in managing supply chains. It acts as the disseminator and enabler for process and product communication along with reducing paperwork and lead times (Tummala *et. al.*, 2006).

It also provides numerous opportunities for a company to streamline communication and improve supplier/customer response deficiencies.

Trust is a favourable attitude that exists when one supply chian (SC) member has confidence in another SC member (Anderson and Narus, 1990). It is required for flow of reliable and accurate information in the supply chain. Trust may be a more important determinant of long-term orientation in more relationship-oriented, collectivist cultures (Cannon *et. al.*, 2010). Lack of trust is one of the major factors that contribute to supply chain risks (Sinha *et. al.*, 2004). According to Faisal *et. al.*, (2006), risk and reward sharing is important for decision making and developing the trust and partnership among the supply chain members.

Nowadays, the delivery systems are becoming more flexible towards customer needs. By being flexible, a delivery system can positively influence the decision of customers to place orders, and hence, this can be regarded as a metric for winning and retaining customers.

In fast-changing markets, organisations need to be flexible in meeting customer requirements. Of the factors by which supply chains compete, flexibility can be rightly regarded as a critical one. Being flexible means having the capability to provide products/services that meet the individual demands of customers (Gunasekaran *et. al.*, 2004). According to Skipper and Hanna (2009), top management support, resource alignment, information technology usage, and external collaboration provide the largest contributions to flexibility. They also found that flexibility has been shown to enhance the ability to minimize risk exposure in the event of a supply chain disruption. According to Fantazy *et. al.*, (2009), firms should invest resources

and time to develop appropriate flexibility dimensions to fit into their strategies. Further in their study on Canadian manufacturing firm they showed that Canadian manufacturers must consider use of information technology to enhance information systems flexibility and improve overall supply chain performance.

Logistics can be defined as the science pertaining to the movement of materials and the services along with the information. According to Pandey and Garg, (2009), several strategies of logistics have been developed based on the principles of logistics management, such as collaborative logistics processes, operational flexibility, logistics postponement and collaborative transportation. The collaborative logistics processes refer to joint decision making, such as assortment planning, joint forecasting, joint inventory management and replenishment (Simchi-Levi *et. al.,* 2008). Inventory management has an important role in the effective management of the supply chain (Deshmukh and Mohanty, 2009). Improved inventory management contributes to increased revenues, lower costs, and greater customer satisfaction (Schwartz and Rivera, 2010). An important role that inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution (Chopra *et. al.,* 2009). Inventory is a major source of cost in a supply chain and has a huge impact on its effectiveness. The growing focus on supply chain management for the increasing intense competitive environment calls for a more efficient management of inventory across the entire supply chain through better coordination and more cooperation. Therefore, integrated inventory management has recently received a great deal of attention (Ye and Xu, 2010).

In SCM context, delivery reliability is defined as "Ratio of the number of deliveries made without any error (regarding time, place, price, quantity, and quality) to the total number of deliveries in a period". The most important aspect of delivery reliability is on-time delivery (Singh *et. al.,* 2007a; Pandey and Garg, 2009). Bhagwat and Sharma (2007) identified different measure of delivery reliability such as delivery-to-request date; delivery-to-commit date and order fill lead-time. An increased effectiveness in these areas may lead to a decrease in inventory levels under consideration (Gunasekaran *et. al.,* 2004). On-time delivery plays a major role in lowering the cost associate with the whole supply chain (Singh *et. al.,* 2007a). According to Chan *et.*

al., (2003), like other activities, delivery heavily relies on the quality of information exchanged. Thus, the quality and the way the information is presented determine the delivery performance to a large extent, which, therefore, can be used to measure and improve performance of supply chain (Chan *et. al.,* 2003).

The ‘‘supply chain lead time’’ is the time spent by the supply chain to process the raw materials to obtain the final products and to deliver them to the customer. It includes supplier lead time, manufacturing lead time, distribution lead time, and logistics lead time for transport of raw materials and semi- finished/finished goods (Bhagwat and Sharma, 2007). The reduction in order cycle time or simply say lead-time also leads to reduction in supply chain response time (Gunasekaran *et.al.,* 2001) and hence in effective implementation of supply chain management.

Lead time reduction can lower safety stock, reduce stock out loss, and improve customer service level. More importantly, lead time can play a major role in achieving competitive advantages through quick response to customer requirement (Ye and Xu, 2010). According to Singh *et .al.,* (2007a), for operational excellence, organisations should optimise the quality/price ratio. It means that in addition to increasing quality, product cost has to be reduced. Reduced cost would lead to higher productivity and would help in achieving our goal in the optimised manner.

According to Bhaskar and lallement (2010), main challenge of the SCM system is to improve the performance while reducing the costs. Performance measurement is an important activity for the survival and growth of any firm. For effective performance measurement system, measurement goals must represent organizational goals and metrics selected should reflect a balance between financial and non-financial measures that can be related to strategic, tactical and operational levels of decision making and control (Gunasekaran *et. al.,* 2004). According to Chan (2003), performance measurement describes the feedback or information on activities with respect to meeting customer expectations and strategic objectives. It reflects the need for improvement in areas with unsatisfactory performance. Thus efficiency and quality can be improved. Shepherd and Gunter (2006) emphasized on the importance of adopting a systemic and balanced approach towards designing PMSs for SCs. The main reason for poor performance of supply chains is the lack of a measurement system (Varma *et. al.,* 2008). In SCM context,

performance measurement can further facilitate inter-understanding and integration among the supply chain members. (Chan *et. al.,* 2003). In this chapter, 14 enablers have been identified based on literature review and opinions of experts from both industries and academia for analysis. Five experts were considered for taking their opinion to develop ISM. Three experts were from manufacturing Sectors and two were from Academia.

Table 6.1: Enablers identified for ISM-based model.

S.No.	Enablers	References
1.	Top management commitment	Jharkharia and Shankar (2005); Sarmah *et al.,* (2006); Singh *et. al.,* (2007a); Ou *et. al.,* (2010).
2.	Development of IT infrastructure	Gunasekaran and Ngai (2004); Jharkharia and Shankar (2005); Tummala *et. al.,* (2006); Yu *et. al.,* (2010).
3.	Effective PMS	Gunasekaran *et. al.,* (2004); Shepherd and Gunter (2006); Chan (2006); Varma *et.al.* (2008);Charan *et. al.,* (2008); Bhaskar and Lallement (2010).
4.	Improved flexibility	Gunasekaran *et. al.,* (2004); Singh *et. al.,* (2007b); Skipper and Hanna (2009); Fantazy *et. al.,* (2009).
5.	Strategy	Mehrjerdi (2009);

	development	Fantazy *et. al.,* (2009); Sun *et. al.,* (2009).
6.	Developing the mutual trust and partnership between SC members	Sahay (2003); Faisal *et. al.,* (2006); Stanley *et. al.,* (2009); Pandey and Garg (2009) ; Cannon *et .al,* (2010).
7.	Resource allocation	Chan (2003); Wu *et. al.,* (2009).
8.	Reduced lead-time	Bhagwat and Sharma (2007); Mehrjerdi (2009); Ye and Xu (2010).
9.	Logistic planning and inventory management	Simchi-Levi *et. al.,* (2008); Deshmukh and Mohanty (2009); Pandey and Garg (2009); Ye and Xu (2010).
10.	Networking of processes and departments	Singh *et. al.,* (2007b); Pandey and Garg (2009).
11.	Productivity improvement	Li *et. al.,* (2006).
12.	Delivery reliability	Chan *et. al.,* (2003); Singh *et. al.,* (2007a); Bhagwat and Sharma (2007); Pandey and Garg (2009).
13.	Low cost	Fawcett *et. al.,* (2008);

		Pandey and Garg (2009); Bhaskar and Lallement (2010).
14.	Effective SCM	Fawcett *et. al.,* (2008);Charan *et. al.,* (2008).

6.3. ISM METHODOLOGY AND MODEL DEVELOPMENT

Interpretive Structural Modelling (ISM) is a well-established methodology for identifying relationships among specific items which define a problem (Sage, 1977). ISM methodology helps to impose order and direction on the complex relationships among elements of a system. ISM is an interactive learning process whereby a set of different directly and indirectly related elements are structured into a comprehensive systemic model. The model so formed portrays the structure of a complex issue, a system of a field of study, in a carefully designed pattern employing graphics as well as words. For complex problems, like the one under consideration, a number of enablers may helps in implementing effective supply chain management. However, the direct and indirect relationships between the enablers describe the situation far more accurately than the individual factor taken into isolation. Therefore, ISM develops insights into collective understandings of these relationships. ISM is used by a number of researchers (Jharkharia and Shankar, 2004; Jharkharia and Shankar, 2005; Singh *et. al.*, 2007a,b; Charan *et. al.*, 2008; Pandey and Garg, 2009) to develop a better understanding of the systems under consideration.

The ISM methodology is interpretive from the fact that as the judgment of the group decides whether and how the enablers are related. It is structural too, as on the basis of relationship; an overall structure is extracted from the complex set of variables. It is a modelling technique in which the specific relationships of the variables and the overall structure of the system under consideration are portrayed in a digraph model. ISM is primarily intended as a group learning process, but it can also be used individually. The various steps involved in the ISM techniques are as follows:

(1) Identification of elements which are relevant to the problem or issues, this could be done by survey or any group problem solving technique.

(2) Establishing a contextual relationship between elements with respect to which pairs of elements would be examined.

(3) Developing a structural self-interaction matrix (SSIM) of elements which indicates pair-wise relationship between elements of the system.

(4) Developing a reachability matrix from the SSIM, and checking the matrix for transitivity. Transitivity of the contextual relation is a basic assumption in ISM which states that if element A is related to B and B is related to C, then A is necessarily related to C.

(5) Partitioning of the reachability matrix into different levels.

(6) Based on the relationships given above in the reachability matrix, drawing a directed graph (digraph), and removing the transitive links.

(7) Convert the resultant digraph into an ISM based model by replacing element nodes with the statements; and

(8) Review the model to check for conceptual inconsistency, and making the necessary modifications.

The above steps, which lead to the development of ISM model, are illustrated below.

6.3.1 Structural self-interaction matrix (SSIM)

Experts from industry and academia were consulted to identify the nature of contextual relationships among enablers. Although the ISM methodology suggests the use of expert opinions alone (based on management techniques such as brainstorming, the nominal group technique, etc.) in developing the contextual relationship, the correlation coefficients as obtained from the literature review were also used to facilitate the experts in identifying the nature of these relationships. For analyzing the enablers, a contextual relationship of the 'leads to'' type is chosen. This means that one variable helps to ameliorate another variable. Based on this, contextual relationship between the variables is developed.

Keeping in mind the contextual relationship for each variable, the existence of a relation between any two enablers (*i* and *j*) and the associated direction of the relation

is questioned. Four symbols are used to denote the direction of relationship between the enablers *i* and *j* (here *i*<*j*):

(1) V: parameter *i* will lead to parameter *j*;

(2) A: parameter *j* will lead to parameter *i*;

(3) X: parameter *i* and *j* will lead to each other; and

(4) O: parameters *i* and *j* are unrelated.

The following statements explain the use of symbols V, A, X and O in SSIM:

- Enablers 3 and 7 are unrelated (O);
- Enabler 1 helps to achieve enabler 5 (V); and
- Enabler 6 will be achieved by enabler 7 (A).
- Enablers 6 and 10 will help each other (X).

Based on these contextual relationships, the SSIM is developed (Table 6.2).

Table 6.2: Structural self interaction matrix (SSIM).

S. No.	**Enablers**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	Top management commitment	V	V	V	V	V	V	V	V	V	V	V	V	V
2.	Development of IT infrastructure		V	V	A	V	A	V	V	V	V	V	V	V
3.	Effective PMS			V	A	A	O	V	V	A	V	V	V	V
4.	Improved flexibility				A	A	A	X	A	A	V	V	V	V
5.	Strategy development					V	V	V	V	V	V	V	V	V
	Developing the						A	V	V	X	V	V	V	V

6.	mutual trust and partnership between SC members													
7.	Resource allocation							V	V	V	V	V	V	V
8.	Reduced lead-time								A	A	V	V	V	V
9.	Logistic planning and inventory management									A	V	V	V	V
10.	Networking of processes and departments										V	V	O	V
11.	Productivity improvement											O	V	V
12.	Delivery reliability												V	V
13.	Low cost													V
14.	Effective SCM													

6.3.2 Initial Reachability matrix

The SSIM has been converted into a binary matrix, called the "initial reachability matrix" (Table 6. 3) by substituting V, A, X and O with 1 and 0 as per the following rules:

- If the (*i, j*) entry in the SSIM is V, the (*i, j*) entry in the reachability matrix becomes 1 and the *(j, i*) entry becomes 0;
- If the (*i, j*) entry in the SSIM is A, the (*i, j*) entry in the reachability matrix becomes 0 and the (*j, i*) entry becomes 1;

- If the (*i, j*) entry in the SSIM is X, the (*i, j*) entry in the reachability matrix becomes 1 and the (*j, i*) entry also becomes 1; and
- If the (*i, j*) entry in the SSIM is 0, the (*i, j*) entry in the reachability matrix becomes 0 and the (*j, i*) entry also becomes 0.

Table 6.3: Initial reachability matrix.

S. No.	***Enablers***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	Top management commitment	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Development of IT infrastructure	0	1	1	1	0	1	0	1	1	1	1	1	1	1
3	Effective PMS.	0	0	1	1	0	0	0	1	1	0	1	1	1	1
4	Improved flexibility	0	0	0	1	0	0	0	1	0	0	1	1	1	1
5	Strategy development	0	1	1	1	1	1	1	1	1	1	1	1	1	1
6	Developing the mutual trust and partnership between SC members	0	0	1	1	0	1	0	1	1	1	1	1	1	1
7	Resource allocation	0	1	0	1	0	1	1	1	1	1	1	1	1	1
8	Reduced lead-time	0	0	0	1	0	0	0	1	0	0	1	1	1	1
9	Logistic planning and inventory management	0	0	0	1	0	0	0	1	1	0	1	1	1	1
10	Networking of processes and departments	0	0	1	1	0	1	0	1	1	1	1	1	0	1

11	Productivity improvement	0	0	0	0	0	0	0	0	0	0	1	0	1	1
12	Delivery reliability	0	0	0	0	0	0	0	0	0	0	0	1	1	1
13	Low cost	0	0	0	0	0	0	0	0	0	0	0	0	1	1
14	Effective SCM	0	0	0	0	0	0	0	0	0	0	0	0	0	1

6.3.3 Final Reachability matrix

The final reachability matrix is obtained by incorporating the transitivity as enumerated in Step (4) of the ISM methodology. This is shown in Table 4. In this Table, the driving power and dependence of each factor are also shown. In this two transitivity's exist, first between effective PMS (3) and resource allocation (7) while other is between networking of departments and processes (10) and low cost (13). So in row 7-column 3 and row 10-column 13 respectively, zero's are replaced by one's in final reachability matrix Table 6.4.

The driving power of a particular factor is the total number of factors (including itself), which it may help achieve while the dependence is the total number of factors, which may help achieving it. On the basis of driving power and dependencies, these factors will be classified into four groups of autonomous, dependent, linkage and independent (driver) factors.

Table 6.4: Final reachability matrix.

S. No.	Enablers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	D.P.
1	Top management commitment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14
2	Development of IT infrastructure	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11

3	Effective PMS.	0	0	1	1	0	0	0	1	1	0	1	1	1	1	8
4	Improved flexibility	0	0	0	1	0	0	0	1	0	0	1	1	1	1	6
5	Strategy development	0	1	1	1	1	1	1	1	1	1	1	1	1	1	13
6	Developing the mutual trust and partnership between SC members	0	0	1	1	0	1	0	1	1	1	1	1	1	1	10
7	Resource allocation	0	1	1	1	0	1	1	1	1	1	1	1	1	1	12
8	Reduced lead-time	0	0	0	1	0	0	0	1	0	0	1	1	1	1	6
9	Logistic planning and inventory management	0	0	0	1	0	0	0	1	1	0	1	1	1	1	7
10	Networking of processes and departments	0	0	1	1	0	1	0	1	1	1	1	1	1	1	10
11	Productivity improvement	0	0	0	0	0	0	0	0	0	0	1	0	1	1	3
12	Delivery reliability	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3
13	Low cost	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
14	Effective SCM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	Dependence Power	1	4	7	10	2	6	3	10	8	6	11	11	13	14	106

Where D.P. = Driving Power

6.3.4 Level partitions

From the final reachability matrix, the reachability and antecedent set for each enabler are found. The reachability set consists of the element itself and the other elements which it may impact, whereas the antecedent set consists of the element itself and the other elements which may impact it. Thereafter, the intersection of these sets is derived for all the enablers. The enablers for whom the reachability and the intersection sets are the same occupy the top level in the ISM hierarchy. The top-level element in the hierarchy would not help achieve any other element above its own level. Once the top-level element is identified, it is separated out from the other elements (Table 5). Then, the same process is repeated to find out the elements in the next level. This process is continued until the level of each element is found. Results for other iterations are summarized in Table 6 to15. The identified levels aids in building the final model of ISM

Table 6.5: Iteration 1.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,5,6,7,8,9,10,11,12,13,14	1	1	
2	2,3,4,6,8,9,10,11,12,13,14	1,2,5,7	2	
3	3,4,8,9,11,12,13,14	1,2,3,5,6,7,10	3	
4	4,8,11,12,13,14	1,2,3,4,5,6,7,8,9,10	4,8	
5	2,3,4,5,6,7,8,9,10,11,12,13,14	1,5	5	
6	3,4,6,8,9,10,11,12,13,14	1,2,5,6,7,10	6,10	
7	2,3,4,6,7,8,9,10,11,12,13,14	1,5,7	7	
8	4,8,11,12,13,14	1,2,3,4,5,6,7,8,9,10	4,8	
9	4,8,9,11,12,13,14	1,2,3,5,6,7,9,10	9	
10	3,4,6,8,9,10,11,12,13,14	1,2,5,6,7,10	6,10	
11	11,13,14	1,2,3,4,5,6,7,8,9,10,11	11	
12	12,13,14	1,2,3,4,5,6,7,8,9,10,12	12	
13	13,14	1,2,3,4,5,6,7,8,9,10,11,12,13	13	
14	**14**	**1,2,3,4,5,6,7,8,9,10,11,12,13,14**	**14**	**I**

Table 6.6: Iteration 2.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,5,6,7,8,9,10,11,12,13	1	1	
2	2,3,4,6,8,9,10,11,12,13	1,2,5,7	2	
3	3,4,8,9,11,12,13	1,2,3,5,6,7,10	3	
4	4,8,11,12,13	1,2,3,4,5,6,7,8,9,10	4,8	
5	2,3,4,5,6,7,8,9,10,11,12,13	1,5	5	
6	3,4,6,8,9,10,11,12,13	1,2,5,6,7,10	6,10	
7	2,3,4,6,7,8,9,10,11,12,13	1,5,7	7	
8	4,8,11,12,13	1,2,3,4,5,6,7,8,9,10	4,8	
9	4,8,9,11,12,13	1,2,3,5,6,7,9,10	9	
10	3,4,6,8,9,10,11,12,13	1,2,5,6,7,10	6,10	
11	11,13	1,2,3,4,5,6,7,8,9,10,11	11	
12	12,13	1,2,3,4,5,6,7,8,9,10,12	12	
13	**13**	**1,2,3,4,5,6,7,8,9,10,11,12,13**	**13**	**II**

Table 6.7: Iteration 3.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,5,6,7,8,9,10,11,12	1	1	
2	2,3,4,6,8,9,10,11,12	1,2,5,7	2	
3	3,4,8,9,11,12	1,2,3,5,6,7,10	3	
4	4,8,11,12	1,2,3,4,5,6,7,8,9,10	4,8	
5	2,3,4,5,6,7,8,9,10,11,12	1,5	5	
6	3,4,6,8,9,10,11,12	1,2,5,6,7,10	6,10	
7	2,3,4,6,7,8,9,10,11,12	1,5,7	7	
8	4,8,11,12	1,2,3,4,5,6,7,8,9,10	4,8	

9	4,8,9,11,12	1,2,3,5,6,7,9,10	9	
10	3,4,6,8,9,10,11,12	1,2,5,6,7,10	6,10	
11	**11**	**1,2,3,4,5,6,7,8,9,10,11**	**11**	**III**
12	**12**	**1,2,3,4,5,6,7,8,9,10,12**	**12**	**III**

Table 6.8: Iteration 4.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,4,5,6,7,8,9,10	1	1	
2	2,3,4,6,8,9,10	1,2,5,7	2	
3	3,4,8,9	1,2,3,5,6,7,10	3	
4	**4,8**	**1,2,3,4,5,6,7,8,9,10**	**4,8**	**IV**
5	2,3,4,5,6,7,8,9,10	1,5	5	
6	3,4,6,8,9,10	1,2,5,6,7,10	6,10	
7	2,3,4,6,7,8,9,10	1,5,7	7	
8	**4,8**	**1,2,3,4,5,6,7,8,9,10**	**4,8**	**IV**
9	4,8,9	1,2,3,5,6,7,9,10	9	
10	3,4,6,8,9,10	1,2,5,6,7,10	6,10	

Table 6.9: Iteration 5.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,5,6,7,9,10	1	1	
2	2,3,6,9,10	1,2,5,7	2	
3	3,9	1,2,3,5,6,7,10	3	
5	2,3,5,6,7,9,10	1,5	5	
6	3,6,9,10	1,2,5,6,7,10	6,10	
7	2,3,6,7,9,10	1,5,7	7	

9	**9**	**1,2,3,5,6,7,9,10**	**9**	**V**
10	3,6,9,10	1,2,5,6,7,10	6,10	

Table 6.10: Iteration 6.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,3,5,6,7,10	1	1	
2	2,3,6,10	1,2,5,7	2	
3	**3**	**1,2,3,5,6,7,10**	**3**	**VI**
5	2,3,5,6,7,10	1,5	5	
6	3,6,10	1,2,5,6,7,10	6,10	
7	2,3,6,7,10	1,5,7	7	
10	3,6,10	1,2,5,6,7,10	6,10	

Table 6.11: Iteration 7.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,5,6,7,10	1	1	
2	2,6,10	1,2,5,7	2	
5	2,5,6,7,10	1,5	5	
6	**6,10**	**1,2,5,6,7,10**	**6,10**	**VII**
7	2,6,7,10	1,5,7	7	
10	**6,10**	**1,2,5,6,7,10**	**6,10**	**VII**

Table 6.12: Iteration 8.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,2,5,7	1	1	

2	**2**	**1,2,5,7**	**2**	**VIII**
5	2,5,7	1,5	5	
7	2,7	1,5,7	7	

Table 6. 13: Iteration 9.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,5,7	1	1	
5	5,7	1,5	5	
7	**7**	**1,5,7**	**7**	**IX**

Table 6.14: Iteration 10.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	1,5	1	1	
5	**5**	**1,5**	**5**	**X**

Table 6.15: Iteration 11.

Enabler	Reachability set	Antecedent set	Intersection set	Level
1	**1**	**1**	**1**	**XI**

6.4. RESULTS AND DISCUSSION

Based on above analysis and iterations, these factors can be classified in different categories and can be placed in different levels to develop the ISM based model.

6.4.1 Classification of factors

In this section, the enablers described earlier are classified into four clusters (Figure 6.1). The first cluster consists of the “autonomous factors” that have weak driving power and weak dependence. These factors are relatively disconnected from the system, with which they have only few links, which may not be strong. The

“dependent factors” constitutes the second cluster which has weak driving power but strong dependence. The third cluster has the “linkage factors” that have strong driving power and strong dependence. These factors are unstable due the fact that any change occurring to them will have an effect on others and also a feedback on themselves. A fourth cluster includes the “independent factors” having strong driving power but weak dependence. The driving power and dependence of each of these factors are shown in Table 4. In this table, an entry of “1” added along the columns and rows indicates the dependence and the driving power, respectively. For illustration, the enabler six having a driving power of 10 and dependence of 6 is positioned at a place corresponding to driving power of 10 and dependency of 6 in the Figure 1. Similarly all other factors considered in this study are positioned on different quadrants depending on their driving power and dependency. In figure 1 the number represents the serial number of enablers as shown in Table 1. Some of the findings from driver dependence diagram (Figure 6. 1) are given as below.

- There are no variables in the autonomous cluster, which indicates no variable can be considered as disconnected from the whole system and the management has to pay an attention to all the identified enablers of effective SCM.
- In the next cluster we have logistic planning and inventory management, improved flexibility, productivity improvement, reducing lead-time, low cost which has low driving power and high dependency that means they are dependent on the driving enablers.
- There are no linkage enablers which has a strong driving power as well as strong dependence. Thus, it can be inferred that among all the 14 enablers chosen in this study, no enabler is unstable.
- Enablers such as top management commitment, developing mutual trust and partnership between supply chain members, resource allocation, strategy development, effective PMS and development of IT infrastructure are the major drivers.

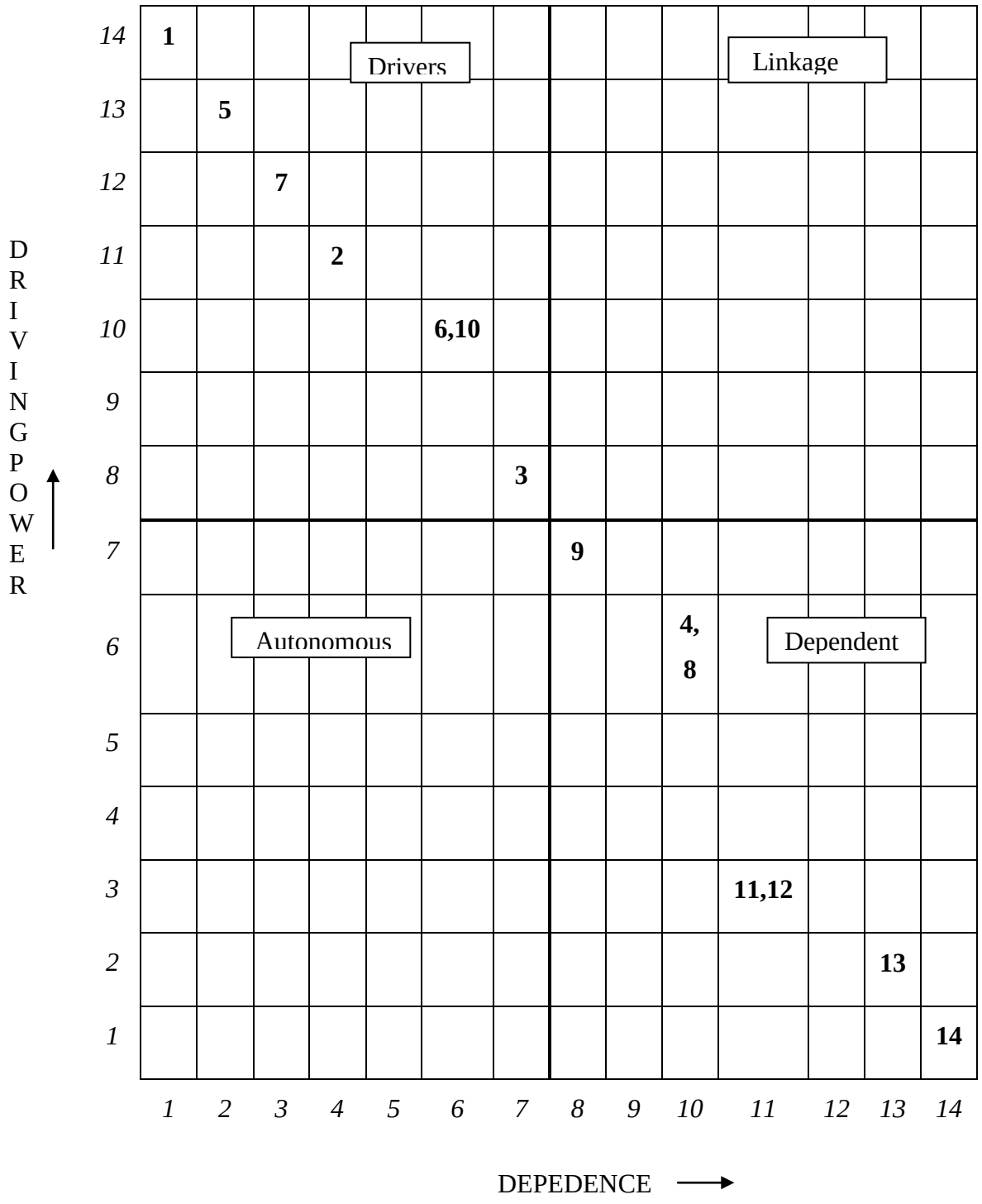


Figure 6. 1: Driving power and dependence diagram

6.4.2 Formation of the ISM model

From the final reachability matrix (Table 6. 4), the structural model is generated. If there is a relationship between the enablers *i* and *j*, this is shown by an arrow which points from *i* to *j*. This graph is called a directed graph, or digraph. The digraph is finally converted into the ISM model as shown in Figure 6. 2.

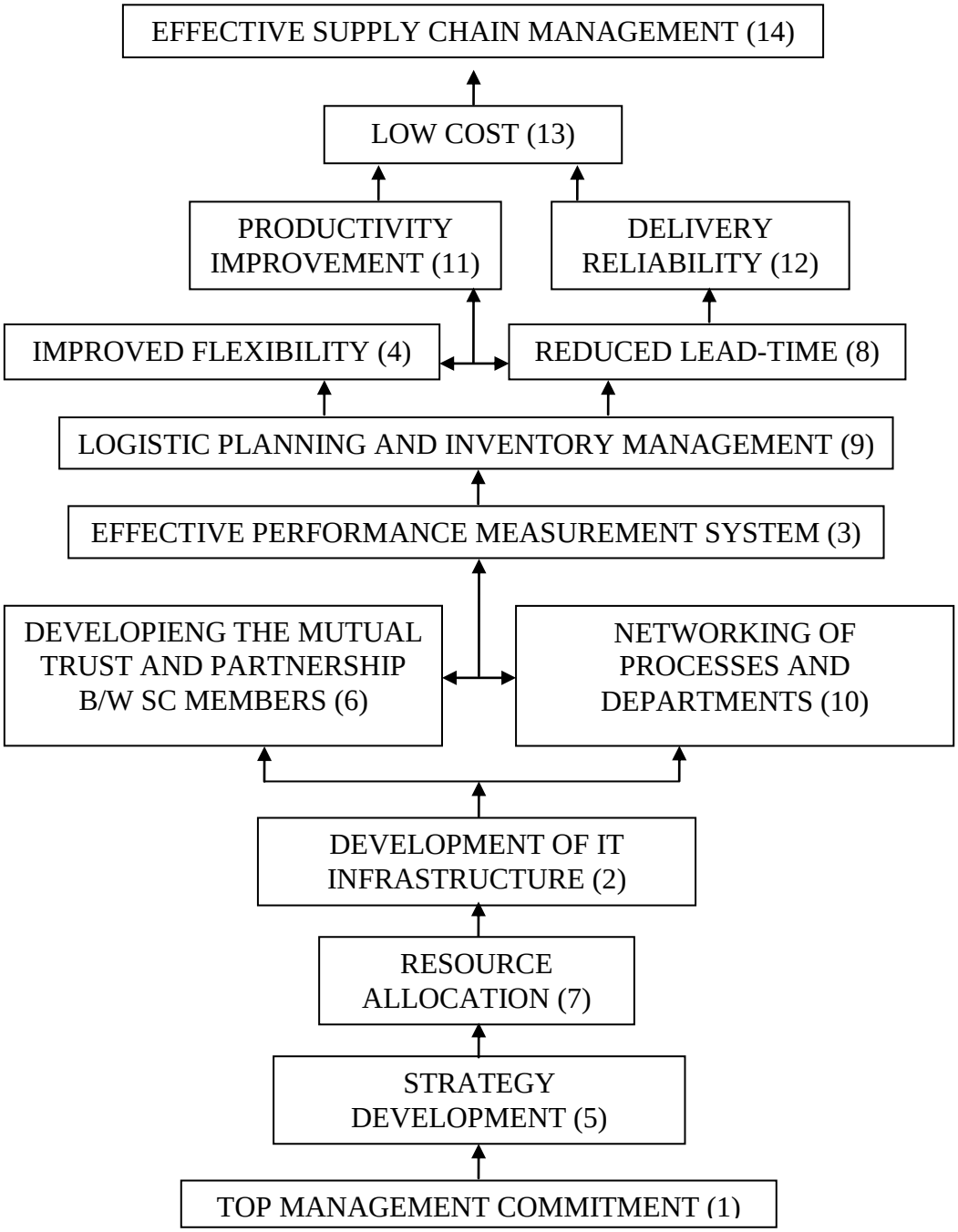


Figure 6.2: ISM-based model for enablers of effective supply chain management implementation

The objective of the ISM model in this research was to develop a hierarchy of enablers that would help in implementing effective supply chain management.

These enablers are important because today it is not individual organizations that are competing; rather it is the supply chain. A supply chain can be effective when all the partners in the chain trust each other and frequently share information among each other. Information sharing is facilitated by relationships/partnership among the supply chain members.

This study has also tried to find the levels for different variables. The levels of variables are important in understanding the successful implementation of supply chain management. It is observed that effective supply chain management is at the top of the model. Low cost is at the second level. Productivity improvement and delivery reliability are at level three. Improved flexibility and reduced lead time are at level four. Logistic planning and inventory management are at level five. These are the dependent variables. The remaining variables are at lower levels. These are top management commitment, strategy development, resource allocation, development of infrastructure, development of mutual trust, networking of processes and departments. These are the major drivers. These findings imply that for getting maximum benefits from supply chain management, top management should develop effective strategies for resource allocation, development of IT infrastructure, developing partnerships and networking of processes and departments.

The variables with higher driving powers are more of the strategic orientation. On the other hand, the dependent variables are more towards performance orientation. Thus, performance can be improved by continuously improving the driving variables. On the basis of these levels and driving power, management needs to address these driving variables more carefully.

6.5. CONCLUDING REMARKS

This chapter has tried to identify the important enablers for effective supply chain management in an organization to achieve their desired objectives. In this context, total 14 enablers were identified in present study. For establishing relationship between these identified enablers, ISM approach has been applied. It has helped us in

determining driving and dependency power of all enablers. It is observed that top management commitment, strategy development, resource allocation and development of IT infrastructure are the major drivers for implementation of effective SCM among the all 14 identified enablers. Successful implementation of effective SCM will improve organization performance in terms of lead time, low cost and fast delivery. Top management should not ignore managerial aspects such as strategy development, proper allocation of resources, networking of departments and processes.

By using the ISM methodology, study has developed a relationship model among the enablers of effective supply chain management on the basis of literature review and experts opinion. But this model has not been statistically validated. Structural equation modelling (SEM), also referred to as linear structural relationship approach, has the capability of testing the validity of such hypothetical models. Thus, this approach can be applied in the future research to test the validity of this model.

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ANNEXURE-A1

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दिल्ली इन्जीनियरिंग कॉलेज

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बवाना रोड, दिल्ली– 110 042

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क्रमांक

No.....

दिनांक

Dated .....

Subject: Study on Impact of Best Supply Chain Management Practices on the Performance of Organizations in India

Dear Sir,

Supply chain is a linked set of resources and processes that begins with the sourcing of raw materials and extends through to the delivery of end items to the final customer. In essence, Supply chain management integrates supply and demand management within and across companies. Organization can compete in the global market only if its supply chain is competitive.

Keeping in view the important role of supply chain in competitiveness of industries, a research project entitled "**Study on Impact of Best Supply Chain Management Practices on the Performance of Organizations in India**" has been undertaken. **The objectives of this project are as follows:**

- To study various supply chain management issues in Indian organization.
- Identification of best supply chain management practices followed by organizations in India.
- To study the effect of best supply chain management practices on the performance of organizations.

In this regard a questionnaire covering different issues related to supply chain management is being sent to your reputed organization. As answers of these questions provided by you, will be utmost value towards the objectives, we earnestly request you kindly spare some of your valuable time for giving answers to various questions as actually observed by your organization.

We assure you that all the information provided by you will be used only for research purposes and will not be divulged to any other organization or individual. We will be highly obliged for your kind cooperation, please. If possible kindly acknowledge its receipt through E-mail.

Thanking you

Yours Sincerely

Enclosure

- Questionnaire

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Annexure

Guidelines

- You can tick (√) more than one option if applicable.
- In scale of 1-5 (1-Very low, 2- Low, 3-Medium, 4-High, 5- Very high)
- Please provide the information for an individual organization not for complete group.
- If any issue is not applicable or relevant to your organization, please write not applicable (NA).
- Please go through following terminology before giving response to questionnaire.

Terminology

SCM: The multi firm relationship's of integrated networks from upstream supplier to downstream customers that share information, product, services, finances and knowledge.

Lead Time: Time required from beginning to end of concerned process.

JIT: Philosophy that focuses on elimination of waste and having right quantity of right quality in the right place and at the right time.

Outsourcing: To distribute some of the functions of organizations to outside agencies.

Third Party Logistics (3PL): It is outside company to perform all or part of firm materials management and product distribution functions.

Customer relationship management (CRM): CRM management practice to enhance relationship with customers for enhancing their satisfaction.

Material requirement planning (MRP): MRP is technique used to plan and control manufacturing inventory.

Electronic Data Interchange (EDI): EDI is the direct, computer to computer transmission of inter-organizational transactions, including purchase orders, shipping notices, debit or credit memos, and more.

Vendor Managed Inventory (VMI): Supplier decides on the appropriate inventory levels of each of the products and appropriate inventory policies to maintain the level.

Customization: Ability of company to deliver highly customized products and services to different customers around the world.

Bullwhip Effect: The phenomenon of distortion and magnification of actual demand as we move from the customer to the supplier in the supply chain.

Cross Docking: Warehouses function as inventory coordination points rather than storage points.

Flexibility: Ability to respond to a changing environment.

Volume Flexibility: The ability to respond to changes in order volume.

Collaborative planning forecasting and replenishment (CPFR): Focuses on information sharing among supply chain trading partners for purpose of planning, forecasting and inventory replenishment.

Responsive supply chain: Supply chain (SC) is responsive and flexible to the changing and diverse needs of the customers. To be responsive, companies use build-to-order and mass customization processes as a mean to meet the specific requirements of customers.

Efficient supply chain: Supply chain (SC) strategies aimed at creating the highest cost efficiency and reduced non value-added activities.

Strategic supply chain: It is long-term win-win relationship between a company and specially selected suppliers where a supplier is virtually an extension of the customer company (except for ownership).

Risk sharing supply chain: Sharing resources in a supply chain, the risk in supply disruption can be shared. Strategies are common in retailing, where retail store or dealership share inventory.

Agile supply chain: Relates to the interface between a company and the market. It profits by responding to rapidly changing, continually, fragmenting global markets by being dynamic.

"Study on Impact of Best Supply Chain Management Practices on the Performance of Organizations in India"

PART- A

1. Name of the organization (optional) : _____
2. Year of Establishment : _____
3. Sales Turnover (2007-2008) : Rs _____
4. Number of Employees : _____
5. Number of Professional : BE ☐ MBA ☐ MCA ☐
6. Nature of products manufactured (Please Tick):

   (a) Product for end user (b) Product for other manufacturer(s)

7. Please tick **only one** sector which suites best to your organization

   a. Plastics and Chemicals ☐
   b. Electronics ☐
   c. Automotive ☐
   d. Light Engineering ☐
   e. Any other (please specify) ☐

8. Which kind of supply chain your company is practicing (Tick only one that best describes)

   a. Responsive supply chain ☐
   b. Efficient supply chain ☐
   c. Strategic supply chain ☐
   d. Risk sharing supply chain ☐
   e. Agile supply chain ☐

1	Please mark (√) the level of the following **motivations** for implementing supply chain management in your organization. (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Motivations**	1	2	3	4	5
	1.	Reduction of product cost					
	2.	Reducing delivery lead time					
	3.	Buying from JIT suppliers					
	4.	Reducing inventory cost					
	5.	Reducing product rejection rate					
	6.	Improving flexibility of production system					
	7.	To reduce number of suppliers					
	8.	To do accurate demand forecasting					
	9.	To meet changing customer demands					
	10.	To share the risk with suppliers and customers					

2	Please mark (√) the level of importance on following investment priorities for **supply chain management success**. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Investment areas**	1	2	3	4	5
	1.	Information technology applications					
	2.	CAD/CAM					
	3.	Supplier development					
	4.	Research and Development					
	5.	Quality management					
	6.	Quick response					
	7.	Flexible manufacturing system(FMS)					
	8.	Sales forecasting and planning					
	9.	Market developments					
	10.	Human resources Development					

3	Please mark (√) the level of the following **hindrances in implementing supply chain management practices**. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Hindrances in implementing supply chain management**	1	2	3	4	5
	1.	Lack of top management commitment					
	2.	Lack of resources and funds					
	3.	Poor transportation facilities					
	4.	Lack of coordination among supply chain members					
	5.	Lack of use of modern technologies					
	6.	Poor demand forecast system					
	7.	Lack of sharing information with suppliers					
	8.	Poor quality of raw materials					
	9.	Lack of sophisticated information system					
	10.	Lack of trust among supply chain member					
	11.	Location of suppliers and customers					

4	Please mark (√) the level of implementation and use in your organization of the following **supply chain management practices**. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Supply Chain Management Practices**	1	2	3	4	5
	1.	Outsourcing					
	2.	Integrated inventory management					
	3.	Bar code/RFID/Other automatic identification tool					
	4.	Third party logistics (3PL)					
	5.	Design for logistics					
	6.	Sharing of point of sale information with the partners					
	7.	Customer relationship management (CRM)					
	8.	Dynamic pricing					
	9.	Enterprise resource planning (ERP)					
	10.	Collaborative planning and forecasting replenishment (CPFR)					
	11.	Vendor managed inventory (VMI)					
	12.	Lead time management					
	13.	Bullwhip effect analysis					
	14.	Cross docking					

5	Please mark (√) the level of **information sharing** on following issues with your suppliers and customers. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Information sharing**	1	2	3	4	5
	1.	Inventory status					
	2.	Order tracking					
	3.	Product development					
	4.	Sales forecasting					
	5.	Company's future plans					
	6.	Company's production costs					
	7.	Technology know-how					

6	Please mark (√) the level of importance for following practices to improve **customer satisfaction** in your organization**.** (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Customer satisfaction**	1	2	3	4	5
	1.	Use of quality control techniques					
	2.	Commitment to continuous improvement in products and processes					
	3.	Successful resolution of customer complaints					
	4.	Entering into long term contract arrangement					
	5.	Being flexible to meet customers changing needs					
	6.	Employing a customer satisfaction measurement system					
	7.	Use of electronic data interchange(EDI)					
	8.	Employing routine follow-up procedures for customer inquiries or complaints					
	9.	Interaction with customers to set reliability, responsiveness and other standards					

7	Please mark (√) the level of satisfaction on following **capabilities** for your organization. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Capabilities**	1	2	3	4	5
	1.	Quality control capability in processes					
	2.	The capability to forecast accurate demand					
	3.	On-time delivery capability					
	4.	The capability to deliver products quickly					
	5.	After-sale service capability					
	6.	The capability to advertise and promote the product					
	7.	The capability to utilize innovative marketing technique					
	8.	The capability to manage distribution network					
	9.	Product design and development flexibility					

8	Please mark (√) the level of importance for following issues/tools in your firm's new **product design and development activates**. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Product design and development activates**	1	2	3	4	5
	1.	Modular design of parts					
	2.	Early supplier involvement					
	3.	The use of concurrent engineering					
	4.	Simplification of component parts					
	5.	Standardization of component parts					
	6.	The use of value analysis/value engineering					
	7.	Involvement of customers					
	8.	Use of CAD and rapid prototyping					
	9.	Postponement and customization					

9	Please mark (√) the level of importance given to following criteria for **supplier selection**. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Supplier selection criteria**	1	2	3	4	5
	1.	Quality of products					
	2.	Suppliers ability to cost saving initiatives					
	3.	Supplier delivery lead times					
	4.	Supplier capacity					
	5.	Volume flexibility					
	6.	Cultural compatibility					
	7.	Geographical proximity					
	8.	Product rejection rates					

10	Please mark (√) the level of the importance for following **environment related issues** in your organization. (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Environmental issues**	1	2	3	4	5
	1.	Buy back					
	2.	Design of products for Recycle and Reuse					
	3.	Design of products for reduced consumption of material/energy					
	4.	Design for environment					
	5.	ISO 14000 certification					
	6.	Environmental audit for suppliers					
	7.	Cooperation with customers for green packaging					

11	Please mark (√) the level of the following **supplier's development activities** in your organization with respect to your goals. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Supplier Development Activities**	1	2	3	4	5
	1.	Assessment of suppliers activities					
	2.	Supplier certification					
	3.	Providing incentives to suppliers for improved performance					
	4.	Providing training to the staff of the supplier					
	5.	Technology support to supplier					
	6.	Financial support to supplier					
	7.	Managerial support in planning and control of production system					
	8.	Close partnership with supplier for Product design					
	9.	Collaborative planning for forecasting and replenishment					

12	Please mark (√) the level of importance of following **efforts** by your firms for supply chain management implementation. (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very high)						
	SN	**Efforts for supply chain management**	1	2	3	4	5
	1.	Locating closer to your customers					
	2.	Locating suppliers closer to your firm					
	3.	Development of transparency and information sharing mechanism					
	4.	Networking with suppliers and customers					
	5.	Integrate departments within the organization					
	6.	Development of cross functional teams and quality circles					
	7.	Reducing response time across the supply chain					
	8.	To organize training programs					

13	Please mark (√) the level of importance for the following **performance measure** for your organization by implementing supply chain management practices. (1-Significant decrease, 2-Decrease, 3-Same as before, 4-Increase, 5- Significant increase)						
	SN	**Performance Measure**	1	2	3	4	5
	1.	Sales growth					
	2.	Profit growth					
	3.	Return on investment					
	4.	Deliver on time					
	5.	Responsiveness					
	6.	Reduction in lead time					
	7.	Reduction in inventory cost					
	8.	Reduction in manufacturing cost					
	9.	Reduction in product rejection rate					

The Respondent's Profile

Name and Designation (Optional):_____

Qualifications and Experience: _____

E-mail address and Phone:_____

Mobile
Number:_____

Website of the organization:_____

Thanking you Sir for sparing your very valuable time. Kindly send this back to following address.

» Please mail the Completed questionnaire to:

Hari Om Sharma
(Research Scholar)
C/o Dr. R.K. Singh
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Email: hodce2002@yahoo.com
Mob: 919911754246

ANNEXURE-A2

LIST OF PUBLICATIONS FROM RESEARCH WORK

International Journals

1. Paper published in International Journal of Business Performance and Supply Chain Modelling on "Interpretive structural modeling for selection of best supply chain practices", Vol. 2, Nos. 3/4, 2010, pp.237–257.
2. Paper (**Accepted)** International Journal of Applied Science and Technology (IJAST) on "Balanced scorecard approach for performance analysis through analytic hierarchy process (AHP)", 2014.
3. Paper (**Accepted)** for Global Business Review on "Study on supply chain issues in Auto component manufacturing organization-A Case study, 2014.

International/National Conferences

4. Paper presented on "Study of supply chain management and emerging issues in automobile sector" (ISTE-157), ISTE Delhi Section convention, 2013, DTU, Delhi.
5. Paper presented in International conference on "Role of third-party logistics (3PL) in success of supply chain: A Review", Macmillan Advanced Research Series (Strategies and Innovations for Sustainable Organizations) ISBN CORP-000186, 2011, pp.577-594.
6. Paper presented on "The role of performance measurement in supply chain management", National Conference on Advance in Mechanical Engineering (NCAME 2009) Moradabad Institute of Technology, Moradabad (pp. 317-325).
7. Paper presented on "Selection of attributes for effective supply chain management", National Conference on Recent Advances in Mechanical and Production Engineering (RAMP 2009), G.B. Pant University of Agriculture and Technology, Pantnagar, (pp. 315-321).

ANNEXURE-A3

BIOGRAPHICAL PROFILE OF HARI OM SHARMA

1971	Born in Meerut, Utter Pradesh (U.P) , India,15th July
Academics	
2014	Registered for Doctor of Philosophy in Production and Industrial Engineering from University of Delhi, Delhi, India since 2009
2006	Post-Graduated from DCE, University of Delhi, Delhi, India.
2000	Graduated in Production Engg from N.M.U. Jalgaon MS.
Experience	More than 12 years of teaching and research experience in Mechanical Engineering
Affiliation	• Life member of Indian Institute of Industrial Engineering (IIIE) • Life member of Indian Society for Technical Education (ISTE)

STUDY ON IMPACT OF BEST SUPPLY CHAIN MANAGEMENT PRACTICES ON THE PERFORMANCE OF ORGANIZATIONS IN INDIA

Thesis submitted to the Faculty of Technology,
University of Delhi in fulfillment of the requirement
for the award of the Degree of

DOCTOR OF PHILOSOPHY

IN

PRODUCTION AND INDUSTRIAL ENGINEERING

BY

HARI OM SHARMA

Under the supervision of

DR. R. K. SINGH
Associate Professor

DR. S. K. GARG
Professor

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING
FACULTY OF TECHNOLOGY, UNIVERSITY OF DELHI
DELHI-110007, INDIA
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IN

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2014

CHAPTER 7

SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

Supply chain management (SCM) often refers either to a process-oriented management approach to sourcing, producing and delivering goods and services to end consumers or, in a broader meaning, to the co-ordination of the various actors belonging to the same supply chain (Harland, 1996). Co-operation among firms belonging to the same supply chain is nowadays recognised as a powerful source of competitive advantage.

Leading-edge companies have realised that by transferring costs either upstream or downstream, they are actually not increasing their competitiveness, since all costs ultimately make their way to consumers. Hence, SCM asks firms to co-operate with the common goal to increase the overall channel sales and profitability, rather than competing for a bigger share of a fixed profit.

Companies typically begin by flattening their organizations and by moving the focus away from short-term economic goals alone. After that, the search for cost-cutting opportunities gives a greater importance to the internal flow of goods and to process-oriented management practices. At this stage, companies reduce the number of administrative functions and encourage the exchange of information among departments.

7.2 SUMMARY OF WORK DONE

In brief the work done in this research can be summarized as given below.

- A literature survey was conducted to identify contemporary research issues and their relevance in context of Indian organizations. For this purpose more than 325 research papers were reviewed from different International Journals like International Journal of Production Management (IJOPM), International Journal of Production Research, Harvard Business Review, Omega International Journal of Management Science, Sloan Management Review,

International Journal of Management Science, Journal of Industrial Engineering, Productivity, Technovation, Journal of Purchasing and Supply Management etc. On the basis of the extensive literature review major gaps identified are as given below.

- There have been very few empirical studies on identification of best supply chain management practices for Indian organizations.
- Few studies on comparison of different manufacturing sectors in terms of various supply chain management issues have been carried out in Indian context.
- Relationship between supply chain management practices and performance have not been explored in previous studies.
- Few frameworks for successful implementation of SCM in Indian organization have been suggested.

- On the basis of gaps identified from literature and discussion with industry professionals a comprehensive questionnaire was prepared to collect response of Indian organizations on several issues.
- Responding organizations were categorized on the basis of sectors, as automotive (88), light engineering (71), any other (57), electronics (22), plastics and chemicals (15).
- Major issues /areas considered for this study are investment priorities for SCM success, hindrances in implementing SCM practices, information sharing issues, customer satisfaction, capabilities, product design and development activates supplier selection criteria, environmental issues, supplier development activities and efforts for supply chain management.
- Major SCM practices identified are Outsourcing, Integrated inventory management, Barcode/RFID/Other automatic identification tool, Third party logistics (3PL), Design for logistics, Sharing of point of sales data, information with the partners, Customer relationship management (CRM), Dynamic pricing, Enterprise resource planning(ERP), Collaborative planning

and forecasting replenishment(CPFR), Vendor managed inventory(VMI), Lead time management, Bullwhip effect analysis and Cross docking.

- Various dimensions of performance measures were identified. These are sales growth, profit growth, return on investment, and deliver on time, responsiveness, reduction in lead time, reduction in inventory cost, reduction in manufacturing cost and reduction in product rejection rate.
- Supply chain management practices and attributes were measured on basis of respondent perception on five point likert scale (1-Very low, 2- Low, 3-Medium, 4-High, 5-Very high).
- To analyze supply chain management issues and survey results in depth, two case studies were developed.
- Based on survey results and observations from case studies, enablers for effective supply chain management were identified.
- Interpretive Structural Modeling(ISM) was done for selected enablers to develop a framework for effective supply chain management. With the help of ISM, driving power and dependence power for different factors was also determined.

7.3 RESEARCH FINDINGS

Research findings of this study can be classified in three parts. First part discusses about descriptive analysis for responding organizations, second part discusses about learning from case studies and finally third part discusses about ISM based model for effective supply chain management.

7.3.1 Descriptive analysis for responding organizations

The survey responses were analyzed to identify major issues related with best supply chain management (SCM) practices and attributes. Major research findings from descriptive analysis are shown in Table 7.1.

Table 7.1: Top three factors from descriptive analysis for different sectors.

Issues	Automotive	Electronics	Light Engineering
Motivations for Implementing SCM	Reduction of Product Cost, Reducing delivery lead time, Reducing inventory cost	Meet changing customer demands, Reduction of Product Cost, Reducing inventory cost	Meet changing customer demands, Reducing delivery lead time, Reduction of Product Cost
Investment Priorities for SCM Success	Quick response, Information technology applications, Quality management	Information technology applications, Quick response , Quality management	Quality management, Quick response, Market developments
Hindrances in Implementing SCM Practices	Lack of use of modern technologies, Poor demand forecast system, Lack of coordination among S C Members	Lack of coordination among S C Members, Lack of resources and funds, Lack of use of modern technologies	Location of suppliers and customers, Lack of sharing information with suppliers, Lack of coordination among S C Members
Supply Chain Management Practices	Customer relationship management(CRM), Enterprise resource planning(ERP), Integrated inventory management	Customer relationship management(CRM), Lead time management, Third party logistics(3PL)	Customer relationship management(CRM), Enterprise resource planning(ERP), Lead time management

Information Sharing Issues, Suppliers and Customers	Order tracking, Sales forecasting, Product development	Company's production costs, Product development, Order tracking	Order tracking, Company's production costs, Inventory status
Customer Satisfaction	Commitment to continuous improvement in products and processes, Interaction with customers to set reliability, responsiveness and other standards, Successful resolution of customer complaints	Interaction with customers to set reliability, responsiveness and other standards, Being flexible to meet customer's changing needs, Use of quality control techniques	Use of quality control techniques, Successful resolution of customer complaints, Commitment to continuous improvement in products and processes
Capabilities	Quality control capability in process, The capability to manage distribution network, On-time delivery capability	Product design and development flexibility, Quality control capability in process, On-time delivery capability	Quality control capability in process, The capability to manage distribution network, On-time delivery capability
Product design and Development Activates	The use of value analysis/value engineering, Standardization of	The use of value analysis/value engineering, Involvement of	The use of value analysis/value engineering, Standardization of

	component parts, Simplification of component parts	customers, The use of concurrent engineering	component parts, Modular design of parts
Supplier Selection Criteria	Quality of products, Supplier delivery lead times, Supplier capacity	Quality of products, Suppliers ability to cost saving initiatives, Supplier delivery lead times	Quality of products, Supplier delivery lead times, Suppliers ability to cost saving initiatives
Environmental Issues	ISO1400 certification, Design for environment, Design of products for reduced consumption of material/energy	Design for environment, ISO1400 certification, Design of products for recycle and reuse	Design for environment, Cooperation with customers for green packing, ISO1400 certification
Supplier Development Activities	Managerial support in planning and control of production system, Assessment of suppliers activities, Supplier certification	Supplier certification, Assessment of suppliers activities, Close partnership with supplier for product design	Supplier certification, Collaborative planning for forecasting and replenishment, Assessment of suppliers activities
Efforts for Supply Chain Management	Networking with suppliers and customers, Reducing response time across the	Reducing response time across the supply chain, Development of transparency and	Reducing response time across the supply chain, Networking with suppliers and

	supply chain, Development of cross functional teams and quality circles	information sharing mechanism, Networking with suppliers and customers	customers, Development of cross functional teams and quality circles
Performance Measure	Deliver on time, Responsiveness, Reduction in product rejection rate	Responsiveness, Profit growth, Deliver on time	Profit growth, Deliver on time, Sales growth

7.3.2 Development of case studies

For analyzing different issues of supply chain management practices in depth, two case studies were developed. First organization is Manufacturer of automotive light components. Second organization is OEM from automotive sector. The research methodology adopted for these case studies is given in Table 5.1. SAP-LAP analysis for each organization is done. Major research findings from these case studies are as follows.

- Major SCM practices followed are CRM, integrated inventory management, just in time systems etc.
- Major hindrances in SCM implementation are location of suppliers and customers, inaccurate demand forecasting and lack of coordination and trust among supply chain members.
- Both organizations the giving attention on IT applications in different functions and for integration of supply chain.
- Both organizations have got benefitted by applying SCM practices.

7.3.3 Interpretive structural modeling

On the basis of survey results, inputs from case studies and literature review and expert's opinion, critical success factor were identified for effective supply chain management in an organization. Total 14 enablers were identified. Major findings of this study as follows.

- Top management commitment, strategy development, resource allocation, development of infrastructure, development of mutual trust, networking of processes and departments were at the bottom of the model having strong driving power. It means these variables will help organizations to achieve its desired objectives and are classified as independent variables or drivers.
- It is observed that effective supply chain management is at the top of the model. Low cost is at the second level. Productivity improvement and delivery reliability are at level three. Improved flexibility and reduced lead time are at level four. Logistic planning and inventory management are at level five. These are the dependent variables.
- Successful implementation of effective SCM will improve organization performance in terms of lead time, low cost and fast delivery.

7.4 CONTRIBUTIONS OF THE STUDY

The contribution to knowledge recorded in this thesis is four fold. Firstly, comprehensive literature review on supply chain management practices. Review of literature on supply chain management practices, shows that there has been little work reported on study of best supply chain management practices, in Indian context. Secondly, extensive multi sector survey of Indian organizations from different parts of country is conducted to investigate various issues related with supply chain management practices. 257 organizations belonging to different sectors such as automotive, electronics, light engineering etc have participated in the study. The third contribution to knowledge is made through development of two case studies to obtain further insights into Indian organizations and of different sectors. The fourth contribution to knowledge is made by developing ISM based model.

7.5 IMPLICATIONS OF THE STUDY

Implications can be analyzed from two perspectives as follows.

7.5.1 Managerial implications

For practitioners, this study provides several important implications:

- It will help to organizations management in understanding concept of best supply chain management practices.
- With the help of proposed framework for selection of best supply chain management practices, organizations can analyze their performance continuously.
- ISM based model will help organisations in integrating different functions and implementation of SCM.
- These observations will help Govt agencies such as National Manufacturing Council, CII, FICCI etc, in framing policies for motivating Indian organizations to improve their supply chains.

7.5.2 Implications for academia

- Questionnaire developed can be further extended to examine linkages with other business functions and issues of supply chain management practices.
- Best supply chain management practices for other sectors can be further analyzed.

7.6 LIMITATIONS AND SCOPE FOR FUTURE WORK

Five manufacturing sectors (Automotive, Electronics, Light Engineering, plastics and chemicals, any other) participated in this study. These are growing sector in Indian economy. Organizations from all part of countries participated in this study. Total 257 respondents were finally selected. Sample size was higher than other reported studies.

However, this study has some limitations. Majority of respondents were from north and central part of India. Therefore this study can be further extended on cluster or region basis for other sectors. In developing ISM model external factors such as government policies and infrastructures were not considered. Therefore these factors can be considered for further modeling. This ISM framework can be further validated by statistical analysis as a future scope of study.

7.7 CONCLUSION

Manufacturing organizations are considered as engine for economic growth of India. But due to unavailability of sufficient literature and different hurdles in collecting data from organizations, very few extensive empirical studies could be conducted on best supply chain management practices of organizations. Therefore present study may be first of its own kind, conducted exclusively on best supply chain management practices of organizations in Indian context.

For collecting responses, questionnaires were mailed to about one thousand three hundred manufacturing organizations. Total duration for collecting response was about one year. In spite of continuous efforts through e-mail, post, telephone, personal visits to organizations and many reminders, only 257 complete responses could be finalised.43 responses were rejected due to incomplete information. Two case studies were developed to understand supply chain management issues in real situation. On the basis of observations from survey, learning from case studies and discussion with other experts, ISM model was also developed. This model will help organizations in developing strategies for implementing supply chain management effectively. Looking into significance of manufacturing sector, this study may be a small step in direction of identification of best supply chain management practices but surely it will work as a strong foundation for other researchers to pursue this cause further. It will also motivate manufacturing organizations to use best supply chain practices to achieve sustainable competiveness. Proposed framework for selection of best supply chain practices will be also helpful to change supply chain practices on continuous manner as per market requirements.