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"Collaborative Knowledge Management Practices across North India in Supply Chain Management"

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ACRONYMS

KM	Knowledge Management
CKMP	Collaborative Knowledge Management Practices
SCM	Supply Chain Management
TK	Tacit Knowledge
EK	Explicit Knowledge
KA	Knowledge Acquisition
KB	Knowledge Base
DM	Decision Making
CRM	Customer Relationship Management
H	Hypothesis
SC's	Supply Chains
KC	Knowledge Creation
KD	Knowledge Dissemination
KS	Knowledge Sharing
KST	Knowledge Storage
SCP	Supply Chain Performance
SCI	Supply Chain Integration
TI	Technological Infrastructure
OI	Organisational Infrastructure

Table of Contents

CHAPTER – I

INTRODUCTION

1. Introduction

Supply chain is a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flow of products, services, finances and/or information from a source to a customer (Mentzer et.al, 2001, p.4) .The concept of supply chain management (SCM) has received increasing attention since businesses have been able to achieve significant benefits as the result of implementing collaborative relationships both within and beyond their own organizations (Lummus and Vokurka, 1999). Christopher (1998) has further stated that effective SCM is a powerful tool with which to achieve cost advantage and a more profitable outcome for all parties in the supply. With the trend of globalization, increased customer demand and advancement in technology development, firms are experiencing ever intense pressure to collaborate with their trading partners to compete with other supply chains. The often discussed inter-firm information sharing practices are not sufficient to provide enough insights and understanding to each trading partner for optimizing its products/services. Firms are seeking to collaborate with their partners at greater extent in the areas such as knowledge management to exploit the potentials of an efficient and effective supply chain.

Supply chain management has been a common practice in today's business world. As pointed out by numerous researchers, current competition is no longer between organizations, but between supply chains. Organizations must integrate their operations with trading partners, rather than work against them in order to maintain competitive advantages for the entire supply chain (Such as Spekman et al., 1994, Monczka and Morgan, 1998; Cox, 1999; Lambert and Cooper, 2000). In today's business environments, it is no longer an option, but a must to better manage and integrate the supply chain (Spekman et al., 1998; O'Connell, 1999).

According to Spekman et al. (2002), effective SCM requires effective knowledge management (KM). They have argued that the KM can constitute the basis of competitive advantage if it is extended beyond individual organizations to embrace the whole supply chain. Both businesses and academic communities believe that a competitive edge can be gained and sustained through an efficient KM (Bhatt, 2001; Neef, 1997, 1999). Maqsood et al. (2007) argue that through KM a supply chain's intangible assets can be better exploited to create value. Managing knowledge is becoming crucial for the long-term survival in the long-term of firms

SC integration is considered as a strategic tool, which attempts to minimize the operating costs and thereby enhancing values for the stack-holders (customers and shareholders) by linking all participating players throughout the system; from supplier's suppliers to the customers.A strategic supply chain integration comes from the belief that the partnering companies will be able to create a new capability which they would otherwise not be able to create separately (Hall and Andriani, 1998). Such capability involves risk sharing, enhanced market responsiveness, corresponsive logistic support etc. All of them can be translated to competitive advantages for all the firms on the value chain. Thus, companies are pursuing to establish and maintain intensive and interactive relationships with their partners in order to collaborate in such activities as new product development, business processes integrationand strategic knowledge exchange (Lin et al, 2002). Siemieniuch and Sinclair (2004) reported that the European manufacturers are increasingly pushing their key partners to take responsibility in designing, developing and supplying components and system.

However, supply chain integration is a cross-functional, complex, and dynamic process, and very difficult to manage (Crawford, 1996; Song et al., 1997). Despite considerable progress that has been made to explore the ways to enhance supply chain integration, there are still many issues remain unexplored. It is particularly evident in relation to

across supply chain knowledge management issues.

Although supply chain's primary role is as a material-processing and product movement system, information processing is critical to supply chain success (Bowersox, et al., 1999). Daft and Weick (1984) argued that gathering, processing, and acting on data from the environment is a firm's main task. Cormican and O'Sullivan, (2003) also believed that knowledge is key resource that must be managed for all the organizations in the supply chain to remain competitive in global markets.

Organisations are realising that Knowledge Management is a valuable instrument towards improving their performance. The organisations are well aware that in the prevailing competitive environment, survival is only possible if they are well connected with people, processes, technology and knowledge management which provide them the leverage thereby enhancing their corporate knowledge and operations. Researchers who study the strategic impacts of knowledge management have noted the criticality of knowledge and knowledge management in building an effective supply chain relationship and in achieving positive supply chain performance. For instance, Jarvenpaa and Tanriverdi (2003) propose that knowledge creation is a key to a firm‟s survival and to its value chain‟s competitiveness. Hult et al. (2004) conclude that the knowledge development process in a strategic supply chain, which consists of knowledge acquisition activities, knowledge distribution activities, and formation of shared meaning, is an important predecessor to supply chain efficiency as measured by cycle time. Despite the emphasis on the role of knowledge in supply chains, there has been a lack of systematic understanding of what constitutes a supply chain‟s knowledge management capability and how to build knowledge management capability in supply chains (Gunasekaran and Ngai 2007).

Collaborative knowledge management practice (CKMP) is the discipline of enabling individuals in a series of organizations to collectively create, share, access, and apply

knowledge across company boundaries to achieve the business objectives of the entire supply chain. CKMP is different from traditional inter-organizational systems, which only allows limited amount of transaction data to be shared.

While the CKMP intends to exchange rich knowledge among supply chain partners by establishing a knowledge network that allows the participants to create, share, and apply knowledge to strategically improve operational efficiency and effectiveness and enables the analysis and management of all supply chain activities. CKMP can fundamentally change the nature of inter-organizational relationships in sharing resources and competences.Through CKMP, firms achieve integration by tightly coupling processes at the interfaces between stages of the value chain (Lin et al, 2002). Sakkas et al. (1999) believe that the introduction of CKMP triggers the formation of new organizational entities to resume the role of the information broker and in effect re-shape the traditional supply chain.The partner firms can take advantage of lowering search cost for information and expertise, combined capability for generating and access to larger amount of and higher quality knowledge. Thus, CKMP is believed to enhance the competitive advantage of the supply chain as a whole. Holland (1995) also argued that the implementation of inter-organizational knowledge management system by suppliers can improve organizational coordination and product quality.

The last decade has witnessed business world's significant interest in exploring the operation and impact of knowledge management on the supply chain dynamic performance. However, our literature review reveals that the research on managing knowledge across organizational boundaries can best be described as sparse (e.g. Holtshouse, 1998). The small numbers of existing papers are limited in scope. The key question is more than whether to manage knowledge collaboratively, but how to manage it. The studies of Apostolou et al (1999), Zaneldin et al (2001), and Lin et al (2002) only examined the technological aspects of knowledge coordination. Desouza et al (2003)

explored the internal information flow mechanism of collaborative knowledge management system, but they didn't investigate how companies can leverage knowledge for the improved performance. While other articles only studied limited operational consequences of CKMP, without exploring the strategic implication to the supply chain, for example, Hult et al (2004) studied the system's effects on total cycle time, and Cormican and O'Sullivan (2003) illustrated the influence to NPD innovativeness. Very little work has been done to formulate an investigative model validated by empirical evidence for the management of knowledge at supply chain context. The conceptual confusion and the lack of theoretical framework in supply chain wide knowledge management research hinders the development of new knowledge in academia as well as supply chain collaboration practices in real corporate world. There are many problems still exist in the coordinating knowledge management efforts for supply chain participants. Lee and Choi (2003) presented some cases of firms with mixed results when trying to implement CKMP. They reported that there are some barriers (e.g. expensive technology investment, personnel trainings, lack of managerial support, lack of mutual trust) which hinder organizations to involve in collaborative knowledge management practice. Many organizations still treat knowledge management as an in-house function that is stand alone from their integration endeavourer with supply chain partners. Further research efforts are needed to view knowledge management efforts from the supply chain perspective and study the related enabling environment and organization impact of CKMP

Firms can no longer effectively compete in isolation of their suppliers and other entities in the supply chain (Lummus and Vokurka, 1999). As organizations seek to develop partnerships and more effective information links with trading partners, internal processes become interlinked and span the traditional boundaries of firms. Various views and definitions have been reported on supply chain management (SCM). For example,

- ✓ the functions within and outside a company that enable the value chain to make products and provide services to the customer (Cox et al., 1995);
- ✓ SCM is defined as the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer et al., 2001);
- ✓ SCM is a melding of logistics (i.e. of distribution and production), procurement, industrial organization economics, marketing and strategy, which emerged as a distinct area of research in the mid-1980s (London and Kenley, 2001);
- ✓ SCM is the collaborative effort of multiple channel members to design, implement, and manage seamless value-added processes to meet the real needs of the end customer (Burt et al., 2004).

The field of supply management is evolving, developing positively, and addressing discipline and theory issues (Harland et al., 2006; Burgess et al., 2006). Supply (chain) management is ultimately about influencing behavior in particular directions and in particular ways (Storey et al., 2006). Mainly, present focus of SCM research is found inclined to large-scale organizations where small businesses act as an ancillary/1st and 2nd tier suppliers in their supply chain. Specifically, fast moving consumer goods (FMCG) and the automobile industry have traditionally been dependent on small and medium scale enterprises (SMEs') where the

latter constitute as first tier suppliers. In many of countries, under the regime of free trade and globalization, the state(s) have withdrawn the protection it provided to small-scale business. Large organizations can now take-up products and services which till recently were reserved for the small-scale sector. With a wish to minimize the system wide cost large organizations often expects various kinds of changes at the end of their SMEs' supply chain partners. On the other side, SMEs' are more likely to have a differentiation advantage than a cost advantage does, most often due to the existence of scale, scope and learning economies in the industry (Porter, 1980).

Superior features and quality, as well as superior customer service, are ways that smaller industrial units often use to differentiate their products and services from those of the more commoditized LEs' (Porter, 1985). Supply chain inefficiency is one of the most prevalent issues facing the small- to mid-size enterprise (Lewis, 2005). SCM appears to be a method for LEs' to de-commoditize their products to reap a price premium from the market and, as an unfortunate side effect, to shrink the differentiated product territory of smaller firms (Elmuti, 2002). Supply and process costs represent 30 per cent of an average manufacturing SMEs' budget and logistics cost incurs about 40 per cent of total supply spending (John and Riley, 1985).

On the other side, smaller industrial units are now more and more taking part in the global business network participating in many interlinked supply chains (Hvolby and Trienekens, 2002). But sustainability and ability to meet changing needs for SMEs' are questionable when they do not have much flexibility in setting prices being a supplier to large organizations and for this, streamlining of their supply chain activities becomes equally important. From a manufacturing strategy point of view, the key strengths of smaller industrial units are: *flexibility, quick decision-making and co-operation from employees*,

while weaknesses are: *the lack of technical superiority, lack of infrastructural facilities and of financial resources* (Dangayach and Deshmukh, 2001).

There are three central aspects in which small firms are different to large firms (LEs'): *uncertainty, innovation and evolution*. SME advantages tend to be *behavioral, stressing qualitative differentiation and innovation* (O'Gorman, 2001).

The characteristics of processes and system at large are different for smaller industrial units compared to LEs'. Smaller industrial units are *more cash focused, short term and instill better communications and incentives for exploiting internal knowledge* (Brynjolfsson, 1994). Compared with LEs', smaller industrial units have traditionally been modeled with some significant worse characteristics including having few products, few customers and low volume, lacking economies of experience and learning capacity, being bounded rational, having higher capital and transaction costs, having a reactive nature, being technologically focused with weak marketing skills, having limited resources and high strategic reliance on CEO perceptions of market forces and generally being more vulnerable (Coviello and McAuley, 1999; O'Gorman, 2001).

The smaller industrial units view of SCM seems to be the exertion of power by customers and consequently is seen by SMEs' as a one-way process. Similarly, smaller industrial units do not employ SCM; rather they are managed at arm's length by large customers (Quayle, 2003). Morrissey and Pittaway (2004) offers two reasons for the further research in the SCM issues of smaller industrial units which include: Firstly, globalization has brought increased pressure on manufacturing SMEs' who have to continually reduce prices against a backdrop of improving quality and services; Secondly, for many SMEs', the expenditure on goods and services account for a high production of turnover and it is influential in the achievement of business objectives.

Smaller industrial units *generate demand as well as provide supplies.* This dual role position further makes the supply chain network complexities much higher. It is a belief that sharing of information among supply chain partners improves the effectiveness of supply chain. However, various obstacles for smooth information exchange among partners in a chain include – *a source of conflict arises when companies need to share information*, and *they do not want to release commercially sensitive data* (Webster, 1995). On the positive side, SCM and other smaller industrial units alliance and network activity is supposed to help the smaller industrial units overcome size and resource constraints through increased innovation and reduced costs and uncertainties (Lipparini and Sobrero, 1994; Coviello and McAuley, 1999), generally leading to higher survival rates (Gartner et al., 1999). On the negative side, smaller industrial units not only have higher transaction costs in such linkages, but also increase those costs to larger partners, to the point where the LEs' may require compensation from the SMEs' (Nooteboom, 1993). Additionally, smaller industrial units are exposed to two further potential problems when they consider entering into long-term cooperative relationships with supply chain partners. This includes:(1) The first is that smaller industrial units become potential acquisition targets of larger firms when the supply chain works well. It is likely that the larger firm will have an advantage in valuing the target better after SCM and, with its operations intertwined, make the target look less attractive to other buyers; all of which means a worse price for the SME (Bleeke and Ernst, 1995); and (2) The choice to do SCM may not be a fully voluntary one for the smaller industrial units because it may be made as an ultimatum by a larger supplier or customer. This may be one method for a larger firm to bully a smaller partner into a closer relationship, where the larger firm can more easily exploit the smaller partner, e.g. by learning its innovative methods smaller industrial units are most likely to differ in strategy than LEs' do, and that difference is likely to have an effect on how SCM influences smaller industrial units performance. Buyers are reluctant to form

partnerships with smaller industrial units, although the benefits of aligning buyer and supplier aspirations are axiomatic (Olorunniwo and Hartfield, 2001). The question then remains why smaller industrial units wish to engage in supply chain partnerships given that their strategies become less privately valuable in the SCM environment. One reason may be to use SCM as a substitute to obtain the differentiation advantage that is supposed to emerge from the firm itself (Gentry and Vellenga, 1996; Lee et al., 1999), this is the weak smaller industrial units assumption.

Further, Quayle (2001) adds that the buyer–supplier relationships that exist tend to be in the traditional adversarial type as opposed to the collaborative type. Another reason may be to use the SCM to complement the differentiation advantage by giving it scale, efficiency and leverage through partner firms, this is the strong smaller industrial units assumption.

The choice of organization's environment (Carroll, 1984; Brittain and Freeman, 1980) is a driver to SME organization's growth (O'Gorman, 2001). smaller industrial units grow by pursuing a differentiated strategy (Porter, 1980) and progressing through discrete stages of growth (Kazanjian, 1988) and consequently the ability of the entrepreneur to make structural and strategic changes may determine the growth prospects of business (O'Gorman, 2001). However, in smaller industrial units the choice of environment is constrained by the entrepreneur's past experience and does not appear to be an active decision variable (Eishenhardt and Schoonhoven, 1990). Superior competitive strategies are essential if the SME is to achieve not only absolute growth rates but also growth relative to competitors and the market (O'Gorman, 2001). The closeness of smaller industrial units management to their customers and suppliers helps to achieve higher reliability of supply chain. Shuman's (1975) empirical study of corporate planning in small companies outlines the few observations which include: *Corporate planning is considered only as the responsibility of top management/ owner; Internal organization and organization mechanisms that effect*

corporate planning vary among SMEs'; and *Definition of functions of planning group varies among companies;*

Proponents of strategic management in the small firms believe that the type of planning employed will be contingent upon its stage of development and that this activity will evolve and become more formal and sophisticated over the life cycle of the business (Robinson and Pearce, 1984). With the changing complexity of activities and supporting functional areas, smaller industrial units need to switchover from simple financial plans and budgets to forecast based planning to externally-oriented planning where the owner-manager begins to think strategically, proactively planning the firms future rather than merely relatively responding to changes within the marketplace (Berry, 1998). Baker et al. (1993) propose four phases which mainly include: complete strategic plan; prepare business plan; communicate and implement business plan; complete formal review for the same. The long-term development of the business in later life cycle stages must be guided by a coherent growth strategy which has been formulated within the framework of identified environmental trends, competitive activity, market opportunities and the recognition of the existing skills, competencies and resource requirements of the firm (Berry, 1998). Growth opportunities frequently for the small firm raises greater organizational complexity, simply because the existing capacity of the organization is overtaxed; yet growth per se need not usher in a new stage of development (Mount et al., 1993). The smaller industrial units managers, irrespective of whether they engage in international business or not, may find it more difficult to avoid the risks resulting from increased global competition in their home or local markets (Ritchie and Brindley, 2000). SCM provides an opportunity for smaller industrial units to align supply chain objectives with business strategy; it is an opportunity to develop and maintain relationships and equally important, to identify skills and competences, thus allowing a focus on life-cycle costs (Quayle, 2003).

Implementation of supply chain initiatives is highly dependent on organization's inter and intra linkages. This section aims to explore barriers and enablers related to implementation issues of SCM in smaller industrial units. In general, the barriers to smaller industrial units normal growth include finance (Cambridge Small Business Research Centre, 1992); industry factors such as the level of demand and the intensity of competition (Cambridge Small Business Research Centre, 1992); internal factors such as the managerial skills of the entrepreneur (El-Namaki, 1990); and the personality and managerial style of the entrepreneur (Baumback and Mancuso, 1993; El-Namaki, 1990). Size and budget constraints restrict SMEs' from the adoption of technology and development of new skills and hence alliance is a necessary means for them to be able to compete (Gunasekaran, 2003). Strategy implementation depends upon organization-wide commitment to any new strategic direction. Gourley (1998) puts heavy thrust on involvement of supplier, distribution centers, and other stakeholders for the success. Tyndal et al. (2000) identify three critical factors that need to be assessed and balancedto enhance chances of successful implementation which include – value (relationship between cost and benefit), risk (probability of success – dependent on time span for tangible results, and method (the approach adopted by the company to balance value and risk). Gunasekaran (2003) understands that employee empowerment is important for the success of SCM in smaller industrial units.

Efficient SCM demands transparency for inventory and deliveries along the whole supply network. Material flow transparency, specifically the visibility to inventories and deliveries in the whole supply network, is considered an imperative requirement for successful SCM, and has been associated with significant supply chain efficiency improvements through long-terms buyer–supplier relationships (Gunasekaran and Ngai, 2004). What is questionable, however, is how the methods used to manage these relationships actually become operationalized in smaller industrial units (Mudambi and Schrunder, 1996). Quayle (2000)

proposes that for many SMEs' purchasing seems to have received little attention from owner-managers, being ranked 14 out of a total 19 attributes valued by them when managing their firms. This indicates that smaller industrial units treat the concept of collaboration with some cynicism (Mudambi and Schrunder, 1996). However, many a time under higher risk and uncertainty these adversarial approaches prove to be a better one for SMEs' (Morrissey and Pittaway, 2004).

Due to the low number of hierarchies and overlapping of responsibilities between the management and planners, the information needs of manufacturing smaller industrial units in planning their internal supply chains are different from the large organization (Huin et al., 2002). In streamlining their internal processes and adoption of lean approach, some of the traditional approaches and methodologies (e.g. Kanban, JIT, etc.) may not be suitable for smaller industrial units because they prefer logical reasoning approach over systematic planning approaches like aggregate production plans, production forecast, etc.. However, this has proven to be a fallacy in actual situations (Huin et al., 2002).

Smaller industrial units rely on a few main customers, face a limited number of competitors and stress the importance of qualitative competitive factors such as personalized service rather than cost and price factors which demands the effective planning and management of their supply chain activities. The key enablers for implementing SCM in smaller industrial units include: greater degree of maneuverability, greater sense of responsibility in the owner and employee, personal contact with the employee and customers, greater flexibility to cater limited and fluctuating demands. On the other side, few obvious shortcomings are: less scope for the use of modern machineries, little scope for division of labor, disadvantage in the purchase of raw materials and other accessories, higher cost of rent, interest, advertisement, etc. per unit of output, inability to meet uncertainty, unutilized by-products. In a broader way, on a growth based approach smaller industrial units may be divided into two main groups –

growth-oriented (to grow and create the most valuable company) and quality-of-life (to provide an income for the owners). Some conflicting understandings on SCM for smaller industrial units include: (1) Smaller industrial units views SCM as exertion of power by customers and is perceived as one-way process. (2) At one side concept of SCM is believed only to be more beneficial to large businesses because of their well-established organizational structure, ability to invest in IT and system development and culture of business. On the other side heavy investment in IT, system development software like ERP, single minded pursuit in the absence of defined responsibilities and higher dominance of owner are considered as few detriments to SCM in smaller industrial units. (3) Large enterprises manage smaller industrial units at arm's length and if they want to continue in business they are expected to obey the norms. (4) smaller industrial units may lose the business with others by entering into long-term contract with particular contractor.

1.1 Defining Supply Chain Management

Like most bandwagons, supply chain management (SCM) has been defined and redefined in many ways over the past ten years. To a large degree, the definition depends on one's motivation and interest. The pace of change and the uncertainty about how markets will evolve has made it increasingly important for companies to be aware of the supply chains they participate in and to understand the roles that they play. Those companies that learn how to build and participate in strong supply chains will have a substantial competitive advantage in their markets.

The term "supply chain management" arose in the late 1980s and came into widespread use in the 1990's. Prior to that time, businesses used terms such as "logistics" and "operations management" instead. Some definitions of a supply chain are offered below:

- ✓ “A supply chain is the alignment of firms that bring products or services to market”, from Lambert, Stock, and Ellram in their book Fundamentals of Logistics Management (Lambert, Douglas M., James R. Stock, and Lisa M. Ellram, 1998, Fundamentals of Logistics Management, Boston, MA: Irwin/McGraw-Hill, Chapter 14)
- ✓ “A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves”, from Chopra and Meindl in their book Supply Chain Management: Strategy, Planning and Operations (Chopra, Sunil and Peter Meindl, 2001, Supply Chain Management: Strategy, Planning, and Operations, Upper Saddle River, NJ: Prentice-Hall, Inc. Chapter 1).
- ✓ “A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers”, from Ganeshan and Harrison at Penn State University in their article An Introduction to Supply Chain Management published at http://silmaril.smeal.psu.edu /supply_chain_intro.html (Ganeshan, Ram, and Terry P. Harrison, 1995, “An Introduction to Supply Chain Management,” Department of Management Sciences and Information Systems, 303 Beam Business Building, Penn State University, University Park, PA).
- ✓ “The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole”, from Mentzer, DeWitt, Deebler, Min, Nix, Smith, and Zacharia in their article Defining Supply Chain Management in the Journal of Business Logistics(Mentzer, John T.,William DeWitt, James S. Keebler,

Soonhong Min, Nancy W. Nix, Carlo D. Smith and Zach G. Zacharia, 2001, "Defining Supply Chain Management," Journal of Business Logistics,Vol. 22, No. 2, p. 18).

Thus, from above definitions one can define Supply Chain in simple words that: "Supply chain management is the coordination of production, inventory, location, and transportation among the participants in a supply chain to achieve the best mix of responsiveness and efficiency for the market being served."

1.2 Difference between concept of Logistics and Supply Chain Management

There is a difference between the concept of supply chain management and the traditional concept of logistics. Logistics typically refers to activities that occur within the boundaries of a single organization and supply chains refer to networks of companies that work together and coordinate their actions to deliver a product to market. Also traditional logistics focuses its attention on activities such as procurement, distribution, maintenance and inventory management. Supply chain management acknowledges all of traditional logistics and also includes activities such as marketing, new product development, finance, and customer service. In the wider view of supply chain thinking, these additional activities are now seen as part of the work needed to fulfill customer requests. Supply chain management views the supply chain and the organizations in it as a single entity. It brings a systems approach to understanding and managing the different activities needed to coordinate the flow of products and services to best serve the ultimate customer. This systems approach provides the framework in which to best respond to business requirements that otherwise would seem to be in conflict with each other. Taken individually, different supply chain requirements often have conflicting needs. For instance, the requirement of maintaining high levels of customer service calls for maintaining high levels of inventory, but then the requirement to operate efficiently calls for reducing inventory levels. It is only when these requirements are seen

together as parts of a larger picture that ways can be found to effectively balance their different demands. Effective supply chain management requires simultaneous improvements in both customer service levels and the internal operating efficiencies of the companies in the supply chain. Customer service at its most basic level means consistently high order fill rates, high on-time delivery rates and a very low rate of products returned by customers for whatever reason. Internal efficiency for organizations in a supply chain means that these organizations get an attractive rate of return on their investments in inventory and other assets and that they find ways to lower their operating and sales expenses.

There is a basic pattern to the practice of supply chain management. Each supply chain has its own unique set of market demands and operating challenges and yet the issues remain essentially the same in every case. Companies in any supply chain must make decisions individually and collectively regarding their actions in five areas:

1. ***Production***—What products does the market want? How much of which products should be produced and by when? This activity includes the creation of master production schedules that take into account plant capacities, workload balancing, quality control and equipment maintenance.
2. ***Inventory***—What inventory should be stocked at each stage in a supply chain? How much inventory should be held as raw materials, semi-finished, or finished goods? The primary purpose of inventory is to act as a buffer against uncertainty in the supply chain. However, holding inventory can be expensive, so what are the optimal inventory levels and reorder points?
3. ***Location***—Where should facilities for production and inventory storage be located? Where are the most cost efficient locations for production and for storage of inventory? Should existing facilities be used or new ones built? Once these decisions are made they

determine the possible paths available for product to flow through for delivery to the final consumer.

4. ***Transportation***—How should inventory be moved from one supply chain location to another? Air freight and truck delivery are generally fast and reliable but they are expensive. Shipping by sea or rail is much less expensive but usually involves longer transit times and more uncertainty. This uncertainty must be compensated for by stocking higher levels of inventory. When is it better to use which mode of transportation?
5. ***Information***—How much data should be collected and how much information should be shared? Timely and accurate information holds the promise of better coordination and better decision making. With good information, people can make effective decisions about what to produce and how much, about where to locate inventory and how best to transport it.

The sum of these decisions will define the capabilities and effectiveness of a company's supply chain. The things a company can do and the ways that it can compete in its markets are all very much dependent on the effectiveness of its supply chain. If a company's strategy is to serve a mass market and compete on the basis of price, it had better have a supply chain that is optimized for low cost. If a company's strategy is to serve a market segment and compete on the basis of customer service and convenience, it had better have a supply chain optimized for responsiveness. Who a company is and what it can do is shaped by its supply chain and by the markets it serves.

A technology provider trying to sell software might align SCM with using advanced planning functionality; a third-party logistics provider (3PL) trying to sell its outsourcing capabilities will align SCM with distribution practices and a consulting firm selling services will align SCM with its intellectual property. But there really is an objective, unbiased way to define supply chain management, it's a cross-industry standardized model called the Supply Chain

Operations Reference or SCOR which is the foundation of discussion in later sections of this chapter.

1.3 Working of Supply Chain Management

Two influential source books that define principles and practice of supply chain management are The Goal (Goldratt, Eliyahu M., 1984, The Goal, Great Barrington, MA: The North River Press Publishing Corporation); and Supply Chain Management: Strategy, Planning, and Operation by Sunil Chopra and Peter Meindl. The Goal explores the issues and provides answers to the problem of optimizing operations in any business system whether it be manufacturing, mortgage loan processing or supply chain management. Supply Chain Management: Strategy, Planning and Operation is an in-depth presentation of the concepts and techniques of the profession.

The goal or mission of supply chain management can be defined using Mr. Goldratt's words as "Increase throughput while simultaneously reducing both inventory and operating expense." In this definition throughput refers to the rate at which sales to the end customer occur. Depending on the market being served, sales or throughput occurs for different reasons. In some markets customers value and will pay for high levels of service. In other markets customers seek simply the lowest price for an item.

As already discussed, there are five areas where companies can make decisions that will define their supply chain capabilities: Production; Inventory; Location; Transportation; and Information. Chopra and Meindl define these areas as performance drivers that can be managed to produce the capabilities needed for a given supply chain. Effective supply chain management calls first for an understanding of each driver and how it operates. Each driver has the ability to directly affect the supply chain and enable certain capabilities. The next step

is to develop an appreciation for the results that can be obtained by mixing different combinations of these drivers.

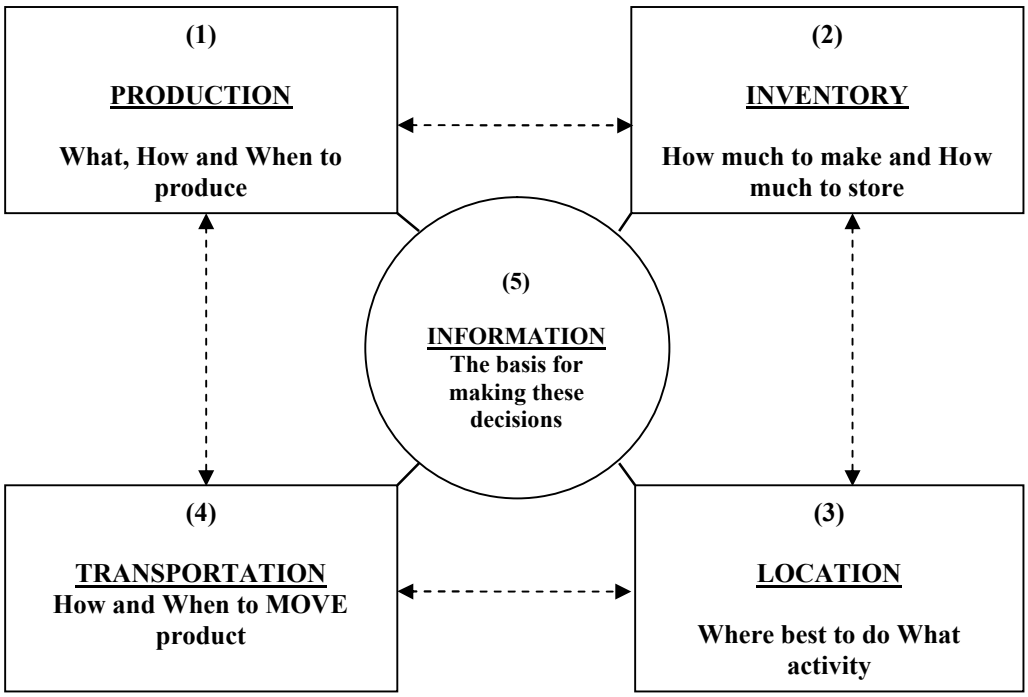

Fig. 1.1: Responsiveness vs. Efficiency

Let's start by understanding the drivers individually.

(A) Production: Production refers to the capacity of a supply chain to make and store products. The facilities of production are factories and warehouses. The fundamental decision that managers face when making production decisions is how to resolve the trade-off between responsiveness and efficiency. If factories and warehouses are built with a lot of excess capacity, they can be very flexible and respond quickly to wide swings in product demand. Facilities where all or almost all capacity is being used are not capable of responding easily to fluctuations in demand. On the other hand, capacity costs money and excess capacity is idle capacity not in use and not generating revenue. So the more excess capacity that exists, the less efficient the operation becomes. Factories can be built to accommodate one of two approaches to manufacturing:

- ✓ ***Product focus***—A factory that takes a product focus performs the range of different operations required to make a given product line from fabrication of different product parts to assembly of these parts.
- ✓ ***Functional focus***—A functional approach concentrates on performing just a few operations such as only making a select group of parts or only doing assembly. These functions can be applied to making many different kinds of products.

A product approach tends to result in developing expertise about a given set of products at the expense of expertise about any particular function. A functional approach results in expertise about particular functions instead of expertise in a given product. Companies need to decide which approach or what mix of these two approaches will give them the capability and expertise they need to best respond to customer demands.

As with factories, warehouses too can be built to accommodate different approaches. There are three main approaches to use in warehousing:

- ✓ ***Stock keeping unit (SKU) storage*** - In this traditional approach, all of a given type of product is stored together. This is an efficient and easy to understand way to store products.
- ✓ ***Job lot storage*** - In this approach, all the different products related to the needs of a certain type of customer or related to the needs of a particular job are stored together. This allows for an efficient picking and packing operation but usually requires more storage space than the traditional SKU storage approach.
- ✓ ***Crossdocking*** - An approach that was pioneered by Wal-Mart in its drive to increase efficiencies in its supply chain. In this approach, product is not actually warehoused in the facility. Instead the facility is used to house a process where trucks from suppliers arrive and unload large quantities of different products. These large lots are then broken down into smaller lots. Smaller lots of different products are recombined

according to the needs of the day and quickly loaded onto outbound trucks that deliver the products to their final destination.

(B) Inventory: Inventory is spread throughout the supply chain and includes everything from raw material to work in process to finished goods that are held by the manufacturers, distributors, and retailers in a supply chain. Again, managers must decide where they want to position themselves in the trade-off between responsiveness and efficiency. Holding large amounts of inventory allows a company or an entire supply chain to be very responsive to fluctuations in customer demand. However, the creation and storage of inventory is a cost and to achieve high levels of efficiency, the cost of inventory should be kept as low as possible. There are three basic decisions to make regarding the creation and holding of inventory:

- ✓ ***Cycle Inventory***- This is the amount of inventory needed to satisfy demand for the product in the period between purchases of the product. Companies tend to produce and to purchase in large lots in order to gain the advantages that economies of scale can bring. However, with large lots also comes an increased carrying cost. Carrying costs come from the cost to store, handle and insure the inventory. Managers face the trade-off between the reduced cost of ordering and better prices offered by purchasing product in large lots and the increased carrying cost of the cycle inventory that comes with purchasing in large lots.
- ✓ ***Safety Inventory***- Inventory that is held as a buffer against uncertainty. If demand forecasting could be done with perfect accuracy, then the only inventory that would be needed would be cycle inventory. But since every forecast has some degree of uncertainty in it, we cover that uncertainty to a greater or lesser degree by holding additional inventory in case demand is suddenly greater than anticipated. The trade-

off here is to weigh the costs of carrying extra inventory against the costs of losing sales due to insufficient inventory.

- ✓ ***Seasonal Inventory***-This is inventory that is built up in anticipation of predictable increases in demand that occur at certain times of the year. For example, it is predictable that demand for anti-freeze will increase in the winter. If a company that makes anti-freeze has a fixed production rate that is expensive to change, then it will try to manufacture product at a steady rate all year long and build up inventory during periods of low demand to cover for periods of high demand that will exceed its production rate. The alternative to building up seasonal inventory is to invest in flexible manufacturing facilities that can quickly change their rate of production of different products to respond to increases in demand. In this case, the trade-off is between the cost of carrying seasonal inventory and the cost of having more flexible production capabilities.

(C) Location: Location refers to the geographical sitting of supply chain facilities. It also includes the decisions related to which activities should be performed in each facility. The responsiveness versus efficiency trade-off here is the decision whether to centralize activities in fewer locations to gain economies of scale and efficiency, or to decentralize activities in many locations close to customers and suppliers in order for operations to be more responsive. When making location decisions, managers need to consider a range of factors that relate to a given location including the cost of facilities, the cost of labor, skills available in the workforce, infrastructure conditions, taxes and tariffs, and proximity to suppliers and customers.

Location decisions tend to be very strategic decisions because they commit large amounts of money to long-term plans. Location decisions have strong impacts on the cost and performance characteristics of a supply chain. Once the size, number, and

location of facilities is determined, that also defines the number of possible paths through which products can flow on the way to the final customer. Location decisions reflect a company's basic strategy for building and delivering its products to market.

(D) Transportation: This refers to the movement of everything from raw material to finished goods between different facilities in a supply chain. In transportation the trade-off between responsiveness and efficiency is manifested in the choice of transport mode. Fast modes of transport such as airplanes are very responsive but also more costly. Slower modes such as ship and rail are very cost efficient but not as responsive. Since transportation costs can be as much as a third of the operating cost of a supply chain, decisions made here are very important. There are six basic modes of transport that a company can choose from:

- ✓ ***Ship*** which is very cost efficient but also the slowest mode of transport. It is limited to use between locations that are situated next to navigable waterways and facilities such as harbors and canals.
- ✓ ***Rail*** which is also very cost efficient but can be slow. This mode is also restricted to use between locations that are served by rail lines.
- ✓ ***Pipelines*** can be very efficient but are restricted to commodities that are liquids or gases such as water, oil, and natural gas.
- ✓ ***Trucks*** are a relatively quick and very flexible mode of transport. Trucks can go almost anywhere. The cost of this mode is prone to fluctuations though, as the cost of fuel fluctuates and the condition of roads varies.
- ✓ ***Airplanes*** are a very fast mode of transport and are very responsive. This is also the most expensive mode and it is somewhat limited by the availability of appropriate airport facilities.

- ✓ ***Electronic Transport*** is the fastest mode of transport and it is very flexible and cost efficient. However, it can only be used for movement of certain types of products such as electric energy, data, and products composed of data such as music, pictures, and text. Someday technology that allows us to convert matter to energy and back to matter again may completely rewrite the theory and practice of supply chain management.

Given these different modes of transportation and the location of the facilities in a supply chain, managers need to design routes and networks for moving products. A route is the path through which products move and networks are composed of the collection of the paths and facilities connected by those paths. As a general rule, the higher the value of a product (such as electronic components or pharmaceuticals), the more its transport network should emphasize responsiveness and the lower the value of a product (such as bulk commodities like grain or lumber), the more its network should emphasize efficiency.

(E) Information: Information is the basis upon which to make decisions regarding the other four supply chain drivers. It is the connection between all of the activities and operations in a supply chain. To the extent that this connection is a strong one, (i.e., the data is accurate, timely and complete), the companies in a supply chain will each be able to make good decisions for their own operations. This will also tend to maximize the profitability of the supply chain as a whole. That is the way that stock markets or other free markets work and supply chains have many of the same dynamics as markets. Information is used for two purposes in any supply chain:

- ✓ ***Coordinating daily activities*** related to the functioning of the other four supply chain drivers: production; inventory; location and transportation. The companies in a supply

chain use available data on product supply and demand to decide on weekly production schedules, inventory levels, transportation routes and stocking locations.

- ✓ ***Forecasting and planning*** to anticipate and meet future demands. Available information is used to make tactical forecasts to guide the setting of monthly and quarterly production schedules and timetables. Information is also used for strategic forecasts to guide decisions about whether to build new facilities, enter a new market or exit an existing market. Within an individual company the trade-off between responsiveness and efficiency involves weighing the benefits that good information can provide against the cost of acquiring that information. Abundant, accurate information can enable very efficient operating decisions and better forecasts but the cost of building and installing systems to deliver this information can be very high.

Within the supply chain as a whole, the responsiveness versus efficiency trade-off that companies make is one of deciding how much information to share with the other companies and how much information to keep private. The more information about product supply, customer demand, market forecasts and production schedules that companies share with each other, the more responsive everyone can be. Balancing this openness however, are the concerns that each company has about revealing information that could be used against it by a competitor. The potential costs associated with increased competition can hurt the profitability of a company.

1.4 Supply Chain Performance Improvement

Supply chain performance issues can show up in a variety of places including:

- Profit-and-loss statements
- Balance sheets
- Corporate key performance indicators

- Employee satisfaction surveys
- Customer report cards
- Market competitive reports
- Analyst ratings and commentary

Ultimately, supply chain performance issues reach a point that pushes an enterprise to take action.

Leading companies in every industry have teams of skilled and motivated business managers working to build integrated supply chains. But many of these managers run into trouble; projects stall and valuable initiatives get scrapped. That doesn't have to be the case. SCOR offers a step-by-step engineering approach that can help you to analyze, design and improve supply chain performance. Its framework is both rigorous and flexible, allowing it to work in any industry and for any supply chain issue.

In most of the cases the projects are done with SCOR, eleven general business issues have been identified, which seem to cover just about any circumstance. Some of these issues are rare, while others are present in almost every company.

1.5 The SCOR Framework

SCOR combines elements of business process engineering, benchmarking and leading practices into a single framework. Under SCOR, Supply Chain Management is defined as these integrated processes: PLAN, SOURCE, MAKE, DELIVER and RETURN - from the suppliers' supplier to the customers' customer and all aligned with a company's operational strategy, material, work and information flows (see Fig 1.2).

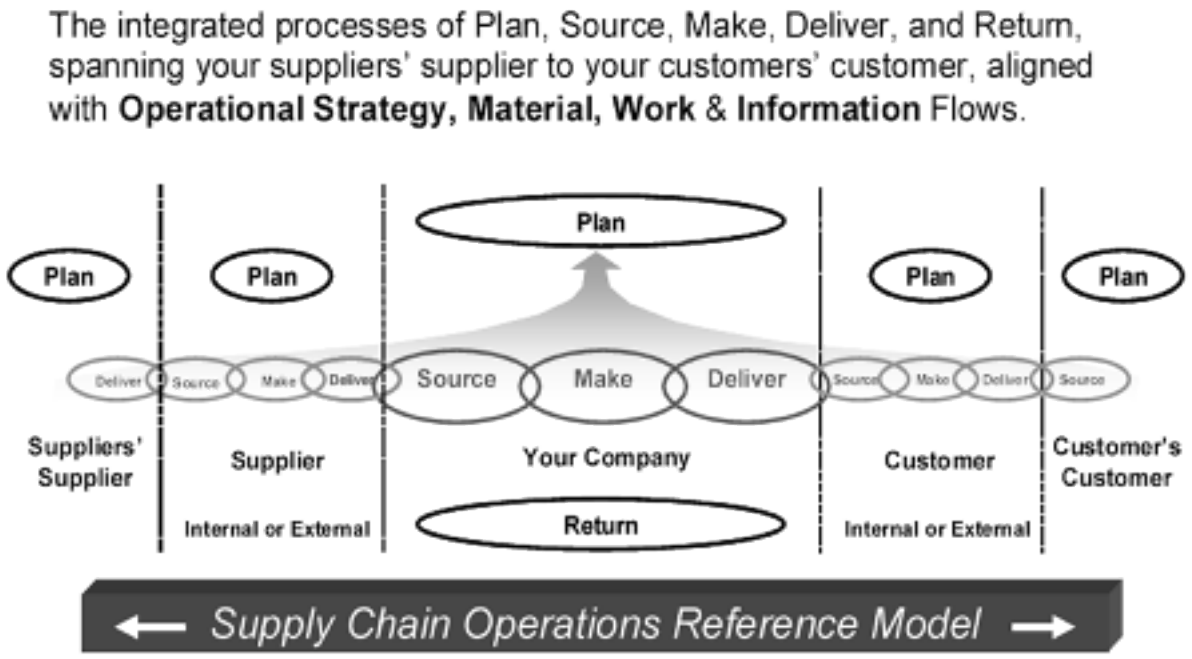

Fig. 1.2: SCOR Reference Model Framework, Source: Supply Chain Council Inc.

Here's what's included in each of these process elements:

- *PLAN.* Assess supply resources; aggregate and prioritize demand requirements; plan inventory for distribution, production, and material requirements and plan rough-cut capacity for all products and all channels.
- *SOURCE.* Obtain, receive, inspect, hold, issue and authorize payment for raw materials and purchased finished goods.
- *MAKE.* Request and receive material; manufacture and test product; package, hold and/or release product.
- *DELIVER.* Execute order management processes; generate quotations; configure product; create and maintain customer database; maintain product/price database; manage accounts receivable,credits,collections and invoicing;executewarehouse processes including pick, pack and configure; create customer-specific packaging/labeling;consolidate orders; ship products; manage transportation processes and import/ export and verify performance.

- *RETURN.* Defective, warrantyand excess return processing, including authorization, scheduling, inspection, transfer, warranty administration, receiving and verifying defective products, disposition and replacement.

In addition, SCOR version 5.0 includes a series of enable elements for each of the processes. Enable elements focus on information policy and relationships to enable the planning and execution of supply chain activities.SCOR spans all customers, product and market interactions surrounding sales orders, purchase orders, work orders, return authorizations, forecasts and replenishment orders.It also encompasses material movements of raw material, work-in-process, finished goods and return goods. In version 5.0, SCOR specifically does not address sales processes, product development and customer relationship management processes.

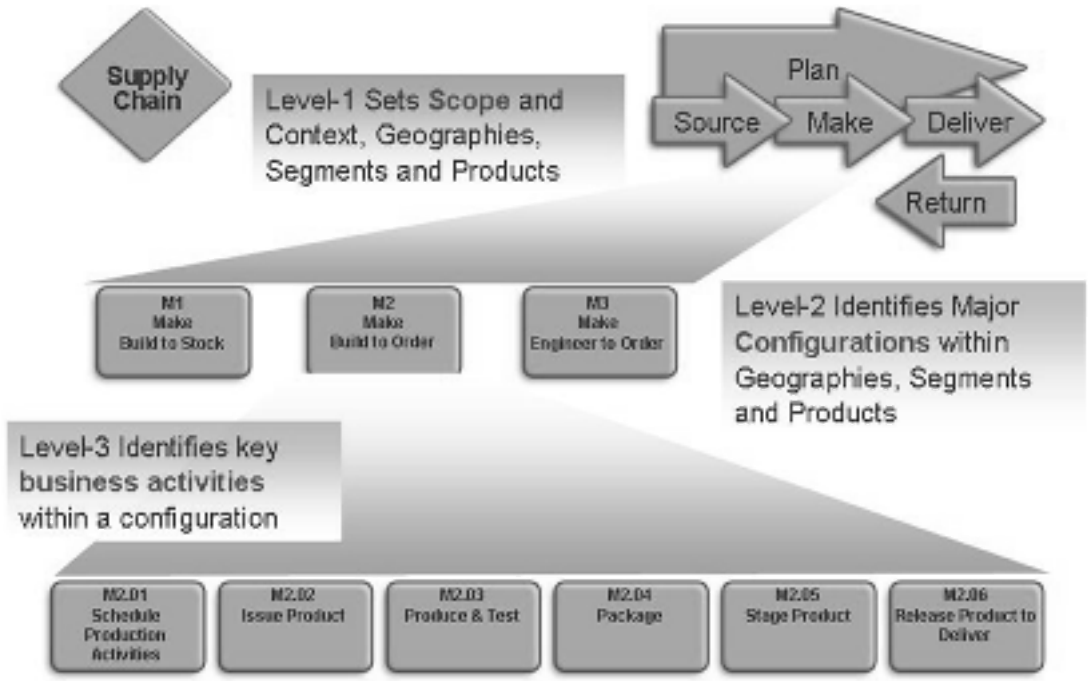

Fig. 1.3: SCOR Framework Levels, Source: Supply Chain Council Inc.

The SCOR model includes three levels of process detail. In practice, Level One defines the number of supply chains and how their performance is measured. Level Two defines the configuration of planning and execution processes in material flow, using standard categories

like stock, to-order, and engineer-to-order. Level Three defines the business process used to transact sales orders, purchase orders, work orders, return authorizations, replenishment orders and forecasts.

1.5.1 The SCOR Project Roadmap

While the framework seems simple, there are multiple levels of detail integrating more than sixty process steps, 200 metrics, fifty leading practices and a hundred potential material flow configurations.Simply having the dictionary does nothing to save money. One needs to do something with it. That's what the SCOR Project Roadmap is all about (see Fig 1.4). In four distinct segments, the roadmap addresses operational strategy, material flow and work and information flow. The segments are:

1. Analyze your basis of competition, which focuses on supply chain metrics and operations strategy;
2. Configure supply chain material flow;
3. Align performance levels, practices, and systems—the information and work flow; and
4. Implement the supply chain changes to improve performance.

Each segment is comprised of deliverables that help a company understand and improve a specific dimension of supply chain performance. *The first segment helps* to understand how many supply chains a company has and how they are performing compared to the competition. *The second segment helps* to optimize material flow inefficiency. *The third helps* to optimize transactional productivity. And *the fourth helps* to plan and implement supply chain improvements.

The SCOR Project Roadmap can be applied to projects of narrow scope or broad-based initiatives that integrate many supply chains across multiple trading partners. It can work for

manufacturers, distributors, retailers, value-added resellers, wholesalers, dealers, franchises, and service providers. It does well in a subordinate role within Six Sigma and Lean Enterprise infrastructures. And with a little creativity, the model can even be used to assemble sophisticated Internet-based trading networks, exchanges and portals.

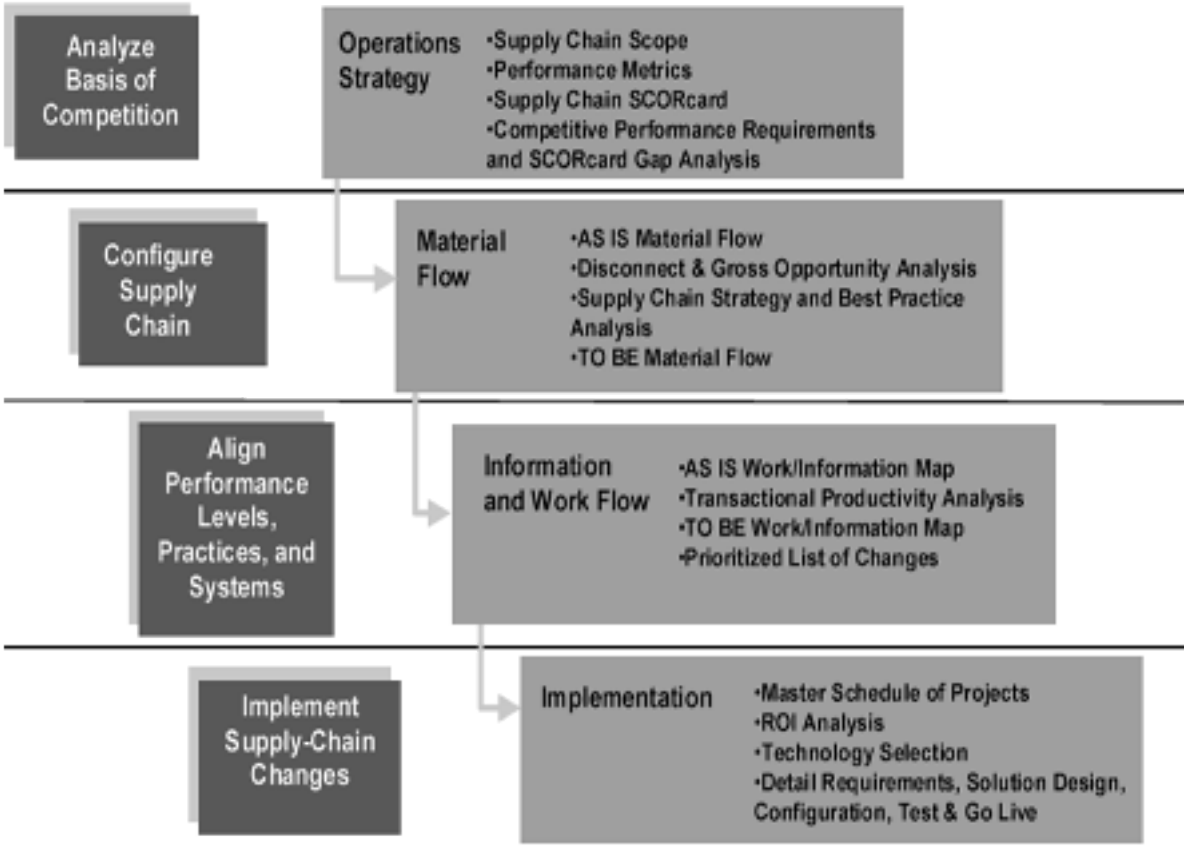

Fig. 1.4: SCOR Project Roadmap.

1.5.2 Applying the SCOR Project Roadmap

For all its power and flexibility, however, there are some essential success factors that are between the lines of the project roadmap—things like change management, problem-solving techniques, project management discipline and business process engineering techniques. These are essential to a successful project and are not explicitly discussed. In other words, the roadmap can tell you where to go, but it can't teach you how to drive the car. This write-up attempts to fill in the lines and provide a brief guide towards using SCOR (see Fig 1.5).

The phases of a SCOR project are as detailed:Educate for support, Discover the opportunity, Analyze, Design and Develop &Implement

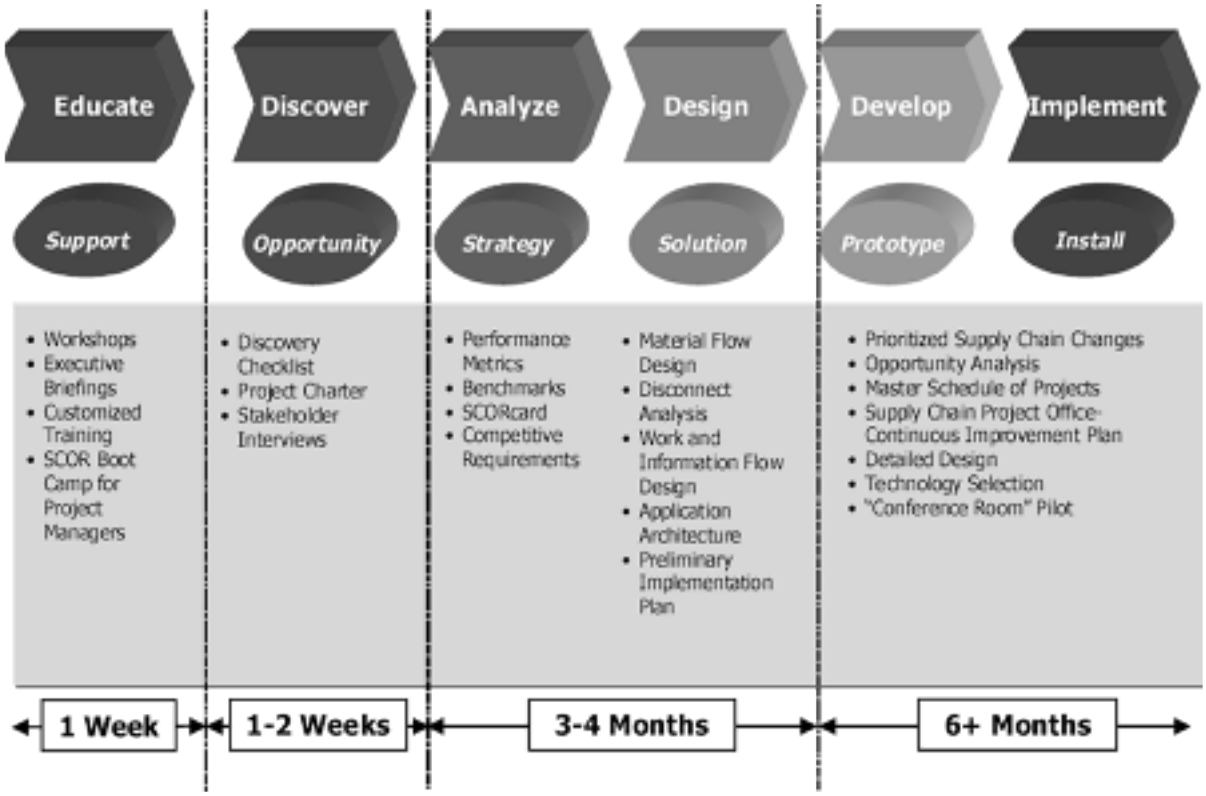

Fig. 1.5: Applying SCOR project roadmap. Source: Pragmatek Consulting Group, Inc.

1.5.2.1 Educate for Support Phase

This phase of a SCOR project tries to find an "evangelist" in the company who has the passion to lead a supply chain project and an executive to actively sponsor it. Both must be willing to invest personal time to learn SCOR. If an executive delegates this initial learning, the organization will probably fail to sustain change over time.

With an evangelist and sponsor in place, the next step of educating for support is to establish a core business team to buy into the approach and commit to supporting a project with words and deeds.

Even as these steps are taking places, there is a larger learning curve that every company must follow. It begins with general education about SCOR - how it works, the language in

which it's written and the available tools to support it. The next educational step is conceptual application of SCOR to one's own company. At this stage, a real supply chain in the company is researched and summarized as a business case. Then, in a classroom environment, a trip with the project road-map is simulated. The third educational stage is to apply the roadmap to a real project, setting expectations and results. Using a formal SCOR coach helps to expand the learning process from individuals to the organizations by including necessary teams. Finally comes implementation of the supply chain improvement projects.

1.5.2.2 Discover the Opportunity Phase

Discovery helps to form the business case that justifies spending money on a supply chain project. It's where the business team sorts out performance opportunities. The complexity of supply chain discovery can be visualized as a three-dimensional box of questions. The first dimension asks: At what performance level is your supply chain operating? The second dimension asks: Do we have the right strategy as well as the right work, information and material flows to support the desired performance level? The third dimension asks: What other performance factors will impact the supply chain? These include organizational, process and technology issues, in addition to understanding people-related factors such as skill, knowledge and ability. One of the key outcomes from the discovery step is a project charter, which organizes the supply chain opportunity into the approach, budget, organization, clear measures of successes and communication plan.

1.5.2.3 The Analysis Phase

The analysis stage is where the value proposition is articulated in terms that the financial management of a company requires: cash-to-cash cycle time, inventory days, order fulfillment and other performance factors. SCOR helps the team to prioritize and balance

customer metrics with internal-facing metrics: delivery, reliability, flexibility/responsiveness, cost and assets. The resulting SCOR card provides a direct connection to the balance sheet. Performance requirements are established with respect to your competition and are prioritized by both definitions of a supply chain—product and channel. These priorities will help in the design phase of a SCOR project. The SCOR card also summarizes actual performance against benchmark performance with a gap analysis that defines the value of improvements.

1.5.2.4 The Design Phase

The design phase is divided into material flow and work and information flow. Material flow and work / information flow are the two key components for defining *AS IS* flows, uncovering disconnects in your processes, and mapping out *TO BE* flows that eliminate these gaps. The basic questions addressed are: What are my material flow problems and what's it worth to solve them? How efficient is my work and information flow and what's it worth to change them?

1.5.2.5 Develop and Implement Phase

This phase leads to development of a portfolio of projects with a projected return on investment. Developing and implementing each project follows industry standard practices of initiating, planning, executing and formal closing. The detailed development, planning and rollout of individual projects is out of scope from the present discussion.

1.6 Significance of the study:

This Project Proposal aims to propose a research model to analyze the antecedents of collaborative Knowledge Management (CKMP) and its organizational impact. The Project is expected to develop measures for measuring CKMP and also its effective implementation

across the industries.

1.7 Potential Contribution:

The Proposed Project shall allow the practitioners to understand the current CKMP adoption rate and the characteristics of those that have adopted in the Indian Manufacturing industry. The research is expected to identify major components of CKMP, important antecedents, potential outcomes and provided valid measurement instrument to these practices, so that practitioners can take it as a roadmap to guide them through the implementation process.

1.8 Objectives of the Proposed Project:

The approach of this Proposed project has been to focus on broader and popular paradigms that are widely discussed, adopted and reported in the various literatures or Supply Chain Management and Collaborative Knowledge management Practices so as to acquire an in depth understanding of the prevailing situations and strategies adopted by manufacturing Industries in India.

In forming the research objectives, all care has been initiated to the mindful that the key Supply Chain Management Paradigms identified in above discussions are not exhaustive.

- Understand the scope of Supply Chain Management and CKMP in Indian Manufacturing Industries.
- Present a Comprehensive Literature Review to identify Present stage of research and paradigms that are coming up.
- Formulate a set of Propositions for analyzing the issues as apart of further research.
- To provide a common platform for the academicians as well as practitioners for optimizing outcomes in the implementation of best practices across manufacturing

industries in India.

- To develop a comprehensive and sustainable model for CKMP utilization across Indian Industries.

1.9 Area of Study:

For the purposes of carrying out the proposed project, a number of industrial units would be chosen as the universe of research sample. These organizations would be chosen from the States of Jammu & Kashmir, Himachal Pradesh and adjoining areas of Punjab. The Project proposed to give equal representation to all the states as well as different manufacturing units located in the Industrial Areas of these States.

CHAPTER – II

LITERATURE REVIEW

Knowledge has been defined as "information possessed in the minds of individuals" (Alavi and Leidner, 2001), or as "individual's experience and understanding" (Marwick, 2001), or as "a high value form of information that is ready to apply to decisions and actions" (Davenport and Prusak, 2000). Given the growing perception of importance of intellectual resources, it is not surprising that firms have begun to engage in a wide range of strategies to create, store, transfer and apply knowledge within their organizational contexts (Kayworth and Leidner, 2003). In light of this, the KM process can be defined as "the process of capturing, storing, sharing, and using knowledge" (Davenport and Prusak, 2000; Leidner and Kayworth, 2006) or as "a systemic and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge of employees that other employees may make use of to be more effective and productive in their work" (Alavi et al., 2005-2006). Thus, the KM process is the generation, representation, storage, transfer, transformation, application, embedding and protection of organization knowledge (Schultze and Leidner, 2002; Massey and Montoya-Weiss, 2006).

Kankanhalli et al. (2005) have mentioned that the strategic management of organizational knowledge is a key factor in helping organizations to sustain competitive advantage in volatile environments. Organizations are turning to KM initiatives and technologies to leverage their knowledge resources (Kankanhalli et al., 2005). Therefore, the goal of KM is for an organization to become aware of its knowledge, individually and collectively, and to shape itself, so that it makes the most effective and efficient use of the knowledge it has or can obtain (Bennet and

Bennet, 2003; Newell et al., 2003; Alavi et al., 2005-2006). To date, the scientific understanding of knowledge in organizations is still in its infancy, in spite of a large and growing body of literature focused on organizational culture, KM process and knowledge (Griffith et al., 2003; Alavi et al., 2005-2006; Pawlowski and Bick, 2012).

Knowledge is an elusive and unique resource, Jantunen (2005). On the one hand, knowledge can be viewed as representation of the world; on the other hand it can be conceptualized as a product of the interaction between individual cognition and reality (Lin et al 2002). To clearly define knowledge, we should look at the data-information-knowledge hierarchy, which has been extensively discussed in literature. Some authors use these terms interchangeably (such as Huber 1991). However, the confusion and misunderstanding of the three terms can lead to problems in knowledge management system design (Davenport and Prusak, 1998) or strategic decisions for organizations in the knowledge era (Alavi and Tiwana, 2002). Thus the discussions about the data–information–knowledge hierarchy have important implications for CKMP.

2.1 Data-Information-Knowledge Hierarchy

Data

Data can be defined as the raw facts which are unorganised (Capion, Lehmann & Hulbert, 1992). Davenport and Prusak (1998) argued that data is the discrete and objective fact that describes only a part of what happened. Data says nothing about its own importance or relevance because it provides no judgment or interpretation and no sustainable basis of action. Many researchers have defined data as taken-for-granted, simple and isolated raw facts. It is a set of symbols that have not being interpreted, its meanings depend upon the representation system (i.e. symbols, language, etc.) used.

Many authors saw data as the raw material of higher order constructs (such as Webster 1961, Davis and Olson, 1985). Only after endowed with relevance, purpose and meaning, and processed into comprehensible forms to the recipients, and is of real or perceived value in current or prospective actions or decisions, data becomes information (Davis and Olson, 1985).

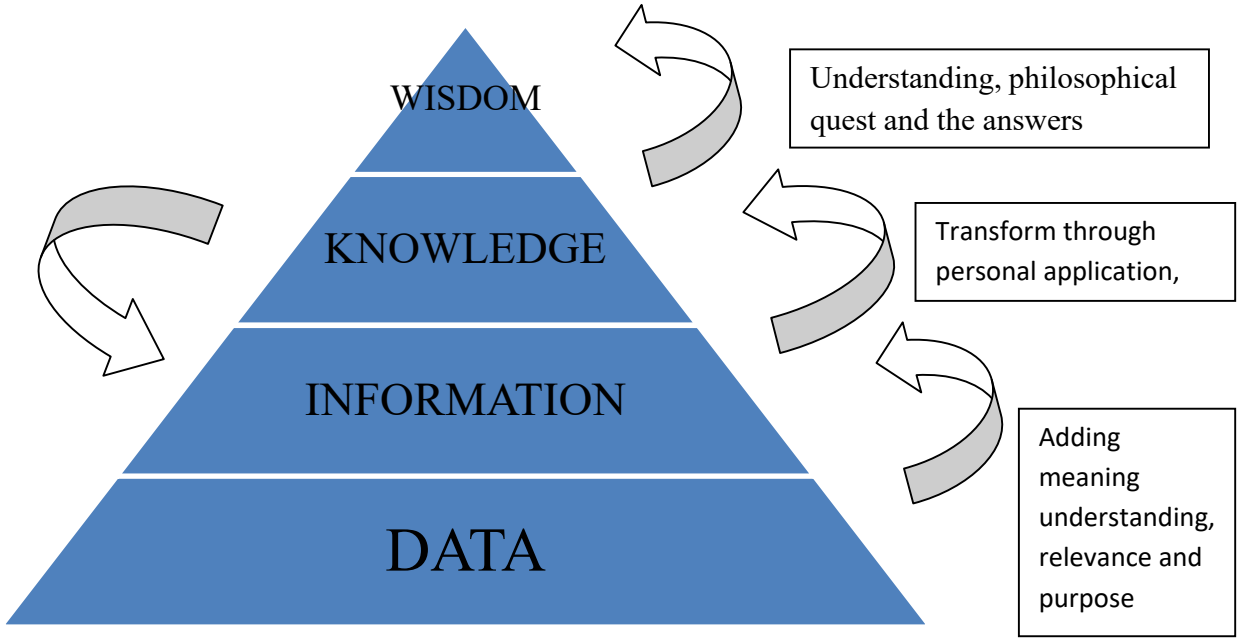

Fig 2.1. Data-Information-Knowledge Hierarchy

Source: The Hierarchy of Mind Content (Swan et al., 1999)

Information

Information can be defined as a series of important and meaningful data that have a link with each other (Moghadam, 2006).Davenport and Prusak (1998), Tuomi, (2000) defined as meaningful, useful data that is organized to describe a particular situation or condition. It is generated by manipulating, presenting and interpreting the collected data. However, the information yielded from the same data (individual interpretations) may be different. The receiver's existing knowledge in part determines the perspective of observation and the meanings that data carries to the receiver. Thus, what type of information can be

generated from the data and how such information is processed are influenced by each individual's existed knowledge base. Transferability is another important feature of information. It is relatively easy to be communicated between people. Machlup (1983) argued that information is the basis for knowledge creation and transfer, because information might add to, restructure or change our existing knowledge.

Knowledge

Knowledge can be defined as an imperative tool to attain sustainable competitive advantage for an organisation (Drucker, 1993; Wiig, 1997).To understand Knowledge various definitions have been developed in the Knowledge Management (KM) literature. Webster (1961) defined knowledge as a clear and certain perception of something; the act, fact, or state of understanding. It can be seen as people's cognitive outcome of information. Dretske (1981) argued that knowledge is information produced (or sustained) belief. Knowledge is created when information is given meaning by being interpreted, analyzed, synthesized, validated and codified. Polanyi (1966) considered knowledge as "justified true belief". His perspective emphasized knowledge as a dynamic human process of justifying personal beliefs under an aspiration for the "truth". Similarly, Nonaka and Takeuchi (1996) argued that knowledge is the mental structure that consists of beliefs, perspectives, concepts, judgments and expectations, methodologies and know-how with a goal to predict future consequences, or to make inferences. These works recognize knowledge involves two aspects, the concrete knowing about and more abstract knowing how (Grant, 1996).

Knowledge was defined by Davenport and Prusak (1998) as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in

documents or repositories but also in organizational routines, processes, practices, and norms".

Polanyi (1966) wrote "we know more than we can tell". Knowledge that can be expressed clearly and objective represents only the tip of iceberg of the entire body of one's knowledge. To make sense of new information, one implicitly relies on culturally shared and accumulated stocks of knowledge. According to Polanyi (1966), "knowing emerges in dynamic interaction between focal and subsidiary components of meaning.

Blackler (1995) defines knowledge as into five different forms: embodied, embedded, embrained, encultured, and encoded. These forms are explained in the following table

1.	Embodied Knowledge	Embedded knowledge is gained through training of the body to perform a task
2.	Embedded Knowledge	Embedded knowledge is a knowledge that is found in routines and systems.
3.	Embrained knowledge	Embrained is defined as the knowledge that a person can process, but has the difficulty expressing in words or sharing with other
4.	Encultured Knowledge	Encultured knowledge is defined as asset of knowledge that is shared among the groups of people which have similar environment or culture such as what is accepted, what actions and opinions are considered as normal, and what behaviours are expected of people.
5.	Encoded Knowledge	Encoded Knowledge is a form of knowledge that can be easily written down, expressed in words or diagrams, and is transferable through multiple channels and means.

Table 2.1: Five different forms of Knowledge by Blacker (1995)

In short, the generally accepted views regard data as simple facts that would become information when combined into meaningful structures. Information subsequently becomes knowledge as human perspective is added and the information being put into a context. Tuomi (2000) cited reading book as an example to illustrate the relationship of the data-information-knowledge hierarchy. The book contains data in its letters and words. Reading and understanding a book is a processes of collecting information; the reader's previous knowledge affects what information he or she is getting from the

reading. While breaking down and integrating the collected information with other related information creates knowledge, which is ready to use for solving the reader's practical problems in life.

Wisdom:

Wisdom is more than understanding, philosophical quest and the answers of "why" (Nonaka,1997).Wisdom clarifies the different between "True" and "False"; "Good" and "Bad". So the process of converting data into information, information into knowledge and knowledge into wisdom is an evolutionary procedure.

Types of Knowledge

There are two types of knowledge available to an organization as well as to individual. Polanyi (1982), Nonaka and Tekakeuchi (1995) coincides that Knowledge has been categorized into "Tacit Knowledge" and "Explicit Knowledge". Kok (2003) supposed that the Tacit Knowledge is Personalized knowledge where as Explicit is codified Knowledge.

Explicit Knowledge

Explicit Knowledge can be easily be expressed in words, facts and figures and symbols or codes: such Knowledge is stored in form of database, records, websites, and charts (Tiwana, 2002).

Explicit knowledge, sometimes called codified knowledge, includes information and skills that can be easily described, documented, collected, stored, distributed to others in a tangible format (such as paper or electronic documents).

Nonaka (1994) emphasized explicit knowledge's key feature of being context free in explaining his famous knowledge creation model. Thus the capture and transfer of explicit knowledge is relatively easy.

With the help of information Technology, it is easy to share, communicate and transfer

information from one to another. It plays the role of facilitator or enabler for the transmission of explicit knowledge and knowledge itself. According to Takeuchi and Nonaka (20004), explicit Knowledge is that systematic, formal and codified knowledge which is transmitted to individuals.

Tacit Knowledge

Tacit Knowledge can be expressed as personal and unambiguous knowledge of an individual that resides in the human mind, the culture of people, behaviour, perception as well as organization's experience (Duffy 2000; Rowley,20003). Irick (20007) defines tacit knowledge as private, inner or core knowledge extremely rooted in an individual's experiences, ideas, norms, and values, and emotions.

Tacit knowledge is the subjective and experience-based knowledge that is hard to be expressed in words, sentences and other systematic manners. It is context specific and deeply rooted in action and commitment. It often includes cognitive skills such as beliefs, perspectives, intuition and mental models as well as technical skills such as craft and know-how (Nonaka and Takeuchi, 1996). Thus to formalize, capture, store and transfer tacit knowledge to others can be difficult.

Nonaka (1994) also identified two sub-dimensions of tacit knowledge: the technical element covers concrete know-how, crafts and skills that apply to specific contexts. By contrast, the cognitive element captures an individual's images of reality and visions for the future.

It centers on what Johnson-Laird (1983) called "mental models", which include schemata, paradigms, beliefs, and viewpoints that provide "perspectives" that help individuals to perceive and define their world. People combine their possessed knowledge with obtained information to create and manipulate analogies in their minds to form various working models about the world.

2.2 Nonaka's Model of Knowledge Conversion (SECI Model))

Nonaka and Takeuchi (1995) proposed a Knowledge conversion model to explain the link between explicit and tacit knowledge with the SECI process (socialisation, externalisation, combination and internalisations). In 1993,SECI model emerged ,when Nonaka studied how Knowledge is created and can be converted with the help of a survey (questionnaire) with 105 middle managers in different Japanese manufacturing companies such as Matushita, Mazda, Canon, and Honda (Nonaka,1994).This study suggested four models of Knowledge conversion which are based on the transformation of tacit and explicit knowledge. Nonaka categorized four models are as follows:

- Converting tacit knowledge into tacit as "Socialisation"
- Converting tacit knowledge into explicit as "Externalisation"
- Converting explicit Knowledge into explicit as "Combination"
- Converting explicit knowledge into tacit as "Internalisation" (Nonaka,1994)

Fig: The Four Modes of Knowledge Conversion

Socialization (From Tacit to Tacit):

The process of Sharing experiences which are learned from day to day social interaction as well as cultural processes related to organizational regular activities, all this leads to converting existing tacit knowledge into new tacit knowledge which is known as socialization process (Martin-de- Castro et al; 2008).Sharing tacit Knowledge is

acontinuous process (Nonaka & Taleuchi,1995)

The most typical way in which tacit knowledge is built and shared in face to face meetings and sharing experiences, in an informal environment, where the Information Technology (IT) plays a minimal role.

Externalisation (From Tacit to Explicit):

According to nonaka and Takeuchi (1995), to convert tacit knowledge into explicit knowledge externalisation process is used in an organisation. Through externalisation, Tacit knowledge becomes explicit knowledge, "taking the shape of metaphors, analogies, concepts, hypotheses or models" (Nonaka & Takeuchi, 1995)

Online discussion databases and basic blogs are potential tools to detain tacit knowledge for business application like decision making or solving the problems. To be most effective for externalization, the discussion should be such as to allow the formulation and sharing of metaphors and analogies, which probably requires a fairly informal and even freewheeling style.

Combination (From Explicit to Explicit):

Nonaka and takeuchi (1995) considered that the process of converting existing explicit knowledge into new organised and systematic set of knowledge is known as combination process.

Once tacit knowledge has been conceptualized and articulated, thus converting it to explicit knowledge, capturing it in a persistent form as a report, an email, a presentation, or a Web page makes it available to the rest of the organization. One way to motivate people to capture knowledge is to reward them for doing so. If rewards are to be linked to quality rather than quantity, some way to measure the quality of the output is needed. But the term quality, being abstract, is extremely difficult to assess, since it depends on the potential use to which the document is to be put. In brief the "reconfiguration of existing

information through sorting, adding, combining and categorising of explicit knowledge (as conducted in computer databases) can lead to new knowledge" (Nonaka & takeuchi,1995).

Internalisation (From Explicit to Tacit):

Internalisation is aprocess of recycling the explicit knowledge and sharing it throughout the organization by converting it into tacit knowledge. Internalisation is closely related to "learning by doing" and/or "organisational Learning" (Nonaka & takeuchi, 1995).

Technology to help users form new tacit knowledge, for example, by better appreciating and understanding explicit knowledge, is a challenge of particular importance in knowledge management, since acquisition of tacit knowledge is a necessary precursor to taking constructive action. The people of an organization possess certain types of knowledge and in order to benefit from it at individual and organization level people need to be aware of what kind of knowledge they possess and how they can convert and share it with other people. Therefore it is important to acknowledge the forms of knowledge sharing and related conversion processes. Individuals or group of individuals practice a new knowledge with their own tacit knowledge and by merging knowledge from internal and external sources create an entirely new piece of knowledge (Nold, 2009)

Socialization	**Externalization**
1. Tacit -: Tacit Examples are : Face to face communication Video – Teleconferencing Virtual Reality Tools	3. Tacit -: Explicit Examples are : Process capture tools Traceability Reflective peer-to-peer networks Expert Systems Discussion Platforms

Internalization	Combination
2. Explicit -: Tacit Examples are : Collective Knowledge networks Notes databases/ Organization Memory Pattern Recognition Neural Networks	4.Explicit -: Explicit Examples are System knowledge Tools Collaborative Computing tools Intranets, Groupware Discussion Lists Web Forums Best Practice Databases

Table 2.2: Forms of Knowledge Sharing

Source: Nonaka and Reinmoeller 1998

2.3 Organizational Knowledge

Choo and Bontis (2002) view organizations as bundles of knowledge assets. The organizational capability to learn, create and maintain knowledge, as well as the conditions under which such capabilities are developed, has been deemed critical to the operational and strategic health of organizations. This is simply because from the resources based view, knowledge is a strategic resource that is hard to imitate and provides its possessor a unique and inherently protected advantage. Thus, any techniques and approaches that facilitate knowledge growth and application are considered as critical to today's business success. However, it is until relatively recent that the importance of organizational knowledge is emphasized (Stewart, 1997).

Mansell and Wehn (1998) identified several trends in today's business world: the increasing digitization of social and economic life, the wide spread use of information and communication technologies, a more literate workforce, the increasing dependence of advanced economies on service and the expansion of a professional and technical class et al. All of these emerging factors have made organizational activities and transactions more and more depend on specialized or theoretical knowledge. Thus the studies

unpacking organizational knowledge to learn how organizations 'remember' what they know and learn from their own as well as others' experiences turn out to be theoretically and practically important (Eisenhardt and Santos, 2002).Organizational knowledge is commonly understood as intellectual capital encompassing both knowledge of individuals employed by the organization and group knowledge that is embedded in the organizational policies, procedures and protocols. Both the individual and group knowledge have two basic forms: those that can be easily codified and transmitted in formal, systematic language and shared asynchronously are called explicit knowledge.

While the other type of knowledge that is more personal and subjective in quality and experiential and intuitive in nature thus difficult to transmit and share is referred to as tacit knowledge. Vasconcelos et al (2000) presented an ontological diagram which illustrated the classification of knowledge as well as the relationships of various kinds of knowledge within an organizational domain.

2.4Evolution and Concept of Knowledge Management

Gambell and Blackwell (2001) and Tiwana (2002) as cited in Wong (2006) give the summary of the evolution process of KM as follow:

Year	Developments
1950s	• Electronic data Processing associated with Quantitative Management. • Management by Objectives. • Program evaluation and review technique (PERT) and diversification
1960's	• Effect of centralisation and decentralisation • An early attempt to harness the power of people working as a community. • Theory Y. • Conglomeration and T group
1970's	• Portfolio Management • The strategic Planning (Mintzberg,1978)

	• The experience (Porter, 1979) and automation.
1980s	• Management took more interest in following: • Corporate Culture. • Downsizing and management by walking around. • Theory Z. • Total Quality Management (TQM)
1990s	• Focussed more strongly on releasing the competitive potential of human resource. • Management was more concerned with the following. • Business Process reengineering (BPR), therefore, led to shift towards the three P- Purpose; People; Process (Bartlett & Ghoshal (1998)
1991-1995	• Early origin and Formulation of KM Research • Computer science and business strategy played a major role for the development of KM.
1996-1999	• The growth and expansion Phase (Bayyavarapu,20005) • The disciplinary breadth improved from 3 disciplines (Computer science, business strategy, and library and information sciences) to 13 disciplines.
2000s	• The main Corporate objective for application of KM practice is to integrate enterprise through learning & sharing society. It helps to understand the value of intellectual's capital and to comprehend that opposition does not rely on upon the differentials ownership of physical resources, or even data. However rely on the capacity to deploy and exploit knowledge.KM has been continuously brought into the focal point of the organisation.
2000 onwards	• The two decades has been seen the growing interest for KM as well as developed interest among both researchers and practitioners. Many new theories have been added and practitioners have been added and practitioners have found the new and innovative ways to use KM as a tool to attain competitive edge.

Table 2.3: Evolution of Knowledge Management

2.4.1 Knowledge Management (KM)

Knowledge Management is a dynamic and continuous set of processes and practices embedded in individuals as well as in group and physical structures. At any point in time in a given organization, individuals and groups may be involved in different aspects of the Knowledge management process (Alavi and Leidner, 2001; McInerney, 2002; Pawlowski and Bick, 2012; Pirkkalainen and Pawlowski, 2014). Thus, Knowledge Management must be considered as a sequence of activities and events (i.e. creation, storage, transfer or application of knowledge) that ultimately lead to KM outcomes (Kayworth and Leidner, 2003; Newell et al., 2003; Alavi et al., 2005-2006; Eaves, 2014). The outcome depends on whether the individual has the intention to create, store, transfer or apply their knowledge (KM process intention) to the organization. There is a massive literature on Knowledge management and the important aspect is to actually define what knowledge is for the better understanding of as to how it can be managed. The following table enlists some of the important definitions:

Author/Year	**Definitions**
Alavi and Leidner (2001)	Knowledge is information that exists in individuals mind. This personalised information relates concepts, facts to, ideas, interpretations, judgements, and observations.
Liebowitz and Wilcox,1997	KM refers to the organisation's ability to store, manage and distribute knowledge.
Bassi,1997	KM is the "process of creating, capturing and using Knowledge to enhance organizational performance"
Wiig,1997	KM has following objectives: a) It enables the organization to act intelligently to secure its feasibility and success, and b) To value its knowledge assets

Table 2.4: Knowledge Management KM definitions by various authors

However, in the Knowledge Management process, individual efforts are often seen to clash with organizational culture (Bedford, 2013). This is because organizational culture consists of the basic, taken-for-granted assumptions and deep patterns of meaning shared through organizational participation as well as the manifestation of these assumptions (Ajmal and Koskinen, 2008). According to Schein (2000), any difficulties in the KM process among people are primarily related to the "psychological climate" of the organization, which, in turn, depends upon the culture of the organization. Moreover, the failure of many knowledge transfer systems is often a result of cultural factors rather than technological oversights (Ajmal and Koskinen, 2008; Pirkkalainen and Pawlowski, 2013). For this reason, organizational culture is a major barrier to success in the KM process (DeTiene and Jackson, 2001; Kayworth and Leidner, 2003; Ajmal and Koskinen, 2008). Moreover, organizational culture has multi-faceted dimensions (including results-oriented, tightly controlled, job-oriented, closed system and professional-oriented cultures) (Hofstede, 1990; Eaves, 2014) rather than a single dimension (Fey and Denison, 2003).

At the same time, the Knowledge Management process emphasizes knowledge as being created, shared and applied through interpersonal social relationships and appropriate organizational culture. Therefore, knowledge of how to advocate a supportive organizational culture that encourages employees to have the intention to ensure that knowledge is created, stored, transferred and applied is essential (Kayworth and Leidner, 2003; Leidner and Kayworth, 2006; Ajmal and Koskinen, 2008).

Benefits of KM

1. To share the knowledge, a company creates exponential benefits from the knowledge as people learn from it.
2. To build better sensitivity to “brain drain”
3. To reacting to new business opportunities
4. Promoting standards, repeatable processes and procedures.
5. Customer focuses service and targeting marketing.
6. Improves staff engagement and communications.

Challenges of KM

1. Information

- Transforming vast amount of data into usable form
- Avoiding Overloading users with unnecessary data
- Eliminating wrong/old data
- Ensuring customer confidentially
- Keeping the information up to date

2. Management

- Getting individuals to volunteer knowledge
- Getting business units to share knowledge
- Demonstrating business Value
- Bringing together the many people from various units
- Determining responsibility for managing the knowledge

3. Technology

- Determining infrastructure requirements
- Keeping up with new technologies

2.4.2 KNOWLEDGE MANAGEMENT CYCLE

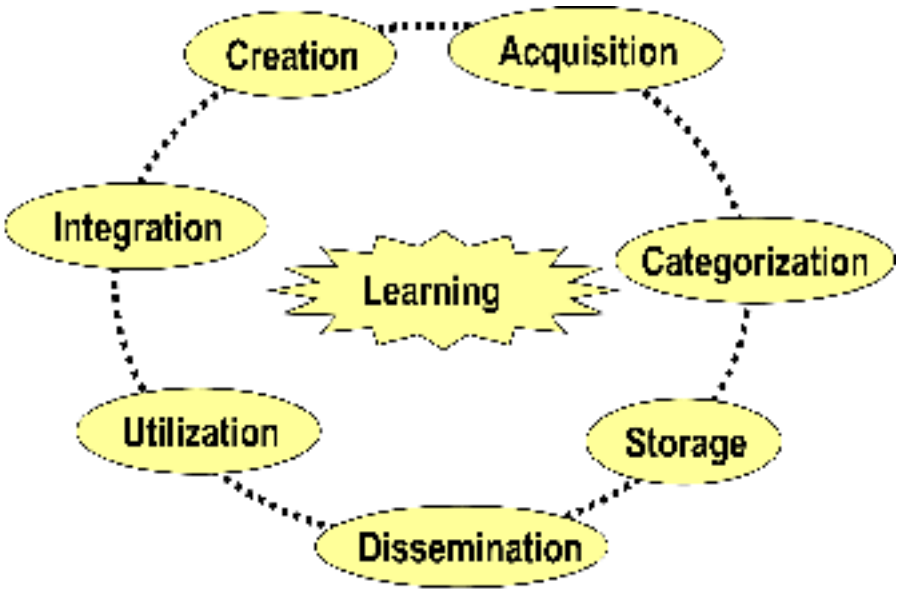

Fig 2. KNOWLEDGE MANAGEMENT CYCLE

Knowledge Creation (KC)

Knowledge creation (KC) is considered as distinctive level of learning. Cook and Brown (1999) suggest that Knowledge creation is an interplay between knowledge and knowing, or in other words, putting knowledge into practice. The generation of new knowledge or knowledge creation happens using four methods of the Socialization, Externalization, Combination and Internalization (SECI) procedure to enhance better performance.

Individual Knowledge	Information believed by an individual as justified truth and stored in memory in a cognitive structure through a cognitive structure through a cognitive process called learning
Group knowledge	Knowledge held by a group of individuals (e.g. organizational departments)
Organizational knowledge	Knowledge held by an organization

Inter-Organizational Knowledge	Knowledge held at an inter organizational level (e.g. Knowledge held between an organization and its suppliers)

Table 2.5 Knowledge Creation Process

Knowledge Acquisition (KA)

Knowledge acquisition includes the elicitation, collection, analysis, modelling and validation of knowledge for Knowledge management projects. The firm can acquire knowledge externally from customers, suppliers, competitors, partners and mergers(Zack et al., 2009).

Knowledge Sharing (KS)

Knowledge sharing is process of transferring or disseminating knowledge from one person to another person or group in an organization.KS constitutes a major challenge in the knowledge management and knowledge sharing occurs when explicit knowledge is made available to be shared between individuals of supply chains. In knowledge management, an essential thought is that knowledge can be shared (Nonaka and Takeuchi, 1995).Sharing of knowledge among multiple entities to cater to the critical issues of organizational adaptation, survival, and competence in face of increasingly discontinuous environmental change.

Benefits of Knowledge Sharing

1. Speed up Response time
2. Increase efficiency
3. Increase creativity and innovation
4. Better decision making
5. Preserving of existing knowledge

Knowledge Dissemination (KD)

Itis the process related to makingknowledge available to knowledge users within and

across organizational boundaries and facilitating knowledge transfer among individuals in order to promote learning and produce new knowledge or understanding (Jasimuddin, 2012).

Knowledge Storage (KST)

Knowledge is a vital key asset and a critical corporate asset, which is genuinely regulated for its utilization of generation (Zack et al., 2009). Knowledge storage may likewise be a device utilized as a part of knowledge transfer (Jasimuddin, 2012).

2.4.3Knowledge Management System (KMS)

The KMS as an IT-based system was developed to supportand enhance the organizational processes of knowledge creation, storage/retrieval, transfer and application (Alavi, M. and D. E. Leidner (2001). With the growing attention of the KM importance in organizations,many of this start developing KMS that offer various benefitsto facilitate KM activities but (Hahn, J. and Subramani, M.R. 2000) recommend that during the development of KMS, the organization should pay attention to various issues and challenges related to using IT to support KM.

Most of the traditional KMSs merely focus on capturing the enterprise's knowledge, storing and organizing it in the enterprise database. However, the purpose of the KMSs was not only to make information available, but also to make sure it willbe shared and leveraged in enterprise context and between the users. Therefore, focusing only on the half of this equation does not add any advantage forhuman capital development. And the result will be that the KMS act like a cyberspace; full with immense amount of information and data, but still not yet leveraged, the VHRD model could be considered as the new generation of the KMSs or at least more mature.

2.5Organizational Culture and KM

Schein (1985, 2000) asserted that organizational culture is the set of shared, taken-for-granted implicit assumptions that a group holds and that determine how it perceives, thinks about and reacts to its various environments. However, members are often unaware of the underlying assumptions of their culture and may not become aware of their culture until they encounter a different one (Ajmal and Koskinen, 2008). Alavi et al. (2005-2006) propounded the values perspective of culture, asserting that organizational culture consists of four dynamic and cyclic elements: assumptions, values, artifacts and symbols. In contrast to a focus on underlying assumptions, the behavioral perspective focuses on culture, as defined by actual work practices (Hofstede et al., 1990; Alavi et al., 2005-2006). Hofstede et al. (1990) provided empirical datawhich showed that shared perceptions of daily practices form the core of organizational subunitsof culture (including resultoriented, tightlycontrolled, joboriented, closedsystem and professio naloriented sub-units).

According to a positive relationship of organizational culture and knowledge creation process, shaping an organizational cultural factors are a key of a firm's ability to manage knowledge effectively (Janz and Prasarnphanich, 2003; Lee and Choi, 2003; Wei, 2005; Ajmal and Koskinen, 2008). However, KM requires a major shift in organizational culture and a commitment at all levels of a firm to make it work (Gupta et al., 2000; Norman, 2004; Ajmal and Koskinen, 2008). Moreover, Ajmal and Koskinen (2008) believed that the success of KM is achieved by building a supportive culture while developing these KM systems. Therefore,

organizational culture is a vital element of an organization's ability to create value through leveraging knowledge assets (Wei, 2005; Ajmal and Koskinen, 2008). In light of this, organizational culture and KM need to be worked coherently (Ajmal and Koskinen, 2008).

Thus, the ability to shape organizational culture is of paramount importance in fostering learning environments (Wei, 2005). A learning culture organization creates an environment in which the acquisition of skills and knowledge is not only viewed as a key responsibility of each employee but also supported by the interaction and encouragement of organizational members (Norman, 2004; Wei, 2005; Alavi et al., 2005-2006). At the same time, many scholars believe that the eventual purpose of knowledge storage is to embed employees' knowledge into the process and culture of the organization, thereby improving organizational performance (Davenport and Prusak, 2000; Newell et al., 2003; Alavi et al., 2005-2006; Massey and Montoya-Weiss, 2006; Chow and Chan, 2008; Ranasinghe and Dharmadasa, 2013). An important aspect of transfer is knowledge-sharing. Shared organizational values influence the individual's perception of ownership of knowledge and subsequent tendencies to share knowledge with others (Gibbert and Krause, 2002; Jarvenpaa and Staples, 2001; Wasko and Faraj, 2005; Tan et al., 2009; Lin and Dalkir, 2010).

In addition, knowledge sharing requires organizational members to be willing to contribute their knowledge to the organization (Politis, 2003; Wei, 2005; Eskerod and Skriver, 2007; Ajmal and Koskinen, 2008).Finally, a culture may influence the motivation of individuals to pursue knowledge application practices (Bock et al., 2005). Organizational efforts to foster knowledge application through rewards and other incentives will ultimately fail unless the underlying cultural climate exists that

rewards, celebrates, and values knowledge application (Markus et al., 2002; Orlikowski, 2002). Therefore, organizational culture can prevent employees from sharing and disseminating their individual powerbase and viability (Gupta et al., 2000). Thus, it is apparent that organizational culture will influence the KM process of organization by affecting employee behavior. Moreover, organizational culture is critically important in facilitating knowledge creation, storage, transfer, and application (Gupta et al., 2000; Bhatt, 2001; Janz and Prasarnphanich, 2003; Leidner and Kayworth, 2006; Ajmal and Koskinen, 2008).

For this reason, Kayworth and Leidner (2003) asserted that behavioral perspectives of organizational culture are represented by various behaviours, beliefs, institutions, structures, and processes in organizations and influence employee behavior. Such a perspective, therefore, is suitable for analyzing the implementation of KM processes of the individual (Kayworth and Leidner, 2003).

2.6Organizational Knowledge Management Practice

The emergent trend of recognizing the growing importance of organizational knowledge surely brings about increasing concerns over how to create, store, access, transfer and make full use of such super abundance of organizational knowledge. A knowledge management system is often introduced to facilitate the organizational functions of identifying and mapping intellectual assets, generating new knowledge, and systemizing knowledge storage, retrieval and sharing.

However, despite the research community's strong interest in knowledge management, researchers and practitioners have not reached an agreement upon a precise definition to knowledge management practice. There are many different interpretations regarding what exactly knowledge management is and how to best address the emerging issue of how to

put effective use to knowledge management practice's potential power (e.g. Wiig, 1995; Nonaka & Takeuchi, 1995; Edvinsson & Malone, 1997; Davenport & Prusak, 1998). Organizational knowledge management is a broad and multi-faceted topic involving social-cultural, organizational, behavioral, and technical dimensions (Alavi and Tiwana, 2003). King (2001) defined knowledge management as a mechanism involves the acquisition, explicating and communicating of mission specific professional expertise in a manner that is focused and relevant to an organizational participants who receive the communications.

Lee and Young (2000) also defined knowledge management as the deliberately designed organizational processes that govern the creation, dissemination, growth, and leveraging of knowledge to fulfil organizational objectives. Marshall (1997) considered that KM refers to the harnessing of intellectual capital within an organization. Despite the different perspectives researchers take in defining knowledge management, it is universally agreed that knowledge management practice will create competitive advantages by improving the efficiency for organizations to access and utilize existing knowledge as well as generating new knowledge.

In most firms, knowledge management practice tends to be kept as an in-house, stand-along function that is not adequately shared with others. Users of the closed knowledge management systems can only access and utilize a fraction of knowledge circulating in supply chain. They would not be able to take a holistic view to the operations of entire supply chain, hesitate to share expertise with others and be unwilling to collaborate for new knowledge creation. In consequence, organizations could not take a full advantage of all the knowledge supply chain partners possess.

Globalization, advancement in technology and the increasingly intense competition in post-industrial business world have made cross-functional and inter-

organizationcollaboration a very popular practice (e.g. integrated product development). Knowledge management practice should follow the rationale and be connected and coordinated across supply chain partner firms for maximum efficiency. The apparent advantages of collaborative knowledge management practice are demonstrated by the system's powerful multidisciplinary problem-solving ability because of the larger amount of knowledge created and leveraged at the intersection of disciplines and functions (Boland and Tenkasi, 1995; Iansiti, 1995; Leonard-Barton, 1995). Roper and Crone (2003) also argued that the development of boundary spanning or inter-firm knowledge transfer andcoordination could help partners in supply chain to internalize sources of internally generated uncertainty and to respond more effectively to externally generated uncertainty.

2.7 Supply Chain Knowledge

In a global economy, employees, partners, suppliers and customers are increasingly sharing knowledge to gain efficiencies in their supply chains. It has been an emergent trend that firms are exploring new ways to put enterprise knowledge in the hands of customers, suppliers and partners to share with them their intellectual capital (Apostolou, 1999). Some authors attempted to address the reasons about firm's increasing enthusiasm to share knowledge with their supply chain partners.

Davis and Meyer (1998) suggest that knowledge and related intangibles not only make business operate but are part of all of "product package" current firms are offering. It is becoming increasingly hard for any firm to be able to sell anything doesn't include combination of tangible products and intangible service, which include solutions etc that can be classified as knowledge. What these firms offer to their customers are product-service hybrids. The supply chain knowledge take the format of technical know how,

product design, marketing presentation, understanding the customer, personal creativity and innovation etc that add value to the supply chain partners.

Christensen et al (2005) echoed similar arguments and believed that driven by global competition and continuing expansion of knowledge, firms are pushed to operate with Just-In-Time (JIT) and Mass Scale Build-To-Order (MSBTO) principles with their supply chain partners to address the market requirement for high levels of product customization and fast delivery. Knowledge from customers about such issues as future purchasing requirements, and anticipated product quality levels and suppliers' knowledge managing and improving product quality, product design, production scheduling, inventory management and control can be critical to supply chain operations, especially between long term and stable trading partners where the number and variety of product about demand is large.

In this scenario, supply chain have to share supply chain knowledge such as technical know how, product design, marketing presentation, understanding the customer, personal creativity and innovation in order to be operate with JIT and MSBTO. Thus, we would like to observe organizational knowledge from the supply chain perspective and define supply chain knowledge as the conglomeration of all the information resources andknowledge assets available for supply chain partners which would help the achievement of supply chain objectives. Supply chain knowledge can not be purchased in a market, is difficult to transfer and to imitate, because of its experiential nature and inter-firm linkages. The next section continues the discussions about our attempts to use inter-firm knowledge collaboration to management the elusive supply chain knowledge.

2.8 Collaborative Systems

According to Schrage, collaboration is the process of shared creation or two or more individuals with complementary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own. Collaboration creates a shared meaning about a process, a product, or an event. It can occur by mail, over the phone lines, and in person."Collaborative model consists in six principal phases.

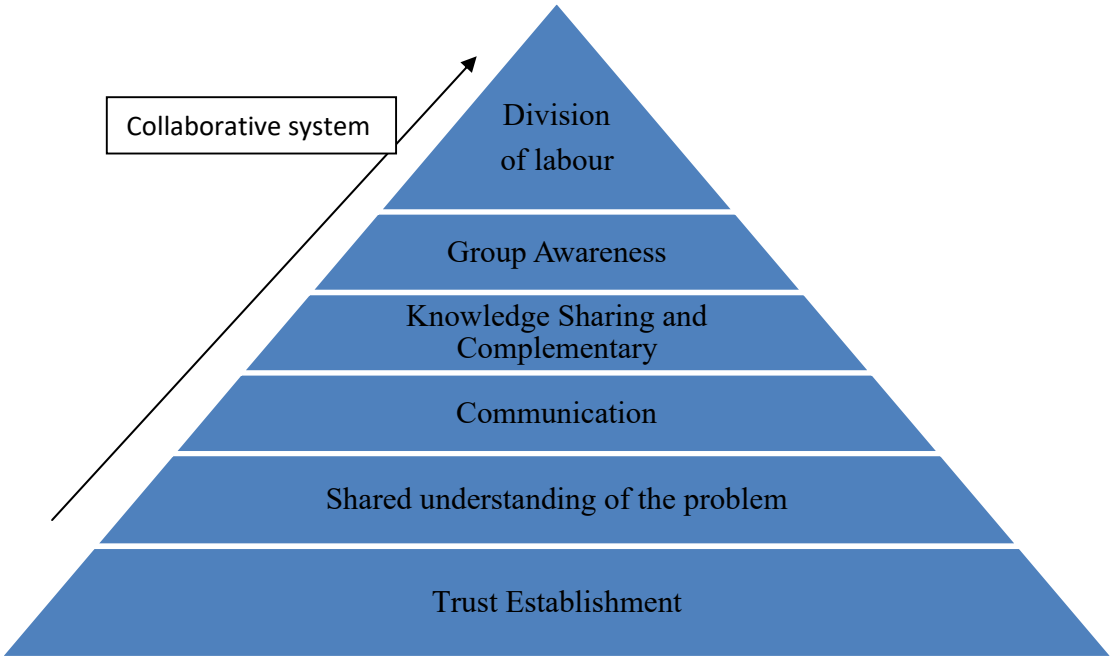

Fig: 3 A Pyramid Collaborative Model
Source: Collaborative Watch by V. Odumuyiwa, E. Site-loria, N. Université, C. Scientifique, andB. P. Vandoeuv (2011), pp. 5–7.

Trust phase - For collaboration among group of individuals exist, a minimum trust among them is required. Collaboration cannot not take place without a minimum level of trust which enables to or more people to jointly solve a problem.

Shared understanding phase - When a group of individuals decide to gatherinformation on a particular problem, they need to define the problem itself and clarify it.**Communication phase** - Communication is not an isolated phase but rather interwoven with all other phases.

Knowledge Sharing phase - This phase allows group members to synergise theirCompetences and to collectively produce actionable knowledge for decision-making. This phase allows members to share both tacit and explicit knowledge trough socialization, externalization, combination and internalization.

Group awareness phase - The possibility of receiving signals from one to another in a group provides understanding of the actions and intentions of the group.

Division of Labour phase - This phase allows members of a group to divide tasksamong themselves in order to reduce redundancy in their activities and to increase the rapidity of their work.

2.8.1 Collaborative Knowledge Management practices (CKMP)

Collaborative Knowledge Management Practice (CKMP) refers to organizational undertaken of collectively create, store, access, disseminate and apply knowledge across company boundaries to achieve business objectives of the entire supply chain. The purpose of CKMP is simply to facilitate intra and inter organizational knowledge management and to create and leverage knowledge resources and intellectual assets collaboratively (Cormican and O'Sullivan, 2003).

Many studies take knowledge process perspective to examined organizational KMpractices (i.e. Bassi, 1998 and Blake, 1998). Lee and Yang (2000) conclude five knowledge processes, namely: knowledge acquisition, knowledge innovation (organizational amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organization), knowledge protection, knowledge integration, and knowledge dissemination. Alvai and Leidner (2001) simplifies the knowledge process model by combining knowledge acquisition, knowledge innovation, and knowledge integration into a single knowledge creation process and propose a new

knowledge application process to emphasize the objective of the KM practice. Their model is composed of four major knowledge functions: knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application.

Similarly, Cormican and O'Sullivan (2003) argue that activities in Alvai and Leidner's second process (knowledge storage and retrieval) have different nature, thus break it into three separate dimensions. Their framework has five generic activities: knowledge generation, knowledge representation, knowledge storage, knowledge access, and knowledge transfer. Based on the above studies, collaborative KM practices can be understood as supply chain wide systematic attempts to generate, store and use knowledge collaboratively in order to improve overall performance. We summarize these above mentioned knowledge processes of regular stand alone KM practice of each organization and propose the following five knowledge processes for collaborative knowledge management practices:

Collaborative Knowledge Generation

CollaborativeKnowledge Generationrelates to the chain-wide joint efforts forknowledge addition and the correction of existing out-of-date knowledge. Example activities include the creation of new ideas, the recognition of new patterns, thesynthesis of different disciplines and the development of new processes, capture knowledge etc.(Davenport and Prusak, 1998). Organizations should enhance knowledge environment which is conducive to effective knowledge creation.

Collaborative Knowledge Storage

Collaborative Knowledge Storageis the process of coordinating data format,location of knowledge storage, knowledge ownership and governing mechanism. Probst etc. (24)

described knowledge storage as a function that preserves and stores perceptions and experiences beyond the moment when they occur, so that they can be retrieved at a later time (Smith, 2001). Olivera (2000) contended that organizational capability for knowledge storage has important consequences for organizational performance. Argote et al (1990) stated that stored knowledge can effectively safeguard the organization from the distracting effects of turnover and assist in framing and solving problems.

Thus, collaborative knowledge storage is the inter-firm efforts to unit and leverage multiple knowledge repositories or retention bins for efficient knowledge acquisition and preservation (Walsh, and Ungson, 1991; Levitt, and March, 1988; Starbuck, 1992). The ultimate objective of collaborative knowledge storage is to set up a knowledge server with common interface and to provide an extensible architecture unifying and organizing access to disparate knowledge repositories in different member organizations and Internet data resources for smooth knowledge integration across the supply chain.

Barrier-Free KnowledgeAccessrefers to the process of retrieving informationand knowledge from the system for reuse by knowledge users within and outside the organization where the knowledge in question resides and the associated mechanisms about how stored knowledge to be accessed, leveraged or transferred et al. Stored knowledge has limited value if it is not transferred. Jasimuddin (2005) argued that it was simply wasting organizational resources to store knowledge that is not put into use in the future.

Davenport and Prusak (1998) pointed out stored knowledge became a valuable corporate asset only it is accessible, its value increased with the level of accessibility. Typically there will be a variety of databases, document repositories and corporate applications residing in different servers, systems and organizations and presented in different format. They often need to be integrated to given users a holistic view for decision making

purposes. The collaborative knowledge management architecture should be able to make those contents from distributed sources accessible, and more or less as if they all came from a single data store. Bob Newhouse, senior knowledge management advisor for the Houston based American productivity and Quality Center (APQC) explains that some supply chains continue to build information repositories, bestpractice-fatheringdatabases, and web portals only to realize that supply managers and suppliers are not accessing these tools (Yuva, 2002). Thus to provide easy access to knowledge by people with various expectations and requirements can be a big challenge for knowledge managers.

Collaborative Knowledge Dissemination

Collaborative Knowledge Disseminationis the process related to makingknowledge available to knowledge users within and across organizational boundaries and facilitating knowledge transfer among individuals in order to promote learning and produce new knowledge or understanding. The value of knowledge is realized only when stored knowledge is disseminated to occasions where it can make an impact. Making knowledge accessible to all potential users is not enough. The mechanism to organize and index knowledge is critical, potential users must know their needed knowledge does exist and have clear idea to locate it then he/she can retrieve it.

Knowledge Application

Knowledge Applicationis the process of utilizing storedknowledge for decisionmaking and problem solving by individuals or groups. Knowledge itself does not produce anyorganizational value, its application for taking effective action does. CKMP emphasizes interactions between individuals and organizations. It will support and facilitateknowledge transactions across the supply chain.

The above-discussed five knowledge processes supplement with each other and jointly form a spirally incurring cycle. At a regular structural business environment, all supply chain function runs smoothly. The supply chain operation is a process of the application of existing knowledge that has been created and fine-tuned over years. It is a static mode where factors such as weekly forecasting, build-to-order and customer services are well managed based on past knowledge. However, at unstructured times when big changes come to the supply chain operation environment, for example, a major new competitor coming into market, or one particular trading partner has made substantial operation changes, organizations in the entire supply chain must make changes to their existing operations to adapt those external or internal changes to remain competitive. At this time, new knowledge has been created and must be harvested, stored, and disseminated for possible future applications. The entire cycle of knowledge process focus on supply chain system optimization and efficiencies by squeezing and integrating competitive advantage from existing business processes before they are marginalized by changing competitive pressures and customer trends.

CKMP is not simply limited to inter-firm information sharing, and more importantly, it enhances knowledge coordination, such as sharing digested understanding andaggregating analysis based on each member's source information and unique expertise. For example, Bayer benefits more if Wal-Mart shares the knowledge about its expert forecast for the recent market trends of Aspirin than getting the simple POS data. As suggested in the CPFR framework (collaborative Planning, Forecasting and Replenishment), upstream suppliers can better adjust their operation functions and strategic directions when downstream customers are being involved in creating knowledge about sales forecasts, event planning, and replenishment schemes, etc. It is important for the supply chain to be able to bring together knowledge from disparate

sources and present it to knowledge users in a comprehensive fashion. CKMP emphasizes interactions between trading partners for collaboration. Because any external and internal changes may result in chain reactions in supply chain, local sub-optimization in these series of changes will negatively affect the performance of many partners in the supply chain. Trading partners have to collaborate with each other to get a sense of changes quickly and to integrate their knowledge with that of other partners for best possible business solutions. However, in practice, there are still many firms that do not collaborate with their trading partners for knowledge management practice.

2.8.2Collaborative innovation for organizational competitiveness

With the increasing globalization in today's dynamic environment, there is a sustained push to improve the efficiency, effectiveness and competitiveness of individual organizations through innovation (Zhang and Deng, 2008; Baldwin and Von, 2011).

Organizations need innovative processes and management that can drive down costs and improve productivity to be competitive (Baldwin and Von, 2011; Chen, 2012). In this context, innovation is the application of better solutions that meet new requirements, unarticulated needs, or existing market needs (Swink, 2006; Serrano and Fischer, 2007). Such an innovation is usually accomplished through more effective products, processes, services, technologies, or ideas that are readily available to markets, governments and societies (Chen, 2012). There are several reasons why innovations are critical to the success of individual organizations (Plessis, 2007; Bueno and Balestrin, 2012). Although every organization has its own priorities and sector-specific issues to balance,businesses that fail to innovate run the risk of losing ground to competitors, losing key staff, or simply operating inefficiently (Coming, 1998; Chen, 2012). Innovation can be a key

differentiator between market leaders and theirrivals. In general the importance of innovation can be reflected in three perspectives. Firstly, innovation can help organizations discover what opportunities exist now, or are likely to emerge in future. Secondly, innovation is not only about designing a new product or service to sell, but can also focus on existing business processes and practices to improve the organizational efficiency, find new customers, cut down waste and increase profits. Thirdly, consumers often see innovation as something that adds value to a company or to its products (Baldwin and Von, 2011).Collaboration is about working together, joining forces or teaming up in a specific situation for solving specific problems(Cowan et al., 2007; Tomas, 2009; Cai, 2012; Boehm and Hogan, 2013). It is the pooling of resources, talents and the best that a team has to offer. Collaborative innovation is a team working together to create new ideas (Li, 2011; Chen, 2012).

The collective talent and resources of a group who are diverse yet focused on a common interest will inevitably lead to new paths within an organization. Innovations are the key to what drives organizations forward within today's global economy (Bommert, 2010; Chen, 2012). Collaborative innovation is critical for the success of individual organizations due to the benefits that it can offer to individual organizations (Gloor, 2006; Fan, 2008; Cui, 2011; Chen, 2012). Firstly, collaborative innovation allows the sharing of new ideas in organizations. With teams working together and pooling intellectual revenue, more ideas will naturally be forthcoming.

Secondly, collaborative innovation facilitates building on others ideas. With creative brain power from multiple individuals, new directions on the ideas can be improved upon. People with different expertise, diversity and backgrounds can elaborate in different ways, adding their take on how the idea can be developed. Thirdly, collaborative

innovation encourages buying in ideas (Cai, 2012). When people invest a part of themselves into an innovation, their interest is peaked. They will strive to have their work a success as they will take ownership, pride and active interest in its success. Finally, collaborative innovation promotes engagement that translates intosuccess. Even collaborative innovations that are not ultimately successful in the market will translate into raised engagement within the organization. Engagement translates to greater loyalty, quality and ultimately profitability when collaborative innovation's products achieve the desired outcome (Li, 2011; Greer and Lei, 2012).Much research is done in collaborative innovation worldwide due to its huge potential to the success of individualorganizations (Gloor, 2006; Cui, 2011; Chen, 2012; Fuller et al., 2012).

2.8.3Knowledge management for collaborative innovation capacity building

Knowledge management is a systematic process of managing knowledge assets, processes, and organizational environments to facilitate the creation, organization, sharing, and utilization of knowledge for achieving the strategic aim of an organization (Song and Deng, 2005; Deng, 2010). It is a formal process that engages an organization'speople, processes, and technologies in a solution that captures knowledge and delivers it to the right people at the right time (Duff, 2001; Jashapara, 2010).

Knowledge management is an effective learning process with the exploration, exploitation and sharing of organizational knowledge using appropriate technologies in a specific environment for enhancing an organization's intellectual capital and learning capabilities (Japshapara, 2010).

It is a multidisciplinary approach that takes a comprehensive and systematic view of the knowledge assets in an organization by identifying, capturing, collecting, organizing, indexing, storing, integrating, retrieving, and sharing organizational knowledge (Geisler

and Wickramasinghe, 2009). Knowledge management is increasingly gaining recognition as the determinant for improving the performance,competitive advantages and innovation through the sharing of lessons learned, integration of various resources and capacities, and continuous improvement of an organization (Geisler and Wickramasinghe, 2009; Xiong and Deng, 2008; Chen, 2012). In recent years, the significance of knowledge management for organizational competitiveness andbetter performance has been widely recognized around the world (Deng and Martin, 2003; Deng, 2010). This leads to the identification of various knowledge management strategies and practices for identifying, creating, representing, distributing, and enabling the adoption of organizational knowledge in order to develop the competitiveness of an Organization.

2.8.4Collaboration Challenges to 19th-Century Theory

Collaboration forms itself through the challenges to 19th-century theory. An organization's challenge to redesign for collaborative work is based on both external andinternal pressures. The external challenge includes difficult financial times, governmentmandates, changing demographics, globalization, and increasing complexity of workers. Internal challenges include lack of research and development, shortages of skilled workers; obsolete equipment; decreases in growth; and increases in social responsibilities (Kezar, 2006).

The theories about collaboration reflect human nature that has underlainthe enlightenment project to explore the disjuncture between modern faith in progress and the reality of modern life. The theories contend that the accumulations of knowledge through scientific practice are supposed to better the human condition.

The benefits include the achieving of greater efficiency, better effectiveness, and faster decision making in complex conditions. Collaboration can lead to the exchange of

information,culture, goals, values, and resources. The philosophers whose work reflects these assumptions include Sigmund Freud and James Strachey (as cited in Brennan, 1992), Ruth Benedict (as cited in Young, 2005), Clifford Geertz (as cited in Johnston, 2000),Claude Levi-Strauss (as cited in Henaff, 1998), Thomas Kuhn (as cited in Nickles, 2003),and Appleby, Covington, Hoyt, Latham, and Sneider (1996). O'Dell, Elliott, and Hubert(2000) stated the following: Organizational knowledge is valuable information in action with value being determined through the eyes of the organization and the recipient. If people don't have a context for the information or understand how to use it, the information is not valuable and therefore cannot be considered knowledge.

In today's competitive, knowledge-driven marketplace, employee skills arecrucial to business success. From accumulated employee experience and knowledge torelationships and hard skills knowledge derives the profitability of companies acrossindustry. However, the translation of knowledge into tangible business results enhancesbest decision making, improves team collaboration, creates business partnerships andalliances, and enables global reach. Fleming, Merrett, and Ville (2004) stated thefollowing:

The workers influence pervading economic development, social structures, andpolitical relationships. Whether they provide the cost efficiencies and overseascontacts to drive economic growth and increased wealth or, alternatively, are abureaucratic leviathan that use their power to extract rents from the rest of society,is a question of sustained interest and discussion. While these large companiestoday are well known in the world, we are far less familiar with their earlydevelopment and predecessors. By investigating their evolution over the course ofthe twentieth century, a much closer understanding is reached of US's leadingcorporations, particularly the bases of their success and their role in our modern economy and society.

Large companies hire skilled workers to bring growth to their firms. Skilledworkers jointly use their knowledge to do research and develop the company. Moreover,collaborative knowledge contributes to enriched social and economic life (Rooney,Hearn, & Ninan, 2005). In addition, Heinrichs and Jeen-Su (2005) have suggested thatknowledge workers use their skills to achieve superior performance and competitiveadvantage and that they stay current with technology to reduce uncertainty.

2.8.5CKM Embraced Supply Chain Management

A supply chain management (SCM) system tracks inventory and informationamong business processes and across companies (Haag et al., 2004). SCM logistics includes companies, suppliers, distributors, and transportation companies. SCM software optimizes business processes for raw material procurement through finished products. Itlinks suppliers, customers, and distributors together. Christopher and Gattorna (2005) found the following:Customers and consumers are increasingly value-driven and, consequently, lessbrand or supplier loyal. In this challenging world, there is a growing recognitionthat creative pricing strategy combined with effective supply chain managementprovide opportunities for significant cost reduction and increased profits. Moreover, Antonioni (2005) stated, “Organizations need trusted and respectedleaders who are free to make choices that contribute to the short- and long-term good ofall the organization’s stakeholders: the customers, shareholders, employees, and theorganization’s natural environment”.

However, organizations use electronic ,supply chains to improve business to business (B2B) processes in terms of speed, agility,real-time control, or customer satisfaction (Cagliano, Caniato, & Spina, 2005). The esupplychain is the communications and operations backbone of the enterprise supplynetwork that links suppliers and business

partners together as one cohesive producingentity (Deise, Nowikow, King, & Wright, 2000). This network is managing collaborativerelationships in a time of discontinuity (Coughlan et al., 2003).

One source of lasting competitive advantage for a market dominance organizationis collaboration knowledge, but assessing the collaboration knowledge dimensions forthese types of organizations is difficult. Very few managers in these organizations seemto understand the true nature of knowledge collaboration because they hold a too-narrowview of what knowledge collaboration is and what the company must do to exploit it. ToCompete well in a global economy, knowledge managers and knowledge management are the tools to improve the effectiveness of the organization. Business Drivers for Today's Information Systems Deise et al. (2000) believes, "As a company works to integrate its business operations with those of its supply chain and demand chain partners, a host of effects occur regarding organizations and people, business processes, and information systems and technology" Collaboration and partnership, globalization of theeconomy, electronic commerce, security and privacy, knowledge asset management, and business processes are the key business drivers that, if carefully managed, can make anOrganization attains a market dominance of its products.

2.8.6 Importance of Collaborative Knowledge Management

In the past, corporations could compete successfully by exploiting scale and scope economies or by taking advantage of imperfections in the world's goods, labour, and capital markets. Besanko, Dranove, and Shanley (2000) defined "economies of scales as the production of a specific good or service over a range of output when average cost (i.e., cost per unit of output) declines over that range".

Furthermore, Besanko et al. (2000) stated that “economics of scope exist if the firm achieves savings as it increases the variety of goods and services it produces”. However, this is no longer true because collaboration and partnership are significant business trends that are influencinginformation systems applications (Hansen and Nohria, 2004; Whitten, Bentley, and Dittman, 2004). Collaboration of knowledge workers involves challenges and time to achieve measurable outcomes, and it needs constant evaluation, whether such workers aremaking the most of collaboration (Weiss, Anderson, and Lasker, 2002).

In addition, CKM is called interunit collaboration, which is formed through alliance, collaboration,and partnership (Hansen and Nohria).CKM is necessary for a company to remain competitive, adapt to a rapidly changing environment, be able to innovate, respond to the demand of e-business, fully capitalize and develop its people, and support effective relationships with suppliers, partners, and customers (Hansen and Nohria, 2004; Smith, 2001,). According to Tollinger, McCurdy, Vera, and Tollinger (2004), at NASA, “CKM allows groups of scientists and engineers to view space in shoulder-to-shoulder collaboration to do free 3 form drawing and do strategic planning”.

In addition, CKM is used in the health care industry, as Guptill (2005) found: It is long-term, sustainable commitment to changing the culture of health care to become more collaborative, more transparent, and more proactive. Knowledge management, implemented well, will transform the health care delivery system over the next few decades, into a more cost-effective, error-averse, andaccountable public resource. Moreover, Guptill added that “knowledge management is more than the centralized repository of data, documents, and other information, but it encompasses the social context of other experiences and the lessons learned in the process”. She continued, “Knowledge management should result in changed behaviour as a result of knowledge

sharing". As Logan and Stokes (2004) phrased it, "Organizations and individuals must be competitive to collaborate, and at the same time they must collaborate to compete."

2.8.7Barriers to Collaboration

Collaborative organizations are flexible and better able to adapt to changingbusiness conditions. Their members are able to develop greater sets of skills andcompetencies. Similarly, they can be used wherever within the organization skill areneeded (Allen & Jarman, 1999; Logan & Stokes, 2004).The barriers to collaboration include a reluctance to share with other unknown others, a fear that may have already solved the problem, and a belief that collaborationmay result in others having power over them.

Logan and Stokes (2004) stated that"effective collaborators must possess the cognitive skills, the technical skills and theability to communicate to be able to contribute to the collaboration process".

Logan and Stokes (2004) found the following:The ideal collaborative behaviour that is desired is one in which tasks andobjectives are achieved not by sacrificing relationships but rather by buildingproductive relationships that will serve one's long-term interests. Individuals actcollaboratively not just for the sake of building relationships; but rather becausethey can better achieve their objectives with the cooperation of their colleagueswho find themselves in a similar position.

Additional barriers to collaboration may include:

(a) Skills that undermine action,

(b) Personnel and information systems that make it difficult to act,

(c) Bosses thatdiscourage actions,

(d) Formal structures that make it difficult to act

(Olson & Singer,2004).According to Leslie (2006), “When it comes to joint ventures and widercollaborations crucial to the success of industry, too many conflicting views, hidden agendas and egos lead to failure”. For example, Leslie added for the Aerospace,Defence, and Energy sectors, the most significant barriers to collaboration are:

1. Concerns over intellectual property rights;
2. Protection of competitive advantage;
3. The problem of benefits being seen to be intangible;
4. The risk of becoming involved with untested collaborative ventures;
5. Mindsets.

The people who have these characteristics are reluctant to share their Knowledge because knowledge is perceived as power. In addition, barriers to collaboration involve the avoidance of previously performed research or knowledge that was not originally developed within the group/institution. For example, technological barriers to online collaboration include security and proprietary software. Social barriers to online collaboration exist because people work differently.

CHAPTER - III

THEORETICAL FRAMEWORK, HYPOTHESIS AND OBJECTIVE DEVELOPMENT

Since the Concept is vast and requires a major understanding, hence the Proposed Project shall be dealt with systematically, as given below:

- Project emphasis would be upon the various characteristics that produces a conducive environment for the implementation of CKMP. These characteristics at this stage could be noted as: Technological Characteristics, Organizational Characteristics, Perceived Benefits of CKMP and Environmental Characteristics.
- The parameters should be analysed and viewed as all those which related to Knowledge Dissemination, Generation, Storage, Access, Access and Application.
- A critical analysis of the project would be analyzed with the respect to the sustainability, Implementation, Performance and Quality of Supply Chain Management Practices is concerned.

3.1 Theoretical Frame work of the Current study

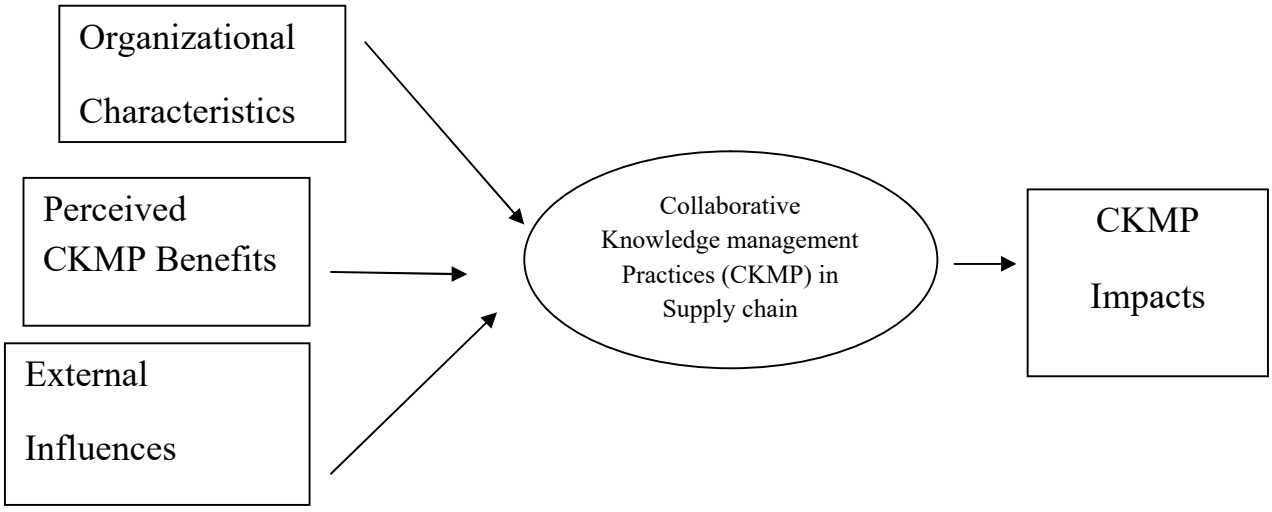

Fig 3.1Theoretical framework of the current study

3.2 Constructs in the Model:

There are 3 CKMP implementation antecedent constructs and 3 impact constructs. The following section would do a thorough literature review and operationalize these constructs as well as their sub-constructs.

3.2.1 Organizational Characteristics

Organizational characteristics refer to the structural and infrastructural features of the organization related to its readiness to implement CKMP. There are 2 sub-dimensions for this construct:

1. Technological infrastructures, the tools and systems that are instrumental to the operation of cross-organizational knowledge communication and management.
2. Organizational infrastructural, the factors that prepare the firm to be collaboration ready and knowledge smart.

3.2.2 Technological Infrastructure (TI)

Technological infrastructure has been emphasized as an important antecedent for knowledge management practices by many researchers. For example, Meso and Smith (2000) viewed knowledge management system as an advanced assembly of software, its associated hardware infrastructures for supporting knowledge work and /or organizational learning through the free access to and increased sharing of knowledge.

In the current study, TI is defined as a set of information technology tools supporting collaborative knowledge management practices. At the simplest level this means a

capable, networked PC for each knowledge user with standardized personal productivity tools so that people can exchange thoughts and documents easily.

Five sub-constructs of technological infrastructure are identified which support the above knowledge processes.

- **Communication Support System**

  Communication support system includes the technological tools such as email, messaging systems, electronic whiteboard, discussion bulletins, and audio/videoconferencing systems. Explicit and factual knowledge can be shared with lean communication tools such as email or threaded discussion; while the more complex, ambiguous and tacit knowledge (e.g. believes, hunch, perspectives) can be transferred with videoconferencing and other rich media format as well.

- **Knowledge Database Management System**

  Organizations generate a large volume of data in their operations, such as customer information, supplier delivery schedules, transaction log etc. Many of these data are functionally different thus needed to be locked in separated databases.

- **Enterprise Information Portal**

  An enterprise information portal is a central access point that enables the transfer of knowledge from knowledge repositories to and from individuals. It often has a web browser interface that looks like an online search engine. A key advantage of enterprise information portal is the ease of use and its ability to transfer knowledge to and from a diverse array of resources and places at any given time.

- **Collaborative System**

  A collaborative system is one where multiple users or agents engage in a shared activity, usually from remote locations. The users in the system are working together towards a common goal and have a critical need to interact closely with each other: sharing information, exchanging requests with each other, and checking in with each other on their status (Baecker, 1993, Cil et al., 2005). The purpose of setting up a collaborative

  Cil et al (2005) suggested the five elements of common collaborative systems: 1) asynchronization and collaboration, which are provided by the Web to link all involved users together; 2) many multi-criteria decision making methods and social choice functions; 3) visualizations and the accessibility of data and information; 4) sharing the data among participants; and 5) screening, sifting, and filtering the data, information, and knowledge.

- **Decision Support System**

  Decision support system is defined as computer based systems that support unstructured decision-making in organizations through direct interactions with data and analytical models (Sprague and NcNurlin, 2001). The advantage of the technology is its ability to combine existing knowledge with unstructured and context-specific information for problem solving

3.2.3 Organizational Infrastructure (OI)

The second dimension to measure organizational characteristics is organizational

infrastructure. An organization can be viewed as a social system of interactions among entities constrained by shared norms. Organizational Infrastructure (OI) thus can be defined as firm's internal configurations and arrangements involving organizational structure, business processes, and work design etc that is intended to support the firm's business and operation strategy Examples of the elements of organizational infrastructure are social systems, structures, development processes, communication mechanism, social networks, rewards etc..

Organizational infrastructure in this study includes three sub-constructs

- **Top Management Support**

  Top management support is defined as the degree of senior managers' understanding to the benefits of CKMP and the level of support to CKMP. A number of researchers (Hamel and Prahalad, 1989; Dale, 1999; Balsmeier and Voisin, 1996) have regarded top management support as the most important driver for any successful change in the organization.

- **Collaboration Supportive Organizational Culture**

  Collaboration Supportive Organizational Culture (CSOC) is the set of norms, values and organizational practices that encourage team work, cross-functional communication, and cooperation (Hart, 2004). Davenport and Prusak (1998) identified three major components for a knowledge friendly organization culture:1. Positive orientation to knowledge -- employees are bright, intellectually curious, willing and free to explore the unknown; and cooperate executives encourage knowledge creation and the use of novel knowledge.

  2. Encouragement for knowledge sharing -- employees are not alienated or

resentful of the company and don't fear that sharing knowledge will cost them their jobs.

3. Decentralized organizational structure that facilitates the fit and alignment of goals, vision, and operation approaches between entities involved.

- **Organizational Empowerment**

Empowerment, sometimes called participation or participative management (Val and Lloyd, 2003), is a classical concept that has gained widespread interesting among researchers when studying the organizational infrastructures (e.g. Drucker, 1988, Thomas and Velthouse 1990, Lawler, 1993, Spreitzer 1995, Doll, et al 2003). Organizational empowerment can be understood as a motivational construct of self-efficacy (Conger and Kanungo, 1998). Thus, Spreitzer (1995) explained an organizational environment with high empowerment as such where individuals wish and feel able to shape his or her work role and context. Spreitzer (1995) studied empowerment from its four cognitive dimensions:

1. **Meaning**: the value of a work goal or purpose, judged in relation to an individual's own ideals or standard

2**. Competence/self-efficacy**: an individual's belief in his or her capability to perform activities with skill (Gist, 1987)

3. **Self-determination**: an individual's sense of having choice in initiating and regulating actions (Deci, Connell, and Ryan, 1989)

4. **Impact**: the degree to which an individual can influence strategic, administrative, or operating outcomes at work (Ashforth, 1989). All four

dimensions must combine together to reflect an active, rather than a passive, orientation to one's work role in the organization (Spreitzer 1995).

3.2.4 Perceived Benefits

Perceived benefits refer to the level of recognition of the relative advantage that CKMP can provide to the organization. Many practitioners and researchers have attempted to identify the potential advantages that knowledge management system has to offer. Firms must be able to identify substantial benefits from adopting CKMP to motivate and justify their commitment. Pfeiffer (1992) and Iacovou et al. (1995) argued that these perceived benefits can be understood from two perspectives.

- The first perspective looks at the direct benefits from CKMP. These are mostly operational improvements in organizational knowledge management capabilities that the firm believes CKMP can bring. The purpose of knowledge management system is to improve the knowledge management process (Alvai and Leidner, 2001). Therefore, our understanding to firm's perceived knowledge management capability improvement is based on the five activities of the generic knowledge management process identified by Cormican and O'Sullivan (2003), i.e. firm's capabilities on supply chain knowledge generation, storage, access, dissemination and application are all expected to be facilitated by CKMP.
- The second perspective of perceived CKMP benefits observes the indirect benefits or opportunities from implementing CKMP. It explores to the impact of CKMP on the overall organizational and supply chain performance dimensions. These are mostly tactical and competitive advantages the firm gains indirectly

from implementing CKMP. Although the ultimate benefits of implementing CKMP can include large financial savings, better product/service offering, improve customer service etc, these benefits are too remote and too general to be analyzed. Thus, much of our attention has focused on its impact on business operations. In a conceptual paper, Smith (2001) summarized six possible dimensions of CKMP benefits to organizational operations:

In a conceptual paper, Smith (2001) summarized six possible dimensions of CKMP benefits to organizational operations:

- Adapt to a rapidly changing environment
- Optimize business transactions
- Enhance supply chain integration
- Exception handling
- Be able to innovate
- Fully capitalize and develop its people .

3.2.5 External Influences

External influences refer to various external conditions and events that create opportunities and threats to the firm, and exert pressure to adopt and implement CKMP. We identified three major external influence factors:

1. Environmental characteristics examine the organizational environment such as environmental uncertainty in business, perceived competitive pressure to implement CKMP and trading partner readiness for CKMP
2. Knowledge complementarities studies how different each firm's knowledge bases

are and how important a firm perceives other's knowledge to its own operations.

3. Trading partner relationship.

All three dimensions of external influences have substantial impact on whether a particular firm is willing to implement CKMP with its trading partners.

3.2.6 Environmental Characteristics

Three environmental factors are identified that are expected to affect firm's level of CKMP implementation including environmental uncertainties, competitive pressure and partner readiness.

3.2.6 Environmental Uncertainty

Environmental uncertainty is defined as the source of events and changing trends that create opportunities and threats for individual organizations (Lenz, 1980; Turner, 1993). Environmental uncertainty has acted as a critical external force driving the implementation of supply chain integration including the collaboration of knowledge management practices between business partners. Most of operational definitions of environmental uncertainty can trace their roots to the work of Aldrich (1979), which proposes five sub-dimensions of environmental uncertainty: 1) capacity, 2) homogeneity-heterogeneity, 3) stability-instability, 4) concentration-dispersion, and 5) turbulence.

- **Customer Uncertainty** is the extent of change and unpredictability of thecustomer's demands and tastes.
- **Supplier Uncertainty** is the extent of change and unpredictability of the

suppliers'product quality and delivery performance. Lee and Billington (1992) studied the potential reasons for supplier uncertainties as such: supplier's engineering level, supplier's lead-time, supplier's delivery dependability, quality of incoming materials, etc.

- **Competitor Uncertainty** is the extent of change and unpredictability of the competitors'actions. Li (2002) identified globalization, increasingly demanding customers, and rapid technology advancement as the factors that lead to competitors' unpredictable actions.
- **Technology Uncertainty** is the extent of change and unpredictability of technologydevelopment in an organization's industry. Technology development provides organizations with numerous opportunities. For example, Chizzo (1998) and Turner (1993) argued that the breakthroughs in information technology facilitate inter-firm knowledge sharing and supply chain and business process integration.

3.2.7 Knowledge Complementarily (KC)

The concept of knowledge complementarily (KC), sometimes called knowledge gaps (such as Young and Lan, 1997, p 671), knowledge lags (Mansfield and Romeo 1983) or knowledge heterogeneity (Tiwana and McLean, 2005), captures the differences in the stock of knowledge between knowledge sharing partners. Knowledge complementarity can be also understood as the relative strength of knowledge base of the partners in knowledge coordination. It is closely related the patterns of knowledge collaboration and coordination activities between partner firms in supply chain. The past attempts to define

KC start from developing taxonomy that distinguishes between different forms of knowledge. Then, KC was studied in terms of differences in the strength of each firm's knowledge base as well as utilization of a range of knowledge and techniques. The current study follows this line of research in understanding KC. However, we find the taxonomy of each knowledge sharing partner's knowledge profile is difficult and sometimes confusing, because trading partners of a supply chain are involved in very different business areas, vary in firm sizes and take different operating structures. This study thus adopts the definition given by Roper and Crone (2003), which emphasize the supply chain context and use knowledge user's perceived difference and strength of each firm's knowledge rather than the comparison from tedious taxonomy. We believe that detailed information on firm's knowledge bases and the extent of knowledge compatibility with suppliers' can only be identified realistically through the eyes of knowledge users. Thus, KC is defined in this study as the knowledge users' perceived difference in the knowledge portfolios of trading partners as well as the perceived importance of a partner's knowledge to other organizations on the supply chain.

We will use the two dimensions to understand and measure the concept of KC: the dimension of perceived knowledge importance will follow the Buckley and Carter's study (1999) in knowledge relationships and measure the impact of the trading partner's knowledge to the firm's operation; the perceived knowledge differences will capture knowledge users' perceived difference between partner organization

's knowledge portfolios. Partner firms' knowledge base must be different enough to encourage mutual interest in knowledge exchange. They must also have considerable degree of common knowledge so that knowledge users from each party can understand,

communicate, and utilize the knowledge shared. Knowledge Compatibility also refers to the commonality in using terms. Multiple and contradictory meanings for the same term can create barriers to sharing knowledge (Koufteros et al, 2001). On the other hand, a common language provides knowledge community members from different professional backgrounds the means to better understand one another. That is to say those trading partners who always use the same term to refer to the same thing are regarded to have higher knowledge compatibility.

3.2.8 Partner Relationships

Partner relationship refers to the degree of trust, commitment, and shared vision between trading partners. Modern technology can easily link together the physical supply chain processes, but not inter-organizational relationships. The successful implementation of CKMP requires part firms have collaborative relationships. Following Li's (2002) study, which provided validated measurement items in supply chain context, we consider partner relationship include three sub-dimensions: trust in trading partners, commitment of trading partners, and shared vision between trading partners. The list of these sub-constructs

a. **Trust in Trading Partners** is defined as the willingness to rely on a trading partner inwhom one has confidence (Ganesan, 1994; Monczka et al., 1998; Wilson and Vlosky, 1998; Spekman et al., 1998). Trust is conveyed through faith, reliance, belief, or confidence in the supply chain partner, viewed as a willingness to forego opportunistic behaviour (Spekman et al., 1998).

b. Commitment of Trading Partners refers to the buyers and suppliers' willingness to

exerteffort for their mutual relationship (Spekman et al., 1998; Monczka et al, 1998). Commitment means an enduring intension to maintain a valued and long-term relationship. It incorporates each party's desire and expectation of sustainable relationship, and willingness to invest resources in collaboration with others (Mentzer et al., 2000). Therefore, commitment 1) is a critical factor for long-term relationship; 2) demonstrates one's willingness to should risks associated with deep involvement into other party's operations; and 3) implies the perceived importance of the relationship to the partners (Mentzer et al., 2000). Through commitment, partners dedicate resources to sustain and further improve the effectiveness of CKMP.

c. Common Vision Between Trading Partners is defined as the extent of trading partners'beliefs in common about what behaviours, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong (Ballou et al., 2000). It is obvious that when partners have established a common vision, it would be easier to exchange knowledge.

3.2.9 CKMP Impact

The impact of CKMP implementation refers to the real benefits adopters believe they have received from utilizing CKMP (Iacovou et al, 1995). We assume these impacts are closely associated with the perceived CKMP benefits. All of the expected benefits should be reflected as an outcome from CKMP, providing the implementation is successful.

Thus there are two general dimensions of impacts: the first is the improve knowledge capabilities as represented by high supply chain knowledge quality, and the second

dimension is the organizational performance advancement, as reflected by supply chain integration as well as supply chain performance. Thus there are three sub construct in CKMP impact and these are:

- Supply Chain Knowledge Quality
- Supply Chain Integration
- Supply Chain Performance

3.2.9.1 Supply Chain Knowledge Quality

Good knowledge quality has been recognized as an important outcome from knowledge management systems and a factor in facilitating knowledge transfer and supply chain integration (e.g. Kane et al, 2005). A set of sub-constructs in supply chain knowledge quality.

1. **Intrinsic Quality: -** It is anintrinsic characteristic of knowledge as an artefact that is independent of the context in which data is produced. It includes the dimensions of accuracy objectivity, credibility, and reputation.
2. **Accessibility Quality: -** It defines the ease to access the knowledge needed and the securitylevel of such knowledge. The Ease of accessing to Knowledge being stored or shared.
3. **Contextual Quality: -** The contextual quality dimension examines the fitness of the knowledge to its context of task, usefulness in decision making at its defined situations, whether the knowledge supports user's tasks and add value to tasks of users. Dimensions included are relevance, timeliness, completeness.

4. **Representational Quality: -** It captures the aspects related to the format of the knowledge. Dimensions include ease of understanding and interpretability.

3.2.9.2 Supply Chain Performance (SCP)

1. Supply chain performance refers to the extended supply chain's activities in meeting

2. End –customer requirements, including product availability, on-time delivery and all necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner.

Different researchers have attempted to assess supply chain performance in different ways, but most measures available in the literature are largely economic performance oriented. A set of measures has been suggested and used in the literature to respond to the current requirements for a comprehensive supply chain performance measurement.

1. **Supply Chain Flexibility**: - Flexibility is often used to describe an organization's ability toadapt or respond to change effectively. Flexibility reflects an organisation ability to effectively adopt or respond to change that directly impacts the organisation.
2. **Customer Responsiveness: -** Supplychain performance must ultimately be measured by itsresponsiveness to customers. The Speed of an organisations responses to customer request
3. **Supplier Performance: -** Itis defined as suppliers' consistency in delivering materials,components, or products to an organization on time and in acceptable condition.
4. **Partnership quality**: - It is defined as how well the outcome of a partnership matches theparticipants' expectation.

3.3 Research Hypotheses

In order to understand the mediating role of CKMP on the relationship between its antecedents and organizational outcomes, we elaborate our theoretical framework with nine hypotheses as presented and illustrated below. They enable the predictions to be made about the role of CKMP in supply chain integration context, so that cross organizational knowledge management can be observed and evaluated, therefore provides better explanations of the implications of CKMP and their consequences.

On the basis of the past researches, researcher formulates the following hypothesis in order to present the analysis objectively.

The following two hypothesis have been framed for the study under reference:

H_1: Industrial Units considering SCM as a strategic choice for long term growth is positively correlated with their performance.

H_2: Financial flow and Inventory flow of Industrial Units become smooth as a consequence of improved supply chain relationship.

3.4 Objectives of the Study

The broad objectives of the study is to explore the various functionaries in Supply Chain Management. These include the study of three popular supply chain paradigms (supply chain integration, strategy and planning and implementation), as summarized,

- ***Broad Objectives***

- ***Supply Chain Integration:*** This shall include - SCM decisions like use of IT, partnering, collaboration, alliance, etc..
- ***Strategy and Planning:***This shall include – strategy and planning issues of SMEs' and their links with SCM.
- ***Implementation:***This shall highlight – implementation difficulties in SCM based decisions like change in culture, need for IT solutions, competition, owner-manager's impact, buyers expectations, etc..

More specifically, the study aims to achieve the below mentioned specific / sub-objectives. In forming the research objectives, all care has been initiated to the mindful that the key SCM paradigms identified in above discussions are not exhaustive.

- ***Specific Objectives***
  - ***Objective-1:*** Understand the scope of Supply Chain Management & CKMP in Indian manufacturing industries;
  - ***Objective-2:*** Present a comprehensive literature review to identify present stage of research and paradigms that are coming up;
  - ***Objective-3:*** Formulate a set of propositions for analysing the issues as a part of further research;
  - ***Objective-4:*** To provide a common platform for the academicians as well as practitioners for optimized outcomes in the implementation of best practices across manufacturing industries in India;

- ***Objective*-5:** To develop a comprehensive and sustainable model for CKMP utilization across Indian industries;

The approach has been to focus on broader and popular paradigms that are widely discussed, adopted and reported in the various literatures of SCM and CKMP so as to acquire an in-depth understanding of the prevailing situation and strategies adopted by industries in this regard.

For the structural model for hypotheses (H_1, & H_2), the following dimensional constructs have been regarded as Independent Variables (Exogenous): Supply Chain Management Practices Perceived Benefits (SCIPB) and Knowledge Complementarily for Financial and Inventory Flow (KC); whereas Supply Chain Management Practices Implementation (SCMP) has been regarded as Dependent Variable (Endogenous). Endogenous latent variables are affected by exogenous variable in the model, either directly or indirectly.

CHAPTER - IV

RESEARCH METHODOLOGY AND DESIGN

This chapter delineates the objectives, conceptual model, hypothesis and research methodology used in this study. The objectives of the study indicate the major research aspects that are proposed to be dealt with the study. The conceptual model of the study explains the variables, which are considered as the determinants of Supply Chain Management in the research project report. The hypothesis refers to the assumptions made on the basis of the objectives and review of existing literature. The section on research methodology consists of the questionnaire development, the sampling frame, data collection, the statistical measures and techniques used in the study.

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4.3 Conceptual Model of the Study

The theoretical base for the present research framework is based on Rogers's diffusion of innovations theory (1983), Tornatzky and Fleisher's (1990) TOE model and the organizational technology adoption model by Iacovou et al. (1995). The literature has rich discussions on technology adoption (e.g. Agarwal and Prasad 1999, Pick and Roberts 2005, Verhoef and Langerak 2001, and Venkatesh and Davis 2000). Many of these studies were based on Rogers's (1995) diffusion of innovation theory (DOI) to investigate how organizations absorb new technologies. The DOI theory is concerned with the manner in which a new technological idea, artifact, or technique migrates from

creation to use, and describes the patterns of adoption, explains the mechanism of diffusion, and assists in predicting whether and how a new invention will be successful (Hsu et al 2006). As illustrated in Figure 4.1, Rogers argued that a firm's adoption and use of innovations such as a new technology was influenced by both the characteristics of such innovation (e.g. relative advantage, compatibility, complexity and trainability) and organizational characteristics (e.g. centralization, formalization, interconnectedness).

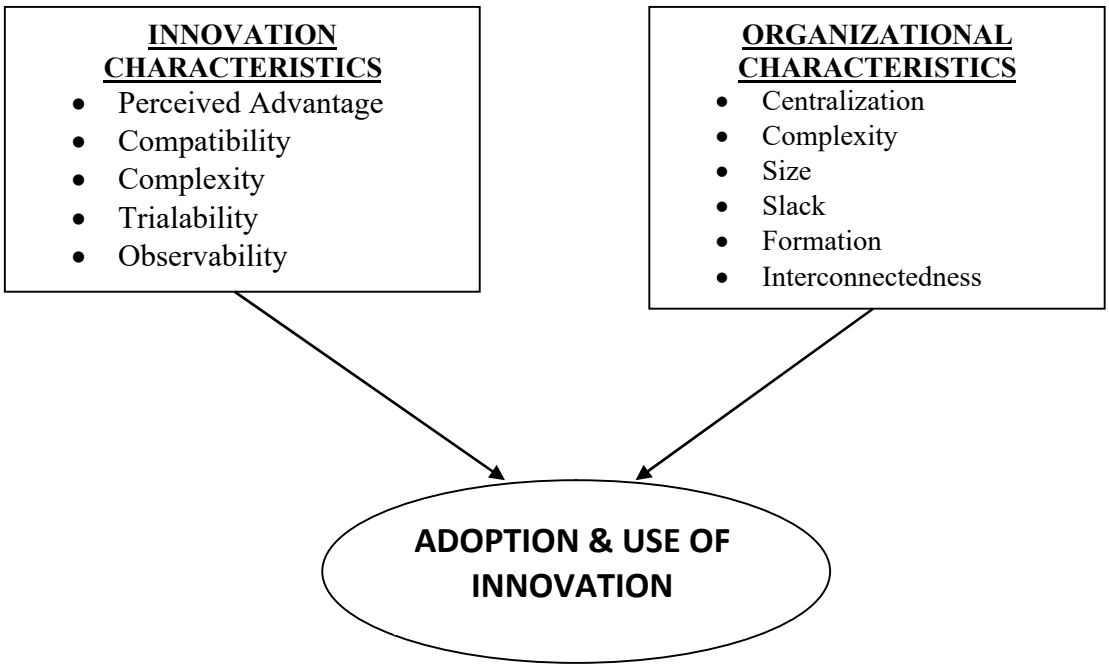


Figure 4.1: Roger's DOI Framework

Although Rogers's diffusion of innovation theory seems to be quite applicable to an investigation of new technology use, researchers continue to search other factors influencing the adoption of organizational innovation and combine them with Rogers's theory to provide richer and potentially more explanatory models (Hsu et al 2006). Tornatzky and Fleisher's (1990) TOE model extended Rogers's framework to explain a firm's technological innovation decision making behavior. Three categories - technology, organization, and environment were included in the TOE model. The technology and

organizational categories were parallel to the dimensions of innovational and organizational characteristics in Rogers's framework. A major contribution of TOE model was including a new and important component, environmental context. The environment context is the arena in which a firm conducts its business-its industry, competitors, and trading partners in supply chain. The environmental /contextual factors presented both constraints and opportunities for new business process and technology implementation. The Tornatzky and Fleisher's (1990) TOE model is presented in Figure 4.2.

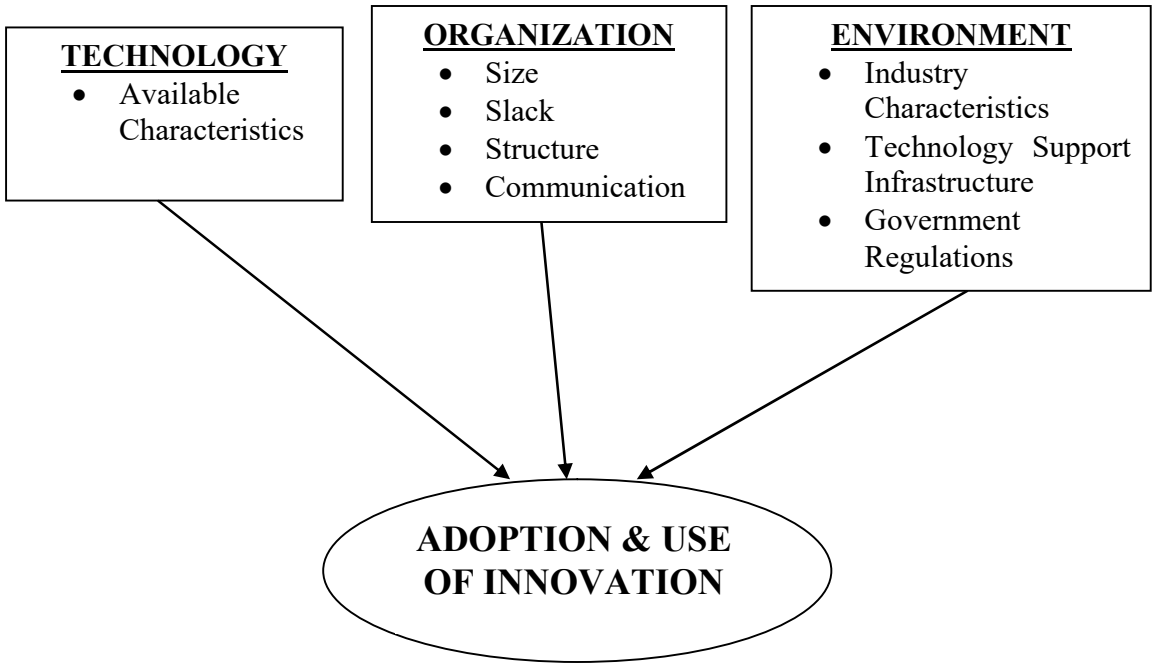


Figure 4.2: Tornatzky and Fleischer's TOE Model

One of the limitations of using TOE framework in supply chain context is its emphasis on within-a-firm innovation diffusion. Over time, when innovations become more complicated and are used beyond the boundaries of any single firm, inter-organizational systems such as Collaborative Knowledge Management Practices (CKMP) turn out to be significant in the business world. To further understand inter-organizational system

adoption and use, Iacovou, Benbasat and Dexter (1995) applied TOE framework in analyzing seven case studies to illustrate how EDI was adopted, and extended the framework by adding a new factor to examine the potential impacts of new technology adoption.

Iacovou et al's (1995) organizational technology adoption model, presented in Fig 4.3, is a validate framework to study technology adoption and implementation patterns. Three categories of firm characteristics that promote the adoption and implementation of new technology are identified in the model: (1) *Perceived Benefits* are the only variable that has been consistently identified as one of the most critical adoption factors (Cragg and King, 1993). A firm must have clearly identified the direct the potential benefits of the new technology system to be motivate for the serious commitment to implement a new technology such as CKMP. (2) *Organizational Readiness*, a firm must be structurally and infrastructural ready to embrace a substantial organizational change. (3) *External Influences / Pressure* are contextual drivers that push the firm to adopt the new technology. For example, a firm is forced to implement EDI system, if an important trading pattern has recently postulated that EDI is the only way of transaction for doing business with it.

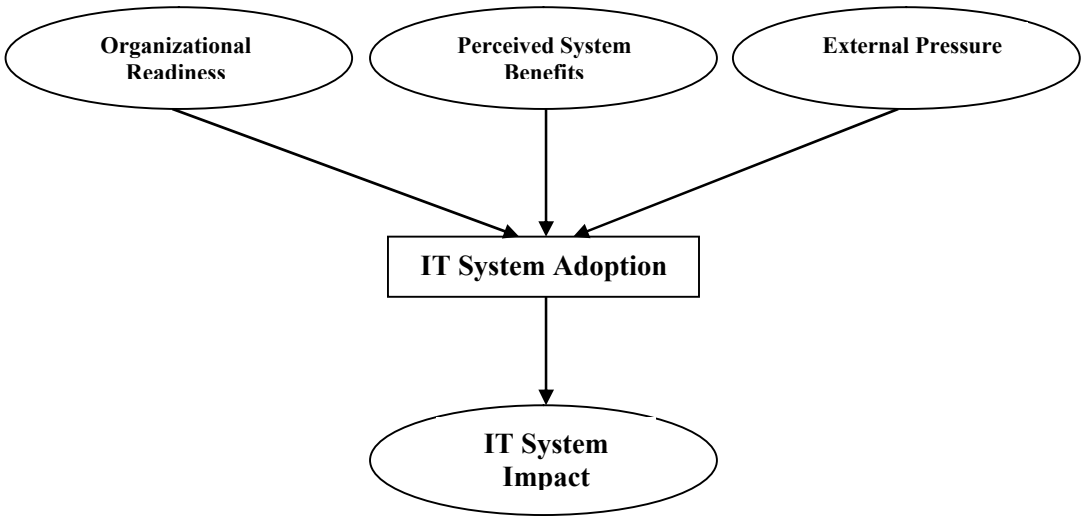


Figure 4.3: Organizational Technology Adoption Model by Iacovou et. al.

Although the original model by Iacovou et al (1995) was first tested in the context of the adoption of EDI for inter-firm transactions, significant empirical research has also shown positive results in applying organizational technology adoption model to various other areas, for example: e-commerce (Chen, Gillenson, & Sherrell, 2002; Koufaris, 2002), digital libraries (Hong, Thong, Wong, & Tam, 2002), tele-medicine technologies (Hu, Chau, Sheng & Tam 1999), smart cards (Plouffe, Hulland&Vendenbosh, 2001) and building management systems (Lowery, 2002). Zhu and Weyant (2003) argued that as a generic theory of technology diffusion, organizational technology adoption model is helpful in understanding the adoption of IS innovation. Swanson (1994) classified IS innovations into three types: ***Type I*** are technical task only innovations; ***Type II*** innovations support business administration; and ***Type III*** innovations are embedded in the core of the business. According to this typology, SCMP with trading partners should be considered as a Type III innovation, because SCMP innovate a firm's core business processes - leveraging two-way communication to improve product offering and customer service. Swanson (1994) further examined the adoption contexts of each innovation type, and contended that typical Type III innovations often requires antecedents such as facilitating technology portfolio, certain organizational attributes, perceived benefits, and external drivers that initiate the firm to adopt such innovation. This theoretical argument can be extended to Supply Chain Management domain: SCMP is being enabled by information and communication technology development, requires organizational enablers, motivated by the potential benefits, and entails environmental drivers of the supply chain context. Thus, upon theoretically examining adoption

contexts, innovation types, and SCMP features, we believe that the three contexts in the organizational technology adoption model are well suited for studying SCM adoption and implementation. The three organizational technology adoption model antecedents are explored in our model as follow:

✓ ***Perceived benefits / Relative advantage -*** expectations of advantages or opportunities reflected by operational and performance improvements related to the adoption of the technology system, such as improved knowledge management operational efficiency, innovation, integrated supply chain relationships. We will operationalize and discuss integrated supply chain relationship in the later section of construct descriptions.

✓ ***Organizational Characteristics –*** We approach this issue from two perspectives: technological infrastructure which looks at the technological preparation of the firm for SCM implementation; organizational infrastructure studies which evaluates whether the firm is structurally and culturally ready for SCM adopting and implementation.

✓ ***External Influences –*** Grandon and Pearson (2004) summarized the technology adoption literature and found that external influences are fairly persistent across different studies. Three dimensions of external influences are identified in our study: environmental characteristics look at factors such as environmental uncertainty, trading partner readiness and perceived external competitive pressure. Knowledge complementarity studies the perceived importance and difference of trading partners' knowledge bases. Partner relationship is about the nature of relationship in supply chain (i.e. long term vs. one time partners).

Compared with other IS innovation, SCM implementation is unique in that it cannot be adopted and used unilaterally. Firms that are motivated to adopt SCM must either find

similarly motivated partners, or persuade their existing market partners into adopting the practice. Moreover, even after SCM has been adopted, firms must continue making sure the above-discussed antecedents still hold to maintain collaborative relationship with partners in KM to gain sustainable benefits.

Thus, our research shall emphasize the implementation process of SCM by enhancing our subject of study to those SMEs who have not yet adopted SCM as well as who have adopted the process of SCM fully or partially and explore how these antecedents can further facilitate SCM and what organizational impact SCM can bring to the supply chain performance. The following section covers the detailed descriptions and literature review to the constructs in the theoretical research framework presented in Figure 4.4.

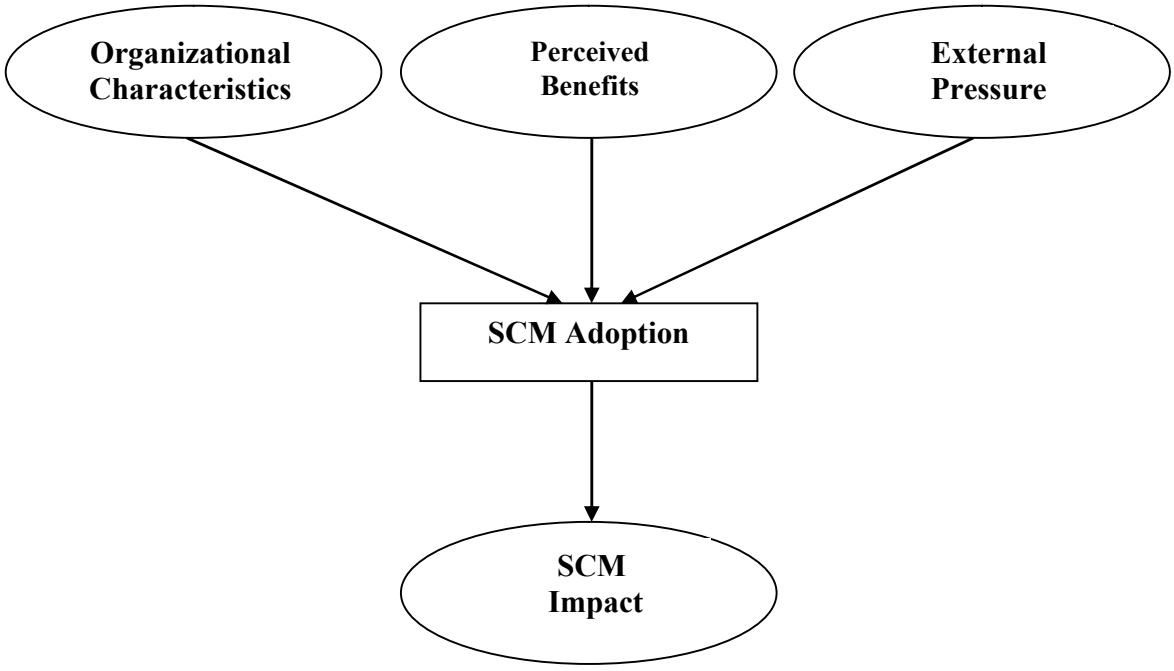


Figure 4.4: Theoretical Framework of the Current Study

4.4 Constructs in the Model

There are 3 SCM implementation antecedent constructs and 3 impact constructs. The following section would do a thorough literature review and operationalize these constructs as well as their sub-constructs.

4.4.1 Organizational Characteristics

Organizational characteristics refer to the structural and infrastructural features of the organization related to its readiness to implement SCM. There are 2 sub-dimensions for this construct: (1) *technological infrastructures*, the tools and systems that are instrumental to the operation of cross-organizational knowledge communication and management; and (2) *organizational infrastructural*, the factors that prepare the firm to be collaboration ready and knowledge smart.

4.4.1.1 Technological Infrastructure

Technological infrastructure has been emphasized as an important antecedent for knowledge management practices by many researchers. For example, Meso and Smith (2000) viewed knowledge management system as an advanced assembly of software, its associated hardware infrastructures for supporting knowledge work and /or organizational learning through the free access to and increased sharing of knowledge. In the current study, TI is defined as a set of information technology tools supporting collaborative knowledge management practices. At the simplest level this means a capable, networked PC for each knowledge user with standardized personal productivity tools so that people can exchange thoughts and documents easily.

Various studies have attempted to identify the key technological components that are critical to the operations of organizational knowledge management systems. Hibbard (1997) and Chaffey (1998) mentioned messaging, video-conferencing and visualization, web browsers, document management, groupware, search and retrieval, data mining,

push technology, and intelligent agents group decision support,. Meso and Smith (2000) also identified ten similar key technologies: computer–mediated collaboration, electronic task management, messaging, video conferencing and visualization, group decision support, web browsing, data mining, search and retrieval, intelligent agents, document management. Lin et al (2002) summarized pervious studies and argued that groupware and web-browser technologies are the most prominent.

Followed the works of Alavi and Tiwana (2003) and Smith (2001), this study approaches the technological infrastructure from the knowledge process perspective, which is based on Nonaka's knowledge creation and transfer model (1998). Knowledge generation, storage, access, dissemination and application are the five essential processes that new knowledge is created, transferred and utilized in the business context. Five sub-constructs of technological infrastructure are identified which support the above knowledge processes. The Table 4.1 below summarizes the mentioned sub-constructs:

Technology Infrastructure Sub-constructs	**Definitions**	**Literature**	**Corresponding Knowledge process**	**Supporting Technologies Examples**
Communication Support System	A system that provides communication support to groups of people that are engaged in common tasks or are sharing common resources, goals, values, etc..	Novikov, 2004; Cormican and O'sullivan 2003; Hibbard 1997; Chaffey 1998; Meso and Smith 2000; Lin et al, 2002.	Knowledge Generation	Groupware, Electronic Whiteboard; Video-conference, Email, Bulletin Board system
Knowledge Database Management System	A system that transforms knowledge into structured data, controls the organization and storage of data in a	Zhu, Tao &Zuzarte, 2005; Gupta, Bhatnagar, &Wasan, 2005; Pai, 2004; Marren 2003, Smolnik and Erdmann, 2003; Hou,	Knowledge Storage	Data Warehousing

	database. It supports the structuring of the database in a standard format and provides tools for data input, verification and storage.	Trappey&Trappey, 2003; Shaw, et al, 2001; Sanderson, Nixon & Aron, 2000; Inmon, 1996.		
Enterprise Information Portal	A central gateway that enables knowledge users search and access knowledge repositories through retrieval, query and other manipulators.	Yang, Yang & Wu, 2005; Rose, 2003; Raol, et al 2003; Kim, Abhijit & Rao, 2002;Dias, 2001, RadoKotorov, Emily Hsu. 2001.	Knowledge Access	Data Mining, Knowledge Server
Collaborative System	A computer-based system that provides an interface to a shared environment to support multiple users engaged in a common task (or goal) and has a critical need to interact closely with each other.	Baecker 1993; Chidambaram 1996; Dennis, George and Jessup 1988; Dhaliwal and Tung 2000; Karacapilidis and Pappi, 2000; Cil, Alpturk and Yazgan, 2005.	Knowledge Dissemination	Audio / Video conferencing, FTP, Intelligent agent, RSS feed
Decision Support System	A computer based systems that support unstructured decision-making in organizations through direct interactions with data and analytical models.	NcNurlin and Sprague, 2001; Lado and Zhang 1998.	Knowledge Application	Executive Information System, Expert System

Table 4.1: Technological Infrastructure Constructs and Sub-constructs

4.4.1.2 Organizational Infrastructure

The second dimension to measure organizational characteristics is organizational infrastructure. An organization can be viewed as a social system of interactions among entities constrained by shared norms and expectations (Bertrand, 1972). Entities in an organization occupy a number of positions and play different roles associated with these positions (Gross, 1958). How these roles related to each other defines the organization's structure and functions. In order to achieve its corporate objectives, organizations have to select and designate appropriate regulations to structure themselves in the right way to control and coordinate activities of interrelated roles. These structure and regulations constituting the underlying foundation or skeleton of an organization form its organizational infrastructure (Holsapple and Luo, 1996). Organizational Infrastructure (OI) thus can be defined as firm's internal configurations and arrangements involving organizational structure, business processes, and work design etc that is intended to support operation strategy (Tapscott and Caston (1993). Examples of the elements of organizational infrastructure are social systems, structures, development processes, communication mechanism, social networks, rewards etc (Anand V. et al 1998; Finegold et al, 2002; Griffith, 1999; Quinn et al, 1997).

Organizational infrastructure constrains makes possible what the entities in an organization can accomplish. It defines the organization's management and philosophy regarding how the employees of the firm are organized into formal and informal teams of departments; how these teams interact formally and informally; and role and goals of each team and how these relate to the overall corporate strategy (Davenport and Prusak, 1998).

Several studies have attempted to identify the dimensions of OI. Henderson and Venkatraman (1999) classified OI components according to their functions in supporting

organization's business process: (1) *Organizational Design*, which includes choices about organizational structure, roles, responsibilities, and reporting relationships; (2) *Processes*, which articulate the workflow and associated information flows for carrying out key organizational activities; (3) *Skills*, which indicate the choices about the capabilities of organizational members needed to accomplish the key tasks that support business strategy. Tapscott and Caston (1993) argued that OI encompasses issues such as sourcing work design, education, training, and human resource management policies. Thus, they proposed five major components of OI from the perspective of OI's functional objective:

(1) Common vision is defined as the collective awareness of the supply chain's overall goal, and consistency in beliefs and assumptions across organizational boundaries. (2) Cooperation is referred to as an orientation toward the collective interest where individuals work together to complete tasks. (3) Empowerment is about employee's acquisition of relevant skills and knowledge in the work environment and the ability to make and execute business decisions independently. (4) Adaptation is defined as the flexibility level and the firm's willingness to different extent of modifications with the changing business environment. (5) Learning is the firm's objective of supporting individual learning and the establishment of norms that encourage change and innovation. Organizational infrastructure was operationalized using 42 items adapted from several instruments (Dale, 1999; Balsmeier and Voisin, 1996; Davenport and Prusak 1998; Smith and Farquhar, 2000; Meso and Smith, 2000; Val and Lloyd, 2003). Bertrand (1972) observed organization as a conglomeration of entities, which play different roles based on their positions in the organization. OI defines the social system of all of the organization's entities interacting with each other. OI stipulates the

organization's selection structures and regulations etc. in order to control and coordinate activities and interrelated roles of these entities for common corporate objectives. Davenport and Prusak (1998) echoed similar understanding and summarized OI as organizations' management style and philosophy and the structures that determines how the employees of the firm are organized into formal and informal teams of departments; how these teams interact formally and informally; and the role and goals of each team and how these relate to the overall corporate strategy. Based on these studies, we come across the belief that the scope of OI is very board and general. It includes the entire social systems, structures, development processes, communication mechanism, social networks, rewards et al of corresponding to organization's business and operation strategy (Anand et al 1998; Finegold et al, 2002; Griffith, 1999; Quinn et al, 1996). Because of the objective of this present study, would limit our emphasis onto the number of OI elements that have direct relationship with knowledge management and intra/inter-organizational collaboration. The selected dimensions are Top management support, Collaboration Supportive Culture, and Organizational Empowerment. All of them are believed to be critical in establishing a set of roles and organizational configurations to support collaborative knowledge management practices.

Organizational infrastructure in this study includes three sub-constructs as presented in Table 4.2 below,

Organizational Infrastructure sub-constructs	**Definitions**	**Literature**
Top Management Support	The degree of top management's understanding of the specific benefits and then willingness to provide support to SCM.	Hamel and Prahalad, 1989; Dale, 1999; Balsmeier and Voisin 1996; Davenport and Prusak 1998; Goldman et al, 2002.

Collaborative Supportive Organizational Culture	The set of norms, values and organizational practices that encourage team work, cross-functional communication and cooperation.	Hart, 2004; Davenport and Prusak, 1998; Smith and Farquhar, 2000; Harrison, 1987.
Organizational Empowerment	Managerial style where managers share with the rest of the organizational members on their influence in the decision making process.	Mitchell, 1973; Vroom and Jago, 1988; Cole et al, 1993; Val and Lloyd, 2003; Cordova, 1982; Dachler and Wilpert, 1978; Harber et al, 1991.

Table 4.2: Organizational Infrastructure Constructs and Sub-constructs

4.4.2 Perceived Benefits

Perceived benefits refer to the level of recognition of the relative advantage that SCM can provide to the organization. Many practitioners and researchers have attempted to identify the potential advantages that knowledge management system has to offer. Pfeiffer (1992) and Iacovou et al. (1995) argued that these perceived benefits can be understood from two perspectives. The first perspective looks at the direct benefits from SCM. These are mostly operational improvements in organizational knowledge management capabilities that the firm believes SCM can bring. The purpose of knowledge management system is to improve the knowledge management process (Alavi and Leidner, 2001). Therefore one's understanding to firm's perceived knowledge management capability improvement is based on the five activities of the generic knowledge management process identified by Cormican and O'Sullivan (2003), that is, firm's capabilities on supply chain knowledge generation, storage, access, dissemination and application are all expected to be facilitated by SCM practices. With the improve knowledge management process, SCM adopters expect to achieve superior knowledge outcome. Thus, it is necessary to add another dimension besides the above five

knowledge activities to look at the overall supply chain knowledge quality improvements.

The second perspective of perceived SCM benefits observes the indirect benefits or opportunities from implementing SCM. It explores to the impact of SCM on the overall organizational and supply chain performance dimensions. These are mostly tactical and competitive advantages the firm gains indirectly from implementing SCM. Although the ultimate benefits of implementing SCM can include large financial savings, better product/service offering, improve customer service etc, these benefits are too remote and too general to be analyzed. Thus, much of one's attention has focused on its impact on business operations. In a conceptual paper, Smith (2001) summarized six possible dimensions of SCM benefits to organizational operations: (1) Adapt to a rapidly changing environment; (2) Optimize business transactions; (3) Enhanced Supply Chain Integration; (4) Exception handling; (5) Be able to innovate (6) Fully capitalize and develop it's people.

4.4.3 External Influences

External influences refer to various external conditions and events that create opportunities and threats to the firm, and exert pressure to adopt and implement SCM. Follow the studies of Kaun and Chau (2001), Zhu et al (2003) and Nikolaeva (2006), one identifies three major external influence factors:

(1) *Environmental characteristics*, which examine the organizational environment such as environmental uncertainty in business, perceived competitive pressure to implement

SCM and trading partner readiness for SCM; (2) *Knowledge complementarity* studies how different each firm's knowledge bases are and how important a firm perceives other's knowledge to its own operations; and (3) *Trading partner relationship*. All these three dimensions of external influences have substantial impact on whether a particular firm is willing to implement SCM with its trading partners.

The Table 4.3 below summarizes the mentioned sub-constructs:

External Influence sub-constructs	Definitions	Literature
Environmental Characteristics	The environmental factors that affect firm's level of SCM implementation, including environmental uncertainty, competitive pressure, and trading partner readiness.	Provan 1980; Ellram, 1990; , Grover, 1993; Brent, 1994; Iacovou et al., 1995; Premkumar et er and al, 1997; Fliedner and Vokurka, 1997; Crook & Kumar, 1998; Krause et al., 1998; Juan and Chau 2001; Zhu et al 2003.
Knowledge Complementarity	Knowledge users' perceived difference in the knowledge portfolios of trading partners as well as the perceived importance of a partner's knowledge to other organizations on the supply chain.	Mansfield and Romeo, 1980; Young and Lan, 1997; Buckley and Carter, 1999; Roper and Crone, 2003; Tiwana and McLean, 2005.
Partner Relationship	The degree of trust, commitment, and shared vision between trading partners.	Achrol et al. 1990; Ganesan, 1994; Tan et al., 1998; Sheridan, 1998; Monczka et al., 1998; Wilson &Vlosky, 19998; Handfield and Nichols 1999; McAdam and McCormack, 2001.

Table 4.3: External Influences Constructs and Sub-constructs

4.4.4 SCM Impact

The impact of SCM implementation refers to the real benefits adopters believe they have received from utilizing SCM related CKMP (Iacovou et al, 1995). Herein it is assumed

that these impacts are closely associated with the perceived SCM benefits. All of the expected benefits should be reflected as an outcome from SCM, providing the implementation is successful. Thus there are two general dimensions of impacts: the first is the improve knowledge capabilities as represented by high supply chain knowledge quality, and the second dimension is the organizational performance advancement, as reflected by supply chain integration as well as supply chain performance.

The definition and supporting literature for the sub-constructs are listed in Table 4.4 below:

SCM Impact sub-constructs	Definitions	Literature
Supply Chain Knowledge Quality	The extent of fit for use by knowledge consumers for understanding and solving supply chain problems.	Strong, Lee and Wang, 1997; Lillrank, 2003; Wong and Strong, 2001; Monczka et al., 1998; Wand and Wang, 1996, Wang and Strong, 1996; Huang and Wang, 1999.
Supply Chain Integration	The extent of all activities within an organization and the activities of its suppliers, customers, and members are integrated.	Peterson et al., 2005; Gunasekaran and Ngai, 2004; Bowersox, 1989; Stevens, 1989; Byrne and Markham, 1991; Lee and Billington, 1995; Hewitt, 1994; Clark and Hammond, 1997; Wood, 1997; Lummus et al., 1998; Stock et al., 2002; Narasimhan and Jayaram, 1998; Johnson, 1999; Frohlich and Westbrook, 2001; Ahmad and Schroeder, 2001; Kim and Narasimhan, 2002; Narasimhan and Kim, 2002; Frohlich and Westbrook, 2002; Frohlich, 2002;
Supply Chain Performance	A set of performance measures to determine the efficiency and / or effectiveness of a system, including	Beamon, 1998; Harland, 1996; Garwood, 1999; Tompkins and Ang,

	partner quality, supply chain flexibility, responsiveness to customer and supplier performance.	1999; Bechtel and Jayaram, 1997; Van Hoek, 1998; Bechtel and Jayaram, 1997; Stevens, 1990; Narasimhan and Jayaram, 1998; Gunasekaran et al., 2001; Li 2003.

Table 4.4: SCM Impact Constructs and Sub-constructs

4.4.4.1 Supply Chain Integration

Supply chain integration is defined as the extent to which all activities within an organization, and the activities of its suppliers, customers, and other supply chain members, are integrated together (Stock and Tatikonda, 2000; Narasimhan and Jayaram, 1998; Wood, 1997; Li, 2002; Marquez et. al., 2004). Supply chain integration links a firm with its customers, suppliers, and other channel members by integrating their relationships, activities, functions, processes and locations (Kim and Narasimhan, 2002). Having an integrated supply chain provides significant competitive advantage including the ability to outperform rivals on both price and delivery (Lee and Billington, 1995). Supply chain integration includes two stages: internal integration between functions and external integration with trading partners. Internal integration establishes close relationships between functions such as shipping and inventory or purchasing and raw material management (Turner, 1993; Stevens, 1990; Morash and Clinton, 1997). While external integration has two directions: forward integration for physical flow of deliveries between suppliers, manufacturers, and customers and backward coordination of information technologies and the flow of data from customers, to manufacturers, to suppliers (Frohlich & Westbrook, 2001). Both internal and external integration can be accomplished by the continuous automation and standardization of each function and by

efficient knowledge sharing and strategic linkage with suppliers and customers. Stevens (1989), Byrne and Markham (1991) and Hewitt (1994) suggested that the development of internal supply chain integration should precede the external integration with suppliers and customers. Narasimhan and Kim (2002) examined the effect of chain integration on the relationship between diversification and performance. The supply chain integration instrument they used is comprised of three dimensions: (1) internal integration across supply chain, (2) a company's integration with customers, and (3) a company's integration with suppliers.

This study adopts the concept of supply chain integration from previous research by Integration with customers, and Internal integration across supply chain (Frohlich and Westbrook, 2002; Frohlich, 2002, Narasimhan and Kim, 2002). Table 4.5 below shows the constructs and sub-constructs of supply chain integration.

Supply Chain Integration sub-constructs	**Definitions**	**Literature**
Internal Supply Chain Integration	The degree of coordination between the internal functions of all the trading partners in the supply chain.	Stevens, 1989; Carter and Narasimhan, 1996; Narasimhan and Carter, 1998; Birou et al, 1998; Wisner and Stanley, 1999.
External Integration with Suppliers	The degree of coordination between manufacturing firm and its upstream partners.	Peterson et al., 2005; Koufteros, Vonderembse and Jayaram, 2005; Bowersox, 1989; Stevens, 1989; Byrne and Markham, 1991; Lee and Billington, 1994; Clark and Hammond, 1997; Wood, 1997; Lummus et al., 2002; Narasimhan and Jayaram, 1998; Johnson, 1999; Frohlich and Westbrook, 2001; Kim and Narasimhan, 2002; Narasimhan and Kim, 2002; Frohlich and

		Westbrook, 2002; Frohlich, 2002.
External Integration with Customers	The degree of coordination between manufacturing firm and it's downstream customers.	Koufteros, Vonderembse and Jayaram, 2005; Bowersox, 1989; Stevens, 1989; Byrne and Markham, 1991; Lee and Billington, 1995; Hewitt, 1994; Clark and Hammond, 1997; Wood, 1997; Lummus et al., 1998; Stock et al., 2002; Narasimhan and Jayaram, 1998; Johnson, 1999; Frohlich and Westbrook, 2001; Ahmad and Schroeder, 2001; Kim Narasimhan, 2002; Frohlich and Westbrook, 2002; Frohlich, 2002.

Table 4.5: Supply Chain Integration Constructs and Sub-constructs

4.4.4.2 Supply Chain Performance

Supply chain performance is a construct with a set of performance measures to determine the efficiency and / or effectiveness of a system (Beamon, 1998). Different researchers have attempted to assess supply chain performance in different ways, but most measures available in the literature are largely economic performance oriented. Harland (1996) suggests that intangible aspects of performance such as customer satisfaction should also be assessed. Garwood (1999) cautions that new measurement angle must be used on besides the old yardsticks for supply chain performance such as purchase price variance, direct labor efficiency, equipment utilization, and production development budget are no longer adequate. A set of measures has been suggested and used in the literature to respond to the current requirements for a comprehensive supply chain performance measurement. Stevens (1990) suggested such items as inventory level, service level,

throughput efficiency, supplier performance, and cost. Pittiglio et al. (1994) summarized four categories of measures, viz, customer satisfaction / qualitity, time, cost and assets. Spekman et al. (1998) suggested cost reduction and customer satisfaction. Narasimhan and Jayaram (1998) identified the customer responsiveness and manufacturing performance. Beamon (1998) recommend to use a bundle including several qualitative measures, namely, customer satisfaction, flexibility, information and material flow integration, effective risk management, and supplier performance. Li (2002) summarized many of the existing research findings and designed a comprehensive measurement instrument. For the present study it was found to be appropriate to borrow the four measurement dimension, viz, Supply Chain Flexibility, Customer Responsiveness, Supplier Performance and Partnership Quality.

Table 4.6 below lists the definitions and supporting literature of the above mentioned four dimensions.

Supply Chain Performance sub-constructs	**Definitions**	**Literature**
Supply Chain Flexibility	Flexibility reflects an effectively adapt or respond to change that directly impacts an organization's customer.	Aggarwal, 1997; Vickery, et al., 1999.
Customer Responsiveness	The speed of an organization's responses to the customer's requests.	Stevens, 1990; Lee and Billington, 1992; Narasimhan and Jayaran, 1998; Beamon, 1998; Spekman, et al., 1998; Kiefer and Novack, 1999; Gunasekaran et al., 2001.
Supplier Performance	Suppliers' consistency in delivering materials, components or products to your organization on time and in good condition.	Stevens, 1990; Davis, Beamon, 1998; Tan, et al., 1998; Carr and Person, 1999; Gunasekaran et al 2001; Levy, 1997; Vonderembse and Tracey, 1999; Shin et al., 2000.
Partnership Quality	How well the outcome of matches the participants' supply chain partnership expectation.	Ellram, 1990; Bucklin and Sengupta, 1993; Harland, 1996; Wilson and Volsky, 1998; Lee and Kim, 1999; Ballou et al., 2000; Mentzer et al.,

		2000.

Table 4.6: Supply Chain Performance Constructs and Sub-constructs

4.4.4.3 Supply Chain Performance and ICT usage

Rapid advancements in information and communication technology (ICT) in recent years, coupled with the collapse of entry-to-market and other trading barriers, have changed significantly the way organizations operate in terms of business model and operating scale (Ritchie & Brindley, 2002). Globalization, lead-time reduction, customer orientation, and outsourcing are some major changes contributing to an increasing interest in advanced logistics services and global Supply Chain Management (Hertz & Alfredsson, 2003). Successful global logistics depends heavily on communication and transportation. Improved communication between different business partners through the use and sharing of real-time information facilitates the logistics of production and inventory over wider geographic areas. Efficient transport arrangement, such as, volume consolidation and cross docking, makes possible the actual transactions between nodes (Bookbinder, 2005). Owing to the increased levels of resource requirement, complexity and risk in running global logistics, many firms tend to outsource their logistics operations to third-party logistics (3PL) providers and focus on their core businesses. Successful management of global supply chains therefore requires radical changes in supply chain structure, business processes and relationships with business partners particularly logistics service providers.

Traditionally, supply chain is relatively linear in structure (See Fig 4.5 below). A typical manufacturing supply chain involves a few tiers of suppliers, the manufacturer (the focal company), a few tiers of distributors (including wholesalers and retailers), and finally the end customers.

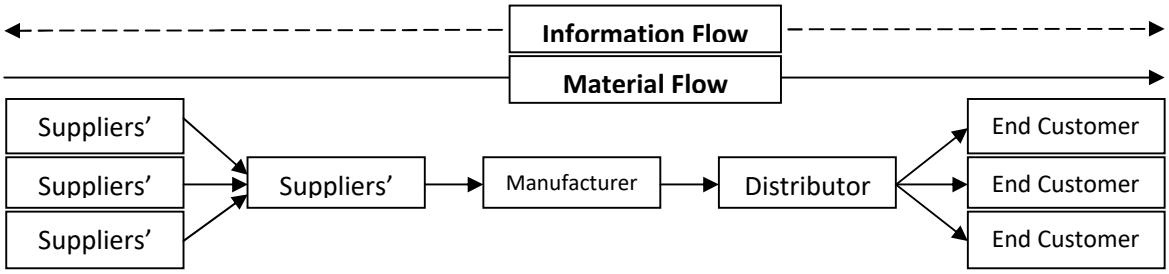


Fig 4.5: A Traditional Linear Supply Chain Model

Materials mainly flow from upstream to downstream (i.e., from suppliers to end customers) with a small reverse flow of returns while information tends to flow in both directions. Transportation is provided either in-house by the various parties separately or outsourced to different 3PL providers (Ballou, 2004; Bowersox, Closs& Cooper, 2002; Chopra &Meindl, 2007; Coyle, Bardi& Langley Jr., 2003; Wisner, Leong & Tan, 2005). With globalization and disintermediation as a result of advancement in ICT, the linear supply chain model and the associated uncoordinated logistics operations can no longer meet the demand of customers for higher efficiency, shorter lead time, and wider geographic coverage. Supply chain tends to become networked (See Fig 4.6 below) with the focal company as the hub and a major 3PL provider looking after the logistics operations of the whole supply chain for the focal company in different regions (Ritchie & Brindley, 2002; Simchi-Levi, Kaminsky &Simchi-Levi, 2008; Waters, 2003).

Even though a solid foundation of supply chain research exists (Chandra and Kumar, 2000; Levy and Grewal, 2000; Mentzer, Dewit, Keebler, Min, Nix, Smith and Zacharia, 2001; Lambert, Cooper, and Pagh, 1998; Langley and Holcomb, 1992; Min and Mentzer, 2000; Chandrashekar and Schary, 1999; Cooper, Lambert, and Pagh, 1997; and Croxton, Garcia-Dastugue, Lambert, and Rodgers, 2001) there is inconsistent evidence that any of the Supply Chain Management research can be effectively integrated into industry practice or provide sustainable performance improvements (Moberg, Speh, and Freese,

2003). Since it is estimated that poor coordination between the supply chain participants in the U.S. food industry is wasting $30 billion annually (Fisher, 1997), it becomes clear that an analysis of the supply chains is of interest. It then becomes important to analyze the degree to which this industry is contributing to the waste. Salin's (2000) research is to seek whether or not sustainable process improvements by Supply Chain Integration has been realized in the US food industry. More specifically, the objective of the research is to assess the impact of internet technologies on the industry's supply chain.

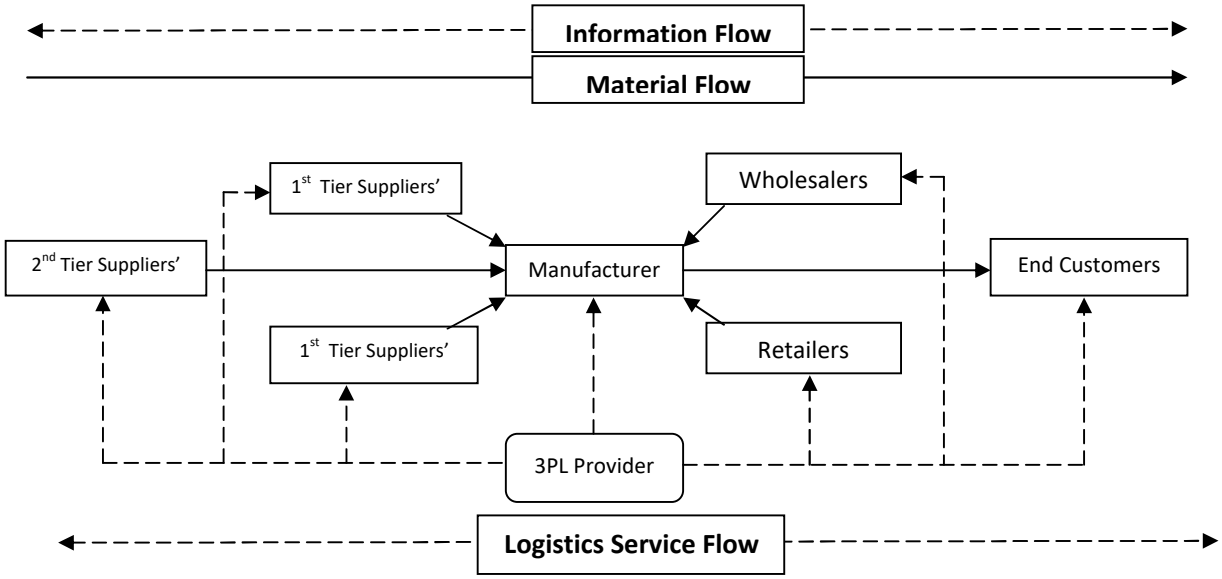


Fig 4.6: A Networked Supply Chain Model

The definitions and sources of the six constructs for Theme-3 contained in the model are summarized in Table 4.7 below.

Constructs	Definitions	Sources
User Satisfaction	Users believe that an information system is able to fulfill their requirements.	Inves et. al. 1983; DeLone and McLean, 1992.
Perceived Usefulness	Users believe that using the system will enhance their working performance.	Davis, 1989.
Perceived Ease of Use	Users believe that using the system will be free of effort.	Davis, 1989.
Training	Instructing users to operate and use the information system correctly and smoothly.	Nelson & Cheney, 1987.

Computer Anxiety	Users fear negative outcome from use of computers.	Heinssen et. al. 1987; Faganet et. al. 2003-2004.
Computer Self-Efficacy	Users believe that they are able to handle a computer well in any situation	Compeau& Higgins, 1995; Marakas et. al. 1998; Venkatesh et. al. 2003.

Table 4.7: Supply Chain Performance and ICT usage Constructs and Sub-constructs

4.5 Research Methodology

This section discusses the research methodology of testing the hypotheses presented in the earlier part of this chapter. The study of the relationships among the constructs in the model depends on the collecting, analyzing and interpreting data about the real situations in the current business world. A survey research approach was defined by Pinsonneault et al. (1993) as data collection and measurement processes to produce quantitative descriptions of some aspects of the studies population. The same group of researchers argued that cross-sectional survey is a convenient and powerful method to in studying business and management issues because it provides neutral observations to different stages of a phenomenon in natural setting at a short period of time. The current study is attempting to explore the implementation and impact as well as knowledge management behaviors in supply chain management. Thus we deem it is appropriate to use cross-sectional survey to obtain candid snap-shot descriptions to the constructs and test the hypotheses derived from the above presented research model.

In order to meet the objectives of the study a comprehensive survey of latest as well as archived articles were reviewed and summarized.

As the objectives of this study requires an extensive selection and survey of constructs from published researches, henceforth to formulate the propositions and understand various aspects as well as underlying constructs and issues for SCM in SMEs, literature

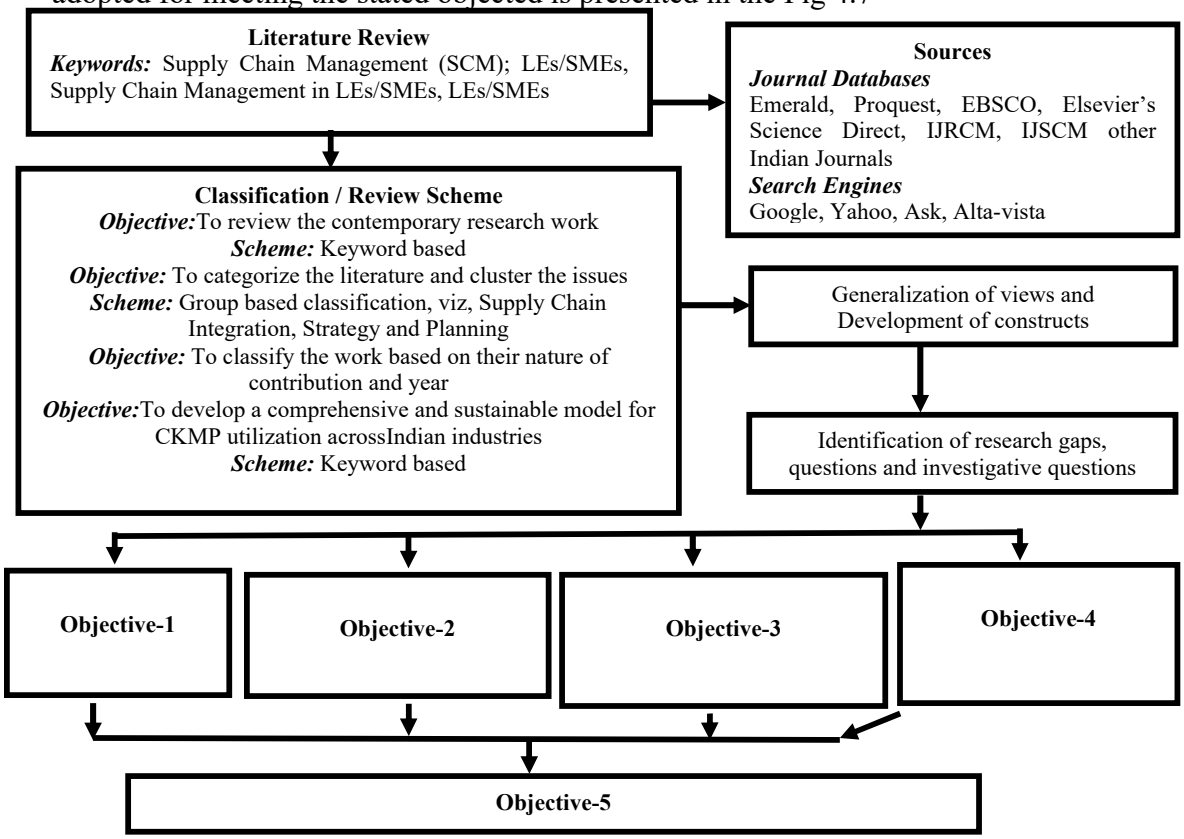
review was used to collect information from a representative pool of research articles. Some select articles published in the recent time on the issue, for example, Arend and Winser (2004), Halley and Guilhon (1997), Higginson and Alam (1997), Holmund and Kock (1996), Huin et al. (2002, 2003), Quayle (2002, 2003), etc. have provided the adequate ground to begin with. Journal articles were sourced from three databases – Emerald, Proquest, EBSCO and Databases. Mainly, search was carried out based on the key words – SCM/CKMP and SMEs, SMEs, SCM/CKMP and small business, CKMP/SCM-Les, SCM/CKMP-Industrial Units, etc. The Table 4.8 below presents a summary of the number of sourced articles from each of the database.

Data base	Keywords used	Initial search result
Emerald	CKMP/SCM and LEs/SMEs	372
EBSCO	CKMP/SCM and LEs/SMEs	88
Proquest	CKMP/SCM and LEs/SMEs	92
Others	CKMP/SCM and LEs/SMEs	165
	Total no. of papers/articles	**717**

Table 4.8: Total Journals Scanned / Searched through various Journal Databases

Many papers have contributed marginally or indirectly highlighted the benefits of proposed model/methodology or analysis towards the subject of present study. To make the review more comprehensive, further scrutiny was carried out and it was found that most of these research papers were either repeating or using similar methodologies and research designs. Research on factors affecting growth of SMEs was focused primarily on entrepreneurial personality, organization development, functional management skills and sector economics (Chaston, 1998; Wijewardena and Tibbits, 1999). Looking to the diversity of issues of both the fields – SMEs and SCM and limited number of published

articles, this study categorizes the literature in three broader areas – supply chain integration, strategy and planning and implementation issues. This helped to develop a holistic view on the supply chain issues in SME sector. The research methodology adopted for meeting the stated objected is presented in the Fig 4.7



4.5.1 Instrument Development and Survey Methodology

In order to collect precise data, a reliable measurement instrument is needed. To ensure brevity, understandability and content validity of the items, a rigorous validation procedure was adopted for preliminary test.

A survey instrument in the form of a questionnaire was designed based on the constructs previously described and verified from the research methodology adopted for meeting the objectives stated for this research study. Respondents were asked to indicate, using a five-point Likert scale, on four varied themes. *Theme-1* was designed so as to elicit

information on the current status of Supply Chain Management and Logistics practices and performance in the organization. *Theme-2* tried to assess the Organizational Performance with respect to Supply Chain Management Implementation, whereas *Theme-3* was all about ICT used to support SCM, Logistics and Production Planning and Control. Finally, *Theme-4* was an attempt to have the opinion of the respondents on the present policy of the State Government(s) for promoting SCM Methodology & concepts along with best practices being adopted in respective industries of the States.

Some other questions including demographics information were also presented in the questionnaire.The survey instrument was pre-tested by 30 supply and materials managers for content clarity, adaptability and validity only. Where necessary, questions were reworded to improve clarity, adaptability and validity. The pre-test questionnaires were thereafter not used for subsequent analyses because these questions were arranged in mixed forms and were not structured in nature. The revised / rearranged survey instrument was then sent to 450 supply and materials managers identified from the validated lists of Industrial Units from the Excise and Taxation Department - Government of respective States offices of respective States Industrial Hubs as well as from the directory of CII. The respondents represented manufacturers of varied products, so as to have a heterogeneous structure of responses. The questionnaire was made available to the respondents using three modes of data collection, viz, personal contact, through courier service and through scheduler. Maximum of the questionnaire was made filled and collected with the help of a scheduler (messenger), who was supplied with the list of the respondents as well as questionnaires in a batch of 25 questionnaire.

To investigate the possibility of non-response bias in the data, responses from various industrial hubs were tested separately. The last set of questionnaire received from the

Industrial hub (second phase) was considered to be representative of non-respondents (Armstrong and Overton 1977; Lambert and Harrington 1990). Each of the samples received in the first phase as well as second phase were tested using chi-square test. The chi-square tests yielded no statistically significant differences between the first phase and second phase response groups, suggesting that non-response bias was not a problem in this study. This research collected data from a single to multiple respondents from each target firm, without collecting and cross-validating responses from a second informant from the same firm. Some researchers argue that relying on a single informant to answer complex social judgments about organizational characteristics increases random measurement error. Thus, strong assessments of convergent or discriminant validity cannot be made. However, the cost associated with using multiple informants from each organization is prohibitive. Henceforth, this research used data from a single as well as multiple respondents while attempting to minimize the extent of common method variance by targeting the surveys to managers. It was assumed that the senior managers were more objective and knowledgeable with respect to their firms' operations.

CHAPTER – V

ANALYSIS,INTERPRETATION, DISCUSSION AND SUMMARY

5.1 Data Collection Methodology

The study uses structured questionnaire to gather pertinent data. Moreover, the present research also uses previous studies related to supply chain management and compares it to its existing data in order to provide conclusions and competent recommendations. A self-administered structured questionnaire as per Appendix-III has been employed so as to optimize time and efforts in the compilation of the research answers. The questionnaire was adopted from the unpublished Ph.D. Thesis of the Principal Investigator of this Research Project.

This research makes use of secondary as well as primary. The secondary sources of data have been collected from published articles of business journals and related research studies in supply chain management and critical success factors. The primary source of data has been collected with the help of a structured and closed-ended questionnaire. In this study, a questionnaire has been constructed and administered to the respondents, and the respondents were requested to answer the same in the survey-questionnaire, wherein each of the statements were graded using the five point Likert scale.

5.2 Survey Respondents

The overallobjective of this research was to determine the Critical Success Factors in Supply Chain Management across Select Northern Indian States based Industrial Units. The States covered in this research included Industrial Units located in Jammu & Kashmir State, Himachal Pradesh and Punjab. A similar research conducted by the Principal Investigator (Gaurav Sehgal) during his Doctoral Degree research from University of Jammu was made as

the baseline. For this study the respondents included managers of the respective companies. The managers were chosen because they are more reliable for this study from the execution and understanding level of the research topic under. The true identity of the respondents has not revealed for confidential purposes and request from most of the respondents.

After identification of the appropriate population, this research makes use of ofinferential statistics so as to draw a concrete conclusion. Inferential statistics helps in knowing a population's attribution through a direct observation of the chosen population. However, such an arrangement has its own disadvantages; but such disadvantages have been taken care of by choosing the most suitable sample from the research specific population.

The selection of respondents has been considered very critical for obtaining sufficient and good quality data in any survey studies. The respondents are expected to have appropriate knowledge on the subject areas of the survey (Quesada, 2004). Since the present research work was focussed on understanding the inter-firm collaboration behaviours on supply chain management in this study, thus the respondents we so chosen who had close contact with their firm's trading partners, had experience in supply chain management practices, as well as possessed general understanding to firm management and supply chain performance indicators.

This research collected data from a single as well as multiple respondents from each target firm(s), without collecting and cross-validating responses from a second informant from the same firm. Some researchers argue that relying on a single informant to answer complex social judgments about organizational characteristics increases random measurement error. Thus, strong assessments of convergent or discriminated validity cannot be made. However, the cost associated with using multiple informants from each organization is prohibitive. Therefore, this research used data from a single as well as multiple respondents while attempting to minimize the extent of common method variance by targeting the surveys to

senior and middle level managers. It was assumed that the senior as well as middle level managers were more objective and knowledgeable with respect to their firms' operations.

5.3 Survey Execution

Survey execution is critical for a good response rate as well as to provide greater validity of the data collected. The survey instrument used in this research work was adapted from the already conducted similar research work of the Principal Investigator (Gaurav Sehgal) during his Doctoral Research from University of Jammu.No rewording of the questions was done so as to retain the authenticity of the questionnaire with the research work already conducted in this regard by the Principal Investigator earlier in 2010-2012. The survey instrument was sent to 1200 supply and materials managers identified from the validated lists of directories of Industries and Commerce for the States of Jammu & Kashmir, Himachal Pradesh and Punjab and as also from the directory of CII. The respondents represented manufacturers of varied products, so as to have a heterogeneous structure of responses.

To ensure a reasonable response rate the questionnaire was sent in two phases in each industrial hub of the identified States with a two months interval. In the first phase the questionnaires were sent to all 1200 respondents inviting them to participate in the study with a brief description of the research, stating that all data collected would be used for academic research only and be handled confidentially.

Since the literature has limited discussion on the adoption of SCM, the researcher was also interested in the adoption rate among the sampled firms and their characteristics as well as potential reasons for those firms' non-adoption. The questionnaires were retained in the original framework as already executed during Doctoral Research which consisted of four themes, viz, *Theme-1*which was so designed so as to elicit information on the current status of Supply Chain Management and Logistics practices and performance in the organization.

Theme-2 tried to assess the Organizational Performance with respect to Supply Chain Management Implementation, whereas *Theme-3* was all about ICT used to support SCM, Logistics and Production Planning and Control. Finally, *Theme-4* was an attempt to have the opinion of the respondents on the SCM policy and its promoting Methodology & concepts.

5.4 Survey Response Rate

The researcher received 364 non-deliverable/un-returned questionnaires in two months after the first phase of questionnaires were sent, excluding 48 replies declining participation to the study due to the following reasons: (1) no longer in the supply chain/procurement area (2) company policy forbidding disclosure of information. Therefore, during the two months period after sending out the questionnaires, a total of 788 responses were collected. Then the second phase of questionnaires were sent fifteen days later to those who had not yet responded for which a total of 233 responses were received. Furthermore, of this total 22 responses received were incomplete and thus were rejected while data entry was administered, thereby making a total of 211 responses. Therefore, the final number of complete and usable responses for the study stood at 999 (788 in first phase and 211 in the second phase). It yielded a response rate of 83.25%, indicating a reasonable and acceptable response rate for surveys (Dillman 2000).

The questionnaire was made available to the respondents using two modes of data collection, viz, personal contactand through online mode (google doc). Maximum of the questionnaire was made filled and collected with the help of the research fellow, who was supplied with the list of the respondents as well as questionnaires in a batch of 25 questionnaire.

5.5 Large-scale Instrument Assessment Methodology

The data analyses of this study involved two procedures, viz, (1)Measurement Models Testing for instrument validation; and (2) Structural Model Testing for verifying the hypothesized relationship among constructs.

As suggested by Gerbing and Anderson (1988), the researcher tested the measurement model so as to avoid possible interactions between the measurement and the structural models. Furthermore, the researcher followed Bagozzi (1980) and Bagozzi& Philips (1982) who suggested the instrument evaluation guideline for the measuring instrument properties for reliability and validity which include purification, factor structure (initial validity), unidimentionality, reliability and the validation of the second-order construct. The methods for each of these analysis were Corrected-Item-to-Total-Correlation (for purification), Cronbach's Alpha (for reliability) and Confirmatory Factor Analysis (for first and second order factor structure and unidimensionality).

The measurement items (76 in total) were first purified by using Corrected-Item-to-Total-Correlation (CITC) scores with respect to a specific dimension of the construct. The preent research work followed the guidelines constructed by Nunnally (1978), wherein an alpha score of higher than 0.70 for a construct is generally considered to be acceptable (Robinson et. al., 1991; Robinson and Shaver, 1973). The reliability analysis was executed on GNU PSPP 1.0.1 Version 3 to perform CITC computation of each of the construct.

After purifying the items based on CITC, an Exploratory Factor Analysis (EFA) of the items in each construct was conducted for assessing construct dimensionality. GNU PSPP 1.0.1 Version 3 was extensively used to explore potential latent sources of variance and covariance in the observed measurements. Principal Component Analysis (PCA) was used as factor extraction method and VARIMAX was selected as the factor rotation method. All the items for each construct were EFA tested regardless for its existence in a proposed sub-dimension. To ensure high quality of instrument development process in the current study, 0.5 was used

as the cut-off for factor loadings as stated by (Hair, et. al., 1992). The Kaiser-Meer-Olkin (KMO) measure of sampling adequacy was calculated for all dimension-level and construct-level factor analysis in the research work under reference. This measure ensures that the effective sample size is adequate for the current factor analysis. The general prevalent notations as detailed were followed for the present research work: a KMO score in the 0.90's was considered outstanding, the score in 0.80's as very good, the score in 0.70's as average, the score as 0.60's as tolerable, the score as 0.50's as miserable and the score below 0.50 as unacceptable.

The next step performed after item purification was to examine the unidimentionality of the underlying latent constructs. Unidimentionality is the characteristic of a set of indicators that has only one underlying trait or concept in common (Hair et. al. 1998). Based on knowledge of the theory, empirical research or both, this research work postulates the relationships between the observed measures and the underlying factors, and thereafter tests this hypothesized structure statistically.

CFA has been used to determine the adequacy of the measurement model's goodness-of-fit to the sample data. Due to the robustness and flexibility of the Structural Equation Modelling (SEM) in establishing CFA, this research uses SEM to test both first-order as well as second-order CFA models. *First-order factors* are those in which the correlations among the observed variables can be described by a smaller number of latent variables, each of which may be one level (these factors are termed primary factors also). *Second-order* CFA models are to examine the correlations among the first-order factors and to verify whether these first order factors can be represented by a single second-order factor or at least a small set of factors. IBM® SPSS® AMOS™ 19.0 and Onyx 1.0-972 was used to perform SEM analysis. Model data fitting was evaluated based on multiple goodness-of-fit indexes. Goodness-of-fit

measures the correspondence of the actual or observed input (covariance or correlation) matrix with that predicted from the proposed model.

Goodness-of-fit measures are of three types: (1) *Absolute Fit Measures* – assess only the overall model fit (both measurement and structural models collectively); (2) *Incremental Fit Measures* - compare the proposed model to another model specified by the researcher, most often referred to as the null model; and (3) *Parsimonious Fit Measures* - relate the goodness-of-fit of the model to the number of estimated coefficients required to this model fit. The purpose of the test is to determine the amount of fit achieved by each estimated coefficient.

Chi-square Fit Index is perhaps the most common fit test. It measures the difference between the sample covariance and the fitted covariance. The chi-square value should not be significant if there is a good model fit. However, one problem with this test is that larger the sample size, the more likely the rejection of the model (Type II error). The chi-square fit index is also very sensitive to violations of the assumption of multi-variate-normality. Therefore, Joreskog and Sorbom (1989) suggested that the test must be interpreted with caution. For that reason, chi-square/degree of freedom (χ^2/df) is used with values less than 3 (<3) indicate good fit (Carmines and McIver, 1981), however various other studies suggests that a value of chi-square/degree of freedom (χ^2/df) less than 5 (<5) can also be a good idea for certain large samples, and hence this study accepts this argument and shall consider the χ^2/df value of 5 or less.

For this study the researcher has used reports of several measures of overall model fit from IBM® SPSS® AMOS™ 19.0 and Onyx 1.0-972, such as, Goodness-of-fit-index (GFI), Adjusted-goodness-of-fit-index (AGFI), Comparative-fit-index (CFI), Normed-fit-index (NFI), Root-mean-square-residual (RMR) and Root-mean-square-error-of-approximation (RMSEA).

GFI indicated the relative amount of variance and covariance jointly explained by the model. It can vary from 0 to 1, but theoretically may yield meaningless negative values. AGFI is similar to GFI but adjusts for the degree of freedom in the model. NFI is a relative comparison of proposed model to the null model. CFI compares the absolute fit of specified model to the absolute fit of the independence model. The greater the discrepancy between the overall fit of the two models the larger the values of CFI. CFI avoids the underestimation of fit but NFI often noted in models with small sample size. Many researchers interpret these index scores (GFI, AGFI, CFI, NFI) in the range of 0.80 - 0.89 as representing reasonable fit; scores of 0.90 or higher are considered as evidence of good fit (Hair et al., 1998; Joreskog and Sorbom, 1998; Bentler and Bonett, 1980). RMR indicates the average discrepancy between the elements in the sample covariance matrix and the model-generated covariance matrix. The value varies from 0 to 1, with smaller values indicating better model; and less than 0.05 indicates good fit (Byrne, 1998). RMSEA has only recently been recognized as one of the most informative criteria in covariance structure modeling. It takes into account the error of approximation in the population and is expressed per degree of freedom, thus making index sensitive to the number of estimated parameters in the model. Values below 0.05 signify good fit and the most acceptable value is 0.08 (Browne and Cudeck, 1993; Byrne, 1989).

Finally, the reliability of the entire set of items comprising the second order constructs was estimated using Cronbach's alpha. Following the guideline established by Nunnally (1978), an Alpha score of higher than 0.50 is generally considered to be acceptable.

5.6 Large-scale Measurement Results

This section of the report presents the large-scale instrument validation results on each of the constructs/sub-constructs used in the research study. For each construct, the instrument

assessment methodology described in the previous section writeup was systematically applied. In presenting the results of the large-scale study, the following acronyms have been used to number the questionnaire items in each sub-construct. The acronyms have not been renamed and their originality as per the already done research work by Principal Investigator during his Doctoral Research Work has been maintained.

S.No.	Category Code	Sub-Category Code	Item Code	Parameters
1.	TechInf	--	TechInf1	Our firm utilizes the technology, such as, JIT, APS, CRM, etc..
2.			TechInf2	Our firm utilizes the technology, such as, TPS, EDI, etc..
3.			TechInf3	Our firm utilizes the technology, such as, ERP / SAP, etc..
4.			TechInf4	Our firm utilizes the technology, such as, Email, Paging, Fax, etc..
5.			TechInf5	Our firm utilizes the technology, such as, Online Billing, e-commerce, e-transactions, etc..
6.	OrgInf	ToMgSu	ToMgSu1	Our firm's top management understands the utility of SCM.
7.			ToMgSu2	Our firm's top management considers SCM as an important tool.
8.			ToMgSu3	Our firm's top management supports the usage and implementation of SCM tools.
9.			ToMgSu4	Our firm's top management acts as an active member for SCM groups in the State
10.			ToMgSu5	Our firm's top management is trying (has already tried) to implement SCM utilities.
11.		OCS	OCS1	Our firm's organizational culture supports decentralized structure.
12.			OCS2	Our firm's organizational culture encourages employees learning.
13.			OCS3	Our firm's organizational culture encourages employees help each other.
14.			OCS4	Our firm's organizational culture encourages team-work for problem solving.
15.			OCS5	Our firm's organizational culture evaluates the employees on team-basis most of the time.
16.		OES	OES1	Our firm's organizational empowerment encourages employees to innovate at work place.
17.			OES2	Our firm's organizational empowerment provides freedom to employees at their work place.
18.			OES3	Our firm's organizational empowerment facilitates employees to have easy access to SCM methodology.
19.			OES4	Our firm's organizational empowerment encourages employees at every levels to participate in work plans.
20.	SCPB	--	SCPB1	It improves our ability to create new SCM Practices.
21.			SCPB2	Improves our market credibility.
22.			SCPB3	Facilitates our relationship with our trading partners.
23.			SCPB4	Improves our ability to explore market potential.
24.			SCPB5	Enables us to make better business decisions.
25.			SCPB6	Decreases our SCM handling costs.
26.			SCPB7	Enhances our ability to innovate.
27.			SCPB8	Improves our ability to handle exceptional business circumstances.
28.			SCPB9	Improves our firm's ability to adapt to environmental changes.
29.			SCPB10	Facilitates business transactions with our suppliers.
30.			SCPB11	Improves and facilitates collaboration across the supply chain.

31.			SCPB12	Improves our ability to keep promises on deliveries.
32.			SCPB13	Improves the overall business decision making model of our firm.
33.			SCPB14	Improves at building customer / supplier relationship management in our firm.
34.	EC	EU	EU1	Our firm faces intense competition in the industry.
35.			EU2	Our firm faces unpredictable nature of customer needs.
36.			EU3	Our firm faces unpredictable deliveries from our suppliers.
37.			EU4	Our firm faces unpredictable quality of supplied products.
38.			EU5	Our firm faces fluctuating customer orders.
39.		CP	CP1	Many other firms in our industry have implemented SCM practices.
40.			CP2	Our major competitor has implemented SCM practices.
41.			CP3	Our major trading partner has implemented SCM practices.
42.			CP4	Our firm with SM practices is able to meet the increasing demands of the market.
43.		TP	TP1	Our firm and our trading partner understand each other's requirements.
44.			TP2	Our trading partner knowledge and expertise id valuable to us.
45.			TP3	Our trading partners respect the confidentiality of the information they receive from our firm.
46.			TP4	Our trading partners are willing to provide assistance to our firm whenever required.
47.			TP5	Our firm DOES NOT have to closely supervise transactions with the trading partner.
48.	KC	--	KC1	Our firm has access to sufficient amount of SCM practices knowledge.
49.			KC2	Our firm has access to the feedback about the products.
50.			KC3	Our firm has convenient ordering system for our customers / suppliers for efficient inventory management.
51.			KC4	Our firm has regular communication with our customer / suppliers for effective financial management.
52.	SCMP	SSP	SSP1	Our firm implements SCM because with it our firm wishes to collaborate on the benefits obtained from its usage.
53.			SSP2	Our firm implements SCM because with it our firm wishes to strengthen relationship with our trading partners.
54.			SSP3	Our firm implements SCM because with it our firm believes that our relationship with trading partner is profitable.
55.			SSP4	Our firm implements SCM because with it our firm and our trading partner can share risks that occur in SCM.
56.			SSP5	Our firm implements SCM because with it our firm can have harmonious relationship with our trading partner.
57.		BFA	BFA1	Our firm believes that with SCM implementation our firm can handle non-standard orders.
58.			BFA2	Our firm believes that with SCM implementation our firm can meet special customer requirements.
59.			BFA3	Our firm believes that with SCM implementation our firm can produce products with multiple features.
60.			BFA4	Our firm believes that with SCM implementation our firm can rapidly adjust to production capacity in response to the change in customer demand.
61.			BFA5	Our firm believes that with SCM implementation our firm can introduce new products quickly.
62.		SCKD	SCKD1	Our firm believes that with SCM implementation our firm can help exchange information with our suppliers.
63.			SCKD2	Our firm believes that with SCM implementation our firm can help maintain long-term partnerships.
64.			SCKD3	Our firm believes that with SCM implementation our firm can help provide stable procurement relationships.
65.			SCKD4	Our firm believes that with SCM implementation our firm can share market information among departments within the firm.
66.		SCPA	SCPA1	Our firm believes that with SCM applications help to have integrated inventory management system.
67.			SCPA2	Our firm believes that with SCM applications help to have

				integrated logistics support system.
68.			SCPA3	Our firm believes that with SCM applications help to have automated order refilling system.
69.			SCPA4	Our firm believes that with SCM applications help to have automated accounting system.
70.			SCPA5	Our firm believes that with SCM applications help to have integrated data sharing system.
71.			SCPA6	Our firm believes that with SCM applications help to have synchronized production schedules.
72.	SCIPB	--	SCIPB1	I believe SCM Practices helps filling orders on-time.
73.			SCIPB2	I believe SCM Practices helps provide short-order-to-delivery cycle times.
74.			SCIPB3	I believe SCM Practices helps provide high-customer-service levels.
75.			SCIPB4	I believe SCM Practices helps provide short-customer-response-time.
76.			SCIPB5	I believe SCM Practices helps provide quick response to the requirements of our firm's target markets.

Table – 5.1: Parameters along with Coding used during Data Analysis

Source: Original & Unpublished Doctoral Research Thesis (2012) of Principal Investigator

5.6.1 Technological Infrastructure

Technological Infrastructure (TechInf) is a single dimension construct measured by 5 items representing the five important technological tools for increasing efficiency and productivity in Industries.

CITC scores indicates that the 1st item (TechInf1) is at 0.174 which is far below 0.5, though the resulted Cronbach's Alpha was acceptable at 0.772; thusTechInf1 was removed from further analysis. The second itinerary of reliability analysis after deleting TechInf1 (item-1) all the left over 4 items showed Cronbach's Alpha values above 0.5; also the overall Cronbach's Alpha value for the 4 items improved to 0.834 which was acceptable for our study along with all individual CITC values for this construct. The CITC for each item with its corresponding code name areas shown in Table-5.2.

Technological Infrastructure (TechInf)				
Item Code	**CITC Initial**	**Cronbach's Alpha - Initial**	**CITC Final**	**Cronbach's Alpha - Final**
TechInf1	0.174	**0.772**	*Item Dropped*	**0.834**
TechInf2	0.632		0.648	
TechInf3	0.696		0.740	
TechInf4	0.605		0.598	
TechInf5	0.648		0.686	

Table – 5.2: CITC Item Purification results for Technological Infrastructure

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction. The Kaiser-Meyer-Olkin (KMO) score of 0.805 indicated an acceptable sampling adequacy. The total variance explained by the single factor for TechInf stood at 66.979%. Furthermore, all the items were loaded on their respective factors and there were no items with cross-loading greater than 0.50, which was acceptable for our study.

The EFA results are as shown in Table-5.3.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.805		
Item Code	**Technological Infrastructure (TechInf)**	**Cronbach's Alpha**
TechInf2	0.804	**0.834**
TechInf3	0.868	
TechInf4	0.766	
TechInf5	0.832	
Eigen Value	***2.679***	
%age of Variance	***66.979***	

Table – 5.3: EFA results for Technological Infrastructure

The next step is to test the 4 items of in Complementary Factor Analysis (CFA) for measurement model fit. The CFA model for Technological Infrastructure (TechInf) was then tested using IBM® SPSS® AMOS™ 19.0and Onyx 1.0-972. The results indicated an acceptable and perfect model fit indices: χ^2/df= 1.322; RMSEA= 0.018 ; RMR= 0.007 ; GFI= 0.999; AGFI= 0.994; NFI= 0.998 and CFI= 1.000 ; thus there was no need for any modifications in the model constructs. The model for Technological Infrastructure (TechInf) is as shown in Figure-5.1. Furthermore, all the factor loadings (λ) were above 0.50 and significantly important. The model fit indices for TechInf is shown in Table–5.4

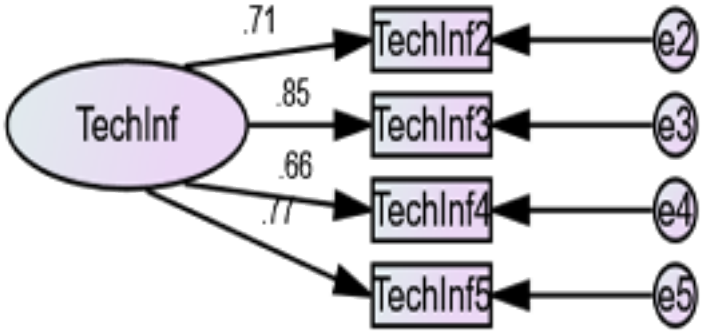


Figure – 5.1: CFA model for Technological Infrastructure

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	2.644	2	1.322	0.018	0.007	0.999	0.994	0.998	1.000

Table – 5.4: CFA model fit results for Technological Infrastructure

5.6.2 Organizational Infrastructure

Organizational Infrastructure (OrgInf) is a multiple dimension construct measured by a total of 14 items representing the five items for Top Management Support (ToMgSu), five items for Organizational Culture Support (OCS) and four items for Organizational Empowerment Support (OES).

CITC scores indicates that the resulted Cronbach's Alpha for OrgInfequalled 0.730 (with ToMgSu=0.909; OCS=0.758& OES=0.791), which was acceptable for the study, but CITC for separate dimensional constructs revealed that CITC scores for OCS1 (0.072) was below our cut off value of 0.5; thus it was removed from further analysis. The second itinerary of reliability analysis after deleting OCS1, all the left over items under OCS dimension showed Cronbach's Alpha values above 0.5; also the overall Cronbach's Alpha value for the OrgInf construct was 0.742 which was acceptable for our study. The CITC for each item with its corresponding code name are shown in Table-5.5.

Organizational Infrastructure (OrgInf)				
Item Code	**CITC Initial**	**Cronbach's Alpha - Initial**	**CITC Final**	**Cronbach's Alpha - Final**
ToMgSu1	0.792	**0.909**	--	**0.909**
ToMgSu 2	0.837		--	
ToMgSu 3	0.825		--	

ToMgSu 4	0.745		--	
ToMgSu 5	0.669		--	
OCS1	0.072		*Item Dropped*	
OCS2	0.654		0.683	
OCS3	0.662	**0.758**	0.688	**0.835**
OCS4	0.622		0.631	
OCS5	0.627		0.657	
OES1	0.598		--	
OES2	0.649	**0.791**	--	**0.791**
OES3	0.564		--	
OES4	0.601		--	

Table-5.5: CITC Item Purification results for Organizational Infrastructure

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction and VARIMAX as method of rotation. The Kaiser-Meyer-Olkin (KMO) score of 0.809 indicated an acceptable sampling adequacy. The cumulative variance explained by the two factors is 68.384%, three factors emerged from the factor analysis as expected with all factor loadings above 0.50. The EFA results are as shown in Table-5.6.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.809				
Item Code	**ToMgSu**	**OCS**	**OES**	**Cronbach's Alpha**
ToMgSu1	0.881			
ToMgSu 2	0.904			
ToMgSu 3	0.898			**0.909**
ToMgSu 4	0.833			
ToMgSu 5	0.770			
OCS2		0.822		
OCS3		0.828		**0.835**
OCS4		0.796		
OCS5		0.816		
OES1			0.783	
OES2			0.816	**0.791**
OES3			0.756	
OES4			0.778	
Eigen Value	***3.701***	***2.680***	***2.509***	
%age of Variance	***28.472***	***20.612***	***19.300***	
Cumulative %age of Variance	***28.472***	***49.084***	***68.384***	

Table – 5.6: EFA results for Organizational Infrastructure

The first order CFA model for OrgInf was then tested using IBM® SPSS® AMOS™ 19.0and Onyx 1.0-972 with the statistics as presented in Table 5.7. The results indicated that although factor loading coefficients for the initial model were greater than 0.50, however, the model fit was not acceptable as χ^2/df was greater than the acceptable value of 5 fixed for this study.

Hence, modification indices were examined and found that the following Constructs were required to be illuminated from the model due to their high values of correlated effects: ToMgSu5, ToMgSu4 and OES3. Thereafter, all the model fit indices were acceptable for the model: χ^2/df = 3.287; RMSEA= 0.048 ; RMR= 0.038 ; GFI= 0.979; AGFI= 0.964; NFI= 0.977 and CFI= 0.984; henceforth no modification was done on the first order model for Organizational Infrastructure (OrgInf), as shown in Table-5.7. The first-order CFA model thus obtained is as shown in Figure-5.2.

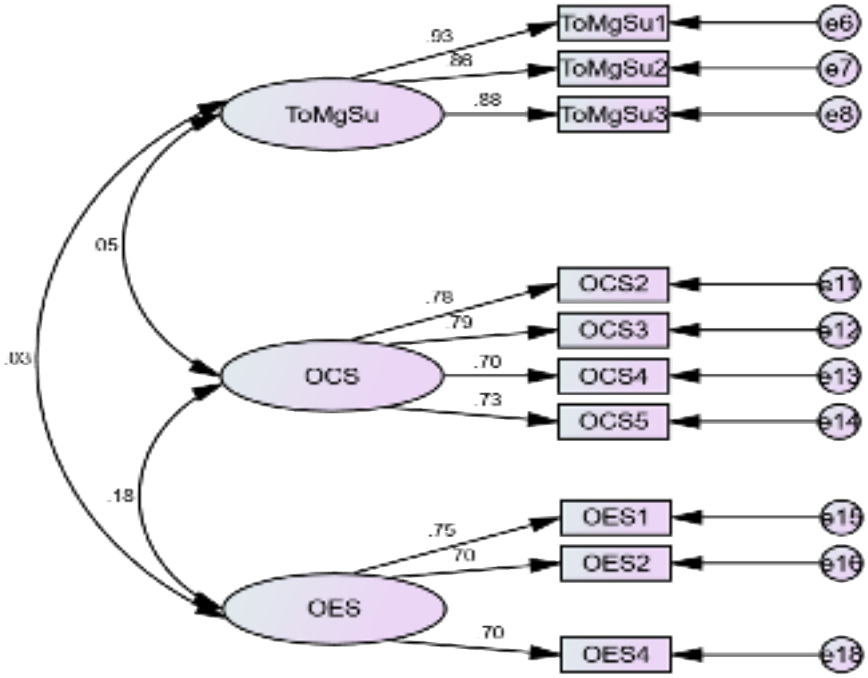


Figure – 5.2: First Order CFA model for Organizational Infrastructure

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	503.006	62	8.113	0.084	0.051	0.928	0.895	0.923	0.932
After Removing ToMgSu5	274.439	51	5.381	0.066	0.041	0.957	0.934	0.953	0.961
After Removing ToMgSu5, ToMgSu4	178.966	41	4.365	0.058	0.043	0.968	0.948	0.964	0.972
After Removing ToMgSu5, ToMgSu4, OES3	105.172	32	3.287	0.048	0.038	0.979	0.964	0.977	0.984

Table-5.7: First Order CFA model fit results for Organizational Infrastructure

In the next step, the second order model was tested to see if the three sub-constructs (ToMgSu, OCS & OES) underlie a single high order construct of OrgInf. The modified second-order model for OI is as shown in Figure-5.3. It was observed that there had been no

high-order correlated effect among any of the constructs of OrgInf. The resultant goodness-of-fit indices for the second-order construct showed an acceptable model fit as illustrated in Table-5.8. Furthermore, all the factor loadings (λ) were above 0.50 and significantly important, hence no further modification was desired in the second-order CFA model thereafter.

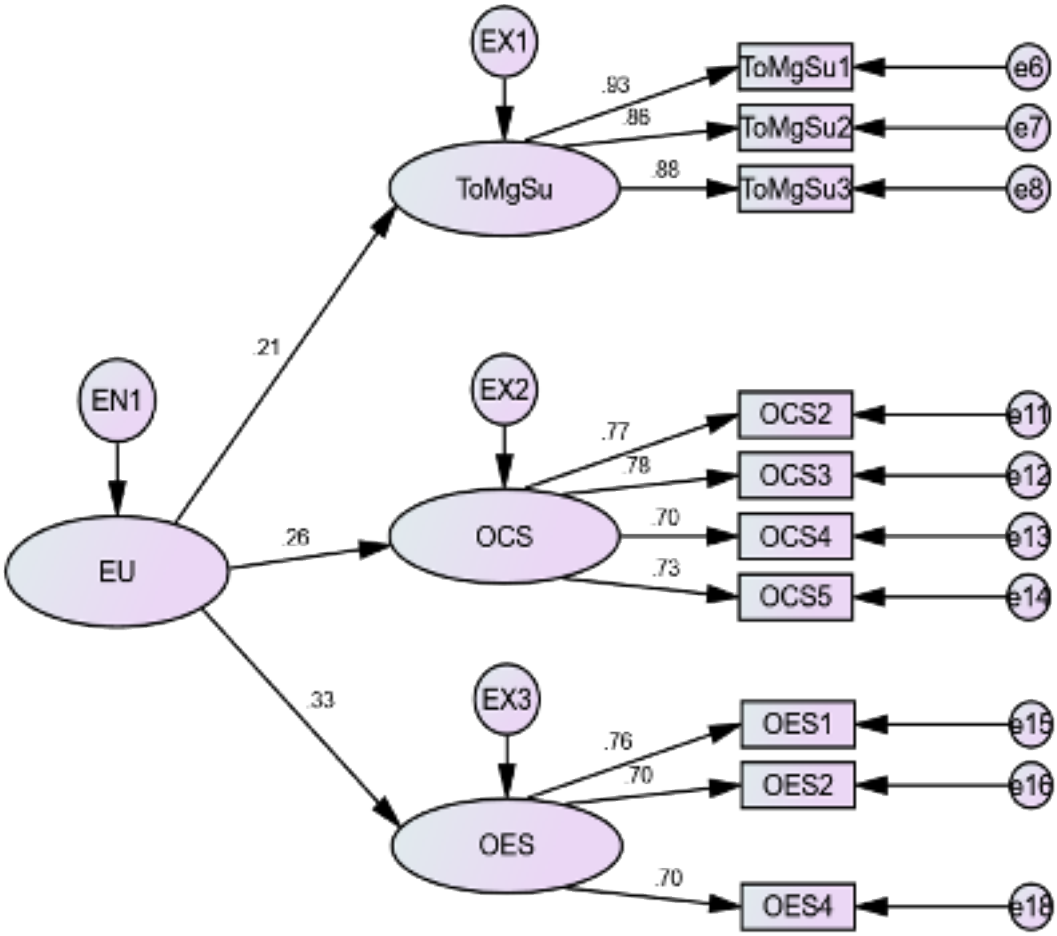


Figure – 5.3: Second Order CFA model for Organizational Infrastructure

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	118.455	33	3.590	0.050	0.055	0.977	0.961	0.974	0.981

Table-5.8: Second Order CFA model fit results for Organizational Infrastructure

5.6.3 Supply Chain Perceived Benefits for Buyer-Supplier Relationship

Supply Chain Perceived Benefits for Buyer-Supplier Relationship (SCPB) is a single dimension construct measured by 14 items representing the items that are considered

important for cordial relationship among trading partners for success of SCM Practices across the Industrial Units for selected Northern Indian States.

CITC scores indicates that Cronbach's Alpha is 0.641, which though acceptable but most of the items of the construct were well below the cut-off value of 0.5, such as, SCPB1 (0.168), SCPB2 (0.114), SCPB3 (0.103), SCPB4 (-0.069), SCPB5 (0.210), SCPB6 (0.134), SCPB7 (0.428), SCPB9 (0.400) and SCPB13 (0.222). It was understood that one item needs to be deleted at a time to look into its scale of variance. After multiple iterations CITC score for the dimension came to be 0.839 which was quite good to be accepted for the study. A total of seven iterations were performed for obtaining this CITC score. The CITC for each item with its corresponding code name are shown in Table-5.9.

Supply Chain Perceived Benefits for Supplier-Buyer Relationship (SCPB)				
Item Code	**CITC Initial**	**Cronbach's Alpha – Initial**	**CITC Final**	**Cronbach's Alpha – Final**
SCPB1	0.168	**0.641**	*Item Dropped*	**0.839**
SCPB2	0.114		*Item Dropped*	
SCPB3	0.103		*Item Dropped*	
SCPB4	-0.069		*Item Dropped*	
SCPB5	0.210		*Item Dropped*	
SCPB6	0.134		*Item Dropped*	
SCPB7	0.428		0.638	
SCPB8	0.543		0.710	
SCPB9	0.400		0.513	
SCPB10	0.565		0.532	
SCPB11	0.540		0.600	
SCPB12	0.503		0.535	
SCPB13	0.222		*Item Dropped*	
SCPB14	0.532		0.619	

Table-5.9: CITC Item Purification results for Supply Chain Perceived Benefits for Buyer-Supplier Relationship

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction. The Kaiser-Meyer-Olkin (KMO) score of 0.857 indicated a perfect sampling adequacy. The analysis demonstrated that one factor was extracted with cumulative variance of 51.055% and there existed no cross loadings. The EFA results are as shown in Table 5.10.

First Iteration of EFA

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.857	
Item Code	**Supply Chain Perceived Benefits for Buyer-Supplier Relationship (SCPB)**
SCPB7	0.759
SCPB8	0.818
SCPB9	0.644
SCPB10	0.659
SCPB11	0.714
SCPB12	0.654
SCPB14	0.737
Eigen Value	***3.574***
%age of Variance	***51.055***
Cumulative %age of Variance	***51.055***

Table-5.10: EFA results for Supply Chain Perceived Benefits for Buyer-Supplier Relationship

The next step is to test the 7 items of SCPB in Complementary Factor Analysis (CFA) for measurement model fit. The CFA model for SCPB was then tested using IBM® SPSS® AMOS™ 19.0and Onyx 1.0-972. The results indicated poor model fit indices: χ^2/df= 19.554; RMSEA= 0.136 ; RMR= 0.050 ; GFI= 0.917 ; AGFI= 0.834 ; NFI= 0.888 and CFI= 0.893; thus modification indices were utilized for calculating the high error correlated factors which came out to be SCPB11 and SCPB12. Items were therefore removed iteratively one by one from the analysis. After these items were removed, the model fit showed that there was no need for any modifications in the model constructs. The model for SCPB is as shown in Figure-5.4. Furthermore, all the factor loadings (λ) were above 0.50. The model fit indices for SCPB is shown in Table–5.11.

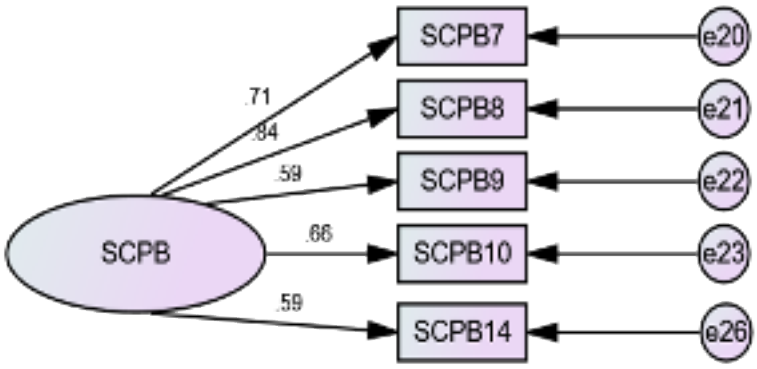


Figure – 5.4: CFA model for Supply Chain Perceived Benefits for Buyer-Supplier Relationship

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	273.753	14	19.554	0.136	0.050	0.917	0.834	0.888	0.893
After Removing SCPB11	110.358	9	12.262	0.106	0.039	0.965	0.918	0.942	0.946

After Removing SCPB11, SCPB12	5.413	5	1.083	0.009	0.009	0.998	0.993	0.996	1.000

Table-5.11: CFA model fit results for Supply Chain Perceived Benefits for Buyer-Supplier Relationship

5.6.4 Environmental Characteristics

Environmental Characteristics (EC) chosen was a multiple dimension construct having a total of 14 items divided into 3 sub-constructs (with 5 items in Environmental Uncertainty (EU), 4 items in Competitive Pressure (CP) and 5 items in Trading Partners Readiness (TP)).

CITC scores indicates that the Cronbach's Alpha for EC equalled 0.800 (with EU=0.910; CP=0.758& TP=0.771), which was acceptable for the study, but CITC for separate dimensional constructs revealed that CITC score for CP1 (0.369) and TP1 (0.319) were below the CITC cut off value of 0.5; hence these items were removed from further analysis. The second itinerary of reliability analysis after deleting CP1 and TP1 revealed that all invividual items for CP as well as TP were well above the cut-off value of 0.5; also the overall Cronbach's Alpha value for the CP and TP constructswas acceptable for our study. The overall Cronbach's Alpha value for EC after these removable came out to be 0.782. The CITC for each item with its corresponding code name are shown in Table-5.12.

Environmental Characteristics (EC)				
Item Code	**CITC Initial**	**Cronbach's Alpha – Initial**	**CITC Final**	**Cronbach's Alpha – Final**
EU1	0.805	**0.910**	--	**0.910**
EU2	0.843		--	
EU3	0.824		--	
EU4	0.740		--	
EU5	0.664		--	
CP1	0.369	**0.758**	*Item Dropped*	**0.795**
CP2	0.587		0.658	
CP3	0.707		0.699	
CP4	0.584		0.574	
TP1	0.319	**0.771**	*Item Dropped*	**0.791**
TP2	0.595		0.598	
TP3	0.642		0.649	

TP4	0.522		0.564	
TP5	0.645		0.601	

Table – 5.12: CITC Item Purification results for Environmental Characteristics

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction and VARIMAX as method of rotation. The Kaiser-Meyer-Olkin (KMO) score of 0.826 indicated an acceptable sampling adequacy. As expected the analysis resulted into extraction of three components with the cumulative variance explained by the three factors as 70.541%. All the factors that emerged from the factor analysis were with factor loadings above 0.50. The EFA results are as shown in Table – 5.13.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.877				
Item Code	**EU**	**CP**	**TP**	**Cronbach's Alpha**
EU1	0.893			**0.910**
EU2	0.910			
EU3	0.899			
EU4	0.827			
EU5	0.764			
CP2		0.763		**0.795**
CP3		0.793		
CP4		0.838		
TP2			0.656	
TP3			0.779	
TP4			0.837	
TP5			0.680	
Eigen Value	***3.713***	***2.451***	***2.301***	
%age of Variance	***30.938***	***20.426***	***19.176***	
Cumulative %age of Variance	***30.938***	***51.364***	***70.541***	

Table – 5.13: EFA results for Environmental Characteristics

The first order CFA model for EC was then tested using IBM® SPSS® AMOS™ 19.0 and Onyx 1.0-972 with the statistics as presented in Table 5.14. The results indicated that although factor loading coefficients for the initial model were greater than 0.60, but the model fit showed a poor indices: χ^2/df= 12.275; RMSEA= 0.106 ; RMR= 0.057 ; GFI= 0.905; AGFI= 0.855; NFI= 0.905 and CFI= 0.912. Henceforth, modification indices were utilized for modifications in the model which indicated a chance for model improvement as a result from possibility of error correlation (as shown in Table-5.14); by removing the correlated affects the final first-order CFA model thus obtained is as shown in Figure-5.5.

Thereafter, modification indices indicated that there was no need for any modifications in the model constructs. The first-order CFA model for Environmental Characteristics (EC) is as shown in Figure-5.5. Clearly, the factor loadings (λ) were acceptable with all factors being above the threshold value of 0.5.

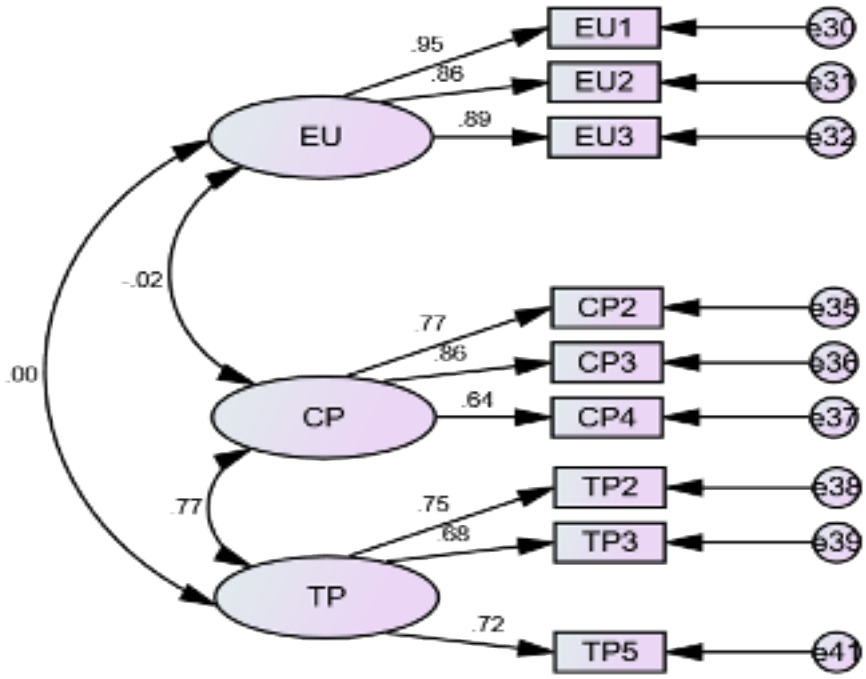


Figure – 5.5: First Order CFA model for Environmental Characteristics

Model Fit	χ^2	Df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	626.028	51	12.275	0.106	0.057	0.905	0.855	0.905	0.912
After Removing EU5	368.522	41	8.988	0.089	0.046	0.939	0.901	0.937	0.944
After Removing EU5, TP4	236.062	32	7.377	0.080	0.038	0.958	0.927	0.956	0.962
After Removing EU5, TP4, EU4	96.852	24	4.035	0.055	0.032	0.979	0.961	0.979	0.984

Table – 5.14: First Order CFA model fit results for Environmental Characteristics

In the next step, the second order model was tested to see if these three sub-constructs (EU, CP & TP) underlie a single high order construct of EC. It was observed there did not happen to be any high-order correlated effect for the constructs of EU. The resulting second-order CFA model for Environmental Characteristics (EC) is as shown in Figure-5.6; The resultant goodness-of-fit indices for the second-order construct are as illustrated in Table-5.15.

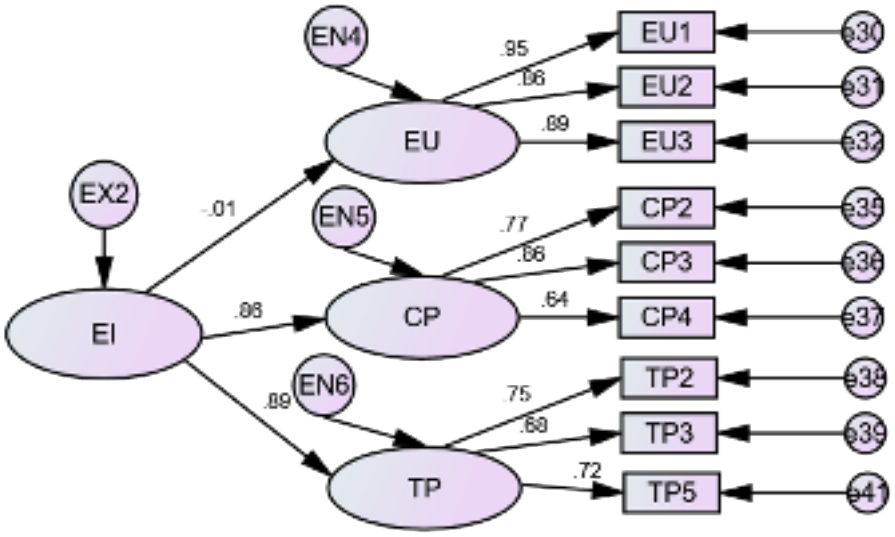


Figure – 5.6: Second Order CFA model for Environmental Characteristics

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	97.191	25	3.888	0.054	0.032	0.979	0.962	0.979	0.984

Table – 5.15: Second Order CFA model fit results for Environmental Characteristics

5.6.5 Knowledge Complementarity

Knowledge Complementarity (KC) used for this study was a single dimension construct having 4 items, which represented four important factors that are necessary for understanding the implementation of SCM in Industrial Units.

CITC scores indicates that the all the items in KC were having CITC scores above 0.5 and also the overall Cronbach's Alpha was 0.787, which was acceptable for the study. The CITC for each item with its corresponding code name are shown in Table-5.16.

Knowledge Complementarity (KC)				
Item Code	**CITC Initial**	**Cronbach's Alpha - Initial**	**CITC Final**	**Cronbach's Alpha – Final**
KC1	0.558	**0.787**	--	**0.787**
KC2	0.610		--	
KC3	0.646		--	
KC4	0.582		--	

Table – 5.16: CITC Item Purification results for Knowledge Complementarity

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction. The Kaiser-Meyer-Olkin (KMO) score of 0.790 indicated an acceptable sampling adequacy. The total variance explained by the single factor for KC stood at 61.381%. Furthermore, all the items were loaded on their respective factors and there were no items with cross-loading greater than 0.50, which was acceptable for our study. The EFA results are as shown in Table - 5.17.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.790		
Item Code	**Knowledge Complementarity (KC)**	**Cronbach's Alpha**
KC1	0.752	**0.787**
KC2	0.793	
KC3	0.819	
KC4	0.769	
Eigen Value	***2.455***	
%age of Variance	***61.381***	

Table – 5.17: EFA results for Knowledge Complementarity

In the next step the 4 items were measured using Complementary Factor Analysis (CFA) for measurement of model fit. The CFA model for KC was then tested using IBM® SPSS® AMOS™ 19.0and Onyx 1.0-972. The results indicated an acceptable model fit indices as summarized in Table-5.18; thus there was no need for any modifications in the model constructs. The model for Knowledge Complementarity (KC) is as shown in Figure-5.7. Furthermore, all the factor loadings (λ) were above 0.50 and significantly important.

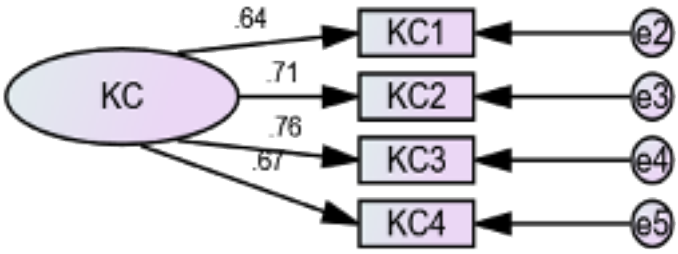


Figure – 5.7: CFA model for Knowledge Complementarity

Model Fit	**χ^2**	**df**	**χ^2/df**	**RMSEA**	**RMR**	**GFI**	**AGFI**	**NFI**	**CFI**
Initial	1.220	2	0.610	0.005	0.005	0.999	0.997	0.999	1.000

Table – 5.18: CFA model fit results for Knowledge Complementarity

5.6.6 Supply Chain Management Practices

Supply Chain Management Practices (SCMP) or Collaborative Knowledge Management Practices had 20 items in 4 sub-dimensions: Supply Chain Performance (SSP) five items, Barrier Free Access (BFA) five items, Supply Chain Knowledge Dissemination (SCKD) four items and Supply Chain Practices Application (SCPA) six items.

The CITC analysis revealed that it had a good Cronbach's α value of (0.832). The results are presented in Table 5.19. Furthermore, separate CITC analysis revealed that no item in each of the sub-constructs were below the CITC cut-off of 0.5.

Supply Chain Management Practices (SCMP)				
Item Code	**CITC Initial**	**Cronbach's Alpha - Initial**	**CITC Final**	**Cronbach's Alpha - Final**
SSP1	0.792	**0.909**	--	**0.909**
SSP2	0.837		--	
SSP3	0.825		--	
SSP4	0.745		--	
SSP5	0.669		--	
BFA1	0.805	**0.910**	--	**0.910**
BFA2	0.843		--	
BFA3	0.824		--	
BFA4	0.740		--	
BFA5	0.664		--	
SCKD1	0.648	**0.834**	--	**0.834**
SCKD2	0.740		--	
SCKD3	0.598		--	
SCKD4	0.686		--	
SCPA1	0.567	**0.880**	--	**0.880**
SCPA2	0.669		--	
SCPA3	0.764		--	
SCPA4	0.678		--	
SCPA5	0.733		--	
SCPA6	0.720		--	

Table – 5.19: CITC Item Purification results for Supply Chain Management Practices

In the next step EFA was performed using principal component as means of extraction and VARIMAX as method of rotation. The KMO score of 0.728 indicated a good sampling adequacy, however SSP4 showed a cross loading (0.544, 0.680), hence this item was removed from further analysis. Thereafter, all items load on their respective factors and the result showed no cross-loadings. The EFA results have been tabulated in Table-5.20.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.755					
Item Code	**SSP**	**BFA**	**SCKD**	**SCPA**	**Cronbach's Alpha**
SSP1	0.944				**0.895**
SSP2	0.860				
SSP3	0.897				
SSP5	0.845				
BFA1		0.952			**0.910**
BFA2		0.863			
BFA3		0.908			
BFA4		0.645			
BFA5		0.847			
SCKD1			0.804		**0.834**
SCKD2			0.863		
SCKD3			0.769		
SCKD4			0.820		
SCPA1				0.686	**0.880**
SCPA2				0.774	
SCPA3				0.849	
SCPA4				0.783	
SCPA5				0.827	
SCPA6				0.811	
Eigen Value	***5.774***	***3.763***	***2.731***	***1.893***	
%age of Variance	***30.390***	***19.804***	***14.373***	***9.965***	
Cumulative %age of Variance	***30.390***	***50.195***	***64.568***	***74.532***	

Table – 5.20: EFA results for Supply Chain Management Practices

The first order CFA model for EC was then tested using IBM® SPSS® AMOS™ 19.0 and Onyx 1.0-972 with the statistics as presented in Table 5.21. The results indicated that although factor loading coefficients for the initial model were greater than0.50, however, the model fit was having poor indices: χ^2/df= 67.619; RMSEA= 0.258 ; RMR= 0.096 ; GFI= 0.680; AGFI= 0.584; NFI= 0.566 and CFI= 0.569 ; henceforth modification indices were utilized for modifications in the model which indicated a chance for model improvement as a result from possibility of error correlation (as shown in Table-5.21); after removing the correlated affects the final first-order CFA model thus obtained is as shown in Fig 5.8. Thereafter, modification indices indicated that there was no need for any modifications in the model constructs. The first-order CFA model for Supply Chain Management Practices (SCMP) is as shown in Fig 5.8.

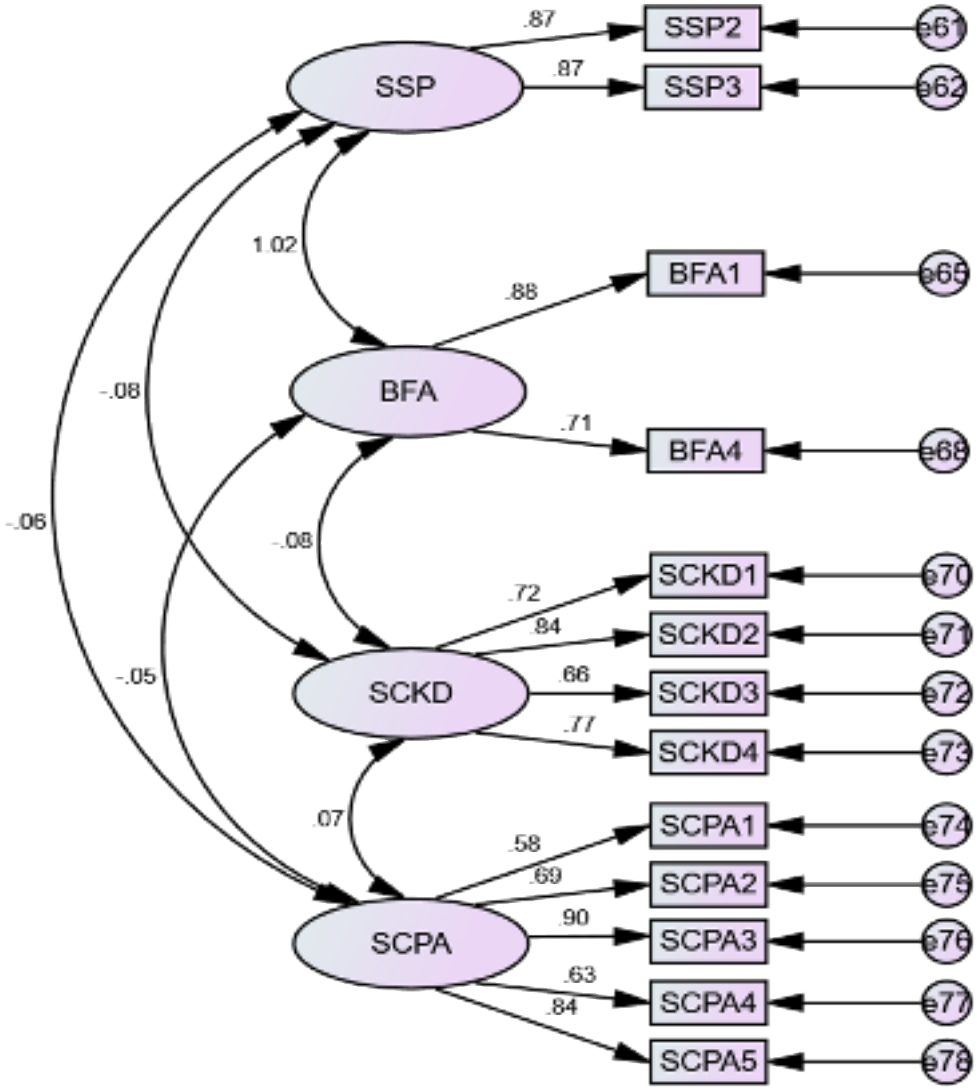


Figure – 5.8: First Order CFA model for Supply Chain Management Practices

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	9872.328	146	67.619	0.258	0.096	0.680	0.584	0.566	0.569
After Removing BFA5	6629.990	129	51.395	0.225	0.072	0.738	0.653	0.652	0.656
After Removing BFA5, BFA2	3384.186	113	29.943	0.170	0.075	0.782	0.705	0.767	0.772
After Removing BFA5, BFA2, SSP5	2964.209	98	30.247	0.171	0.061	0.816	0.745	0.784	0.790
After Removing BFA5, BFA2, SSP5, BFA3	807.917	84	9.618	0.093	0.060	0.903	0.862	0.922	0.929
After Removing BFA5, BFA2, SSP5, BFA3, SCPA6	512.568	71	7.219	0.079	0.055	0.931	0.898	0.946	0.953
After Removing BFA5, BFA2, SSP5, BFA3, SCPA6, SSP1	255.889	59	4.337	0.058	0.044	0.961	0.941	0.962	0.970

Table – 5.21: First Order CFA model fit results for Supply Chain Management Practices

In the next step, the second order model was tested to see if these four sub-constructs (SSP, BFA, SCKD & SCPA) underlie a single high order construct of SCMP. It was observed that no items of SCMP showed high-order correlated effect. The resulting second-order CFA model for Environmental Characteristics is as shown in Figure-5.9; thereafter no further modification in the model was desired. The resultant goodness-of-fit indices for the second-order construct are as illustrated in Table-5.22.

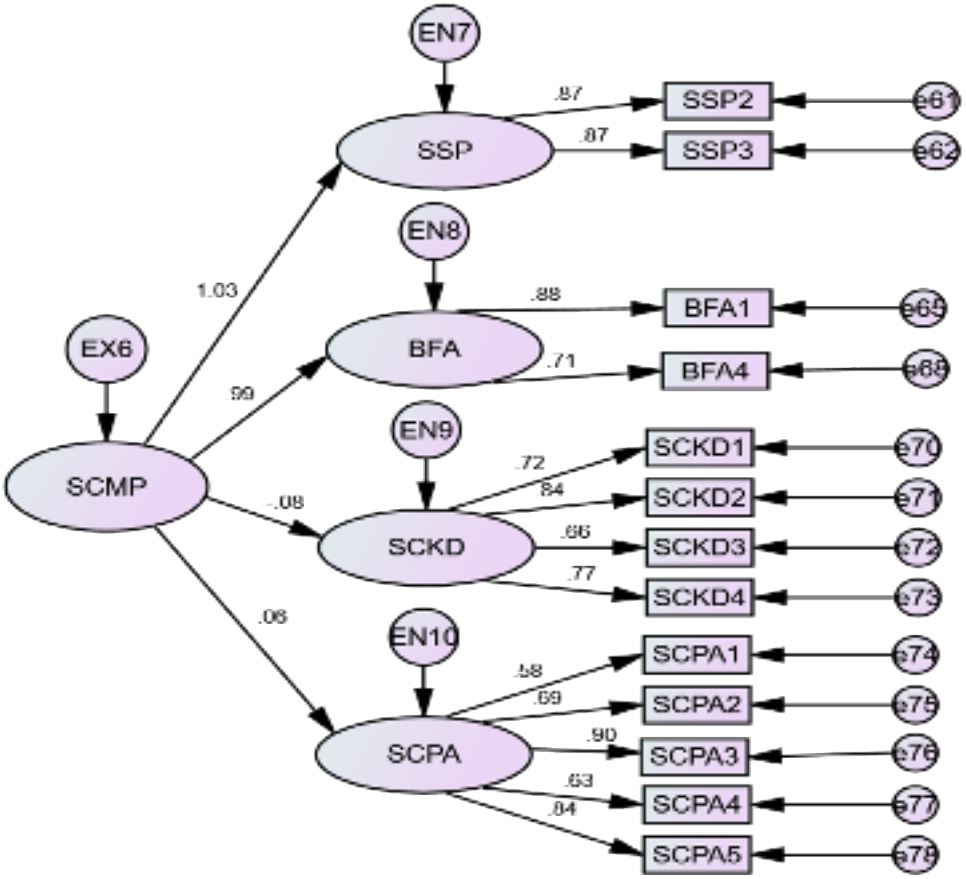


Figure – 5.9: Second Order CFA model for Supply Chain Management Practices

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	259.209	61	4.249	0.057	0.050	0.961	0.941	0.961	0.970

Table – 5.22: Second Order CFA model fit results for Supply Chain Management Practices

5.6.7 Supply Chain Management Practices Perceived Benefits

Supply Chain Management Practices Perceived Benefits (SCIPB) was initially represented with 5 items in one dimension. The CITC analysis showed that all the item were above 0.5

and the overall Cronbanch's Alpha was perfectly acceptable at 0.820, however SCIPB1 was beloe 0.5, hence was removed from further analysis. The CITC scores along with item codes are as presented in Table-5.23.

Supply Chain Management Practices Perceived Benefits				
Item Code	**CITC Initial**	**Cronbach's Alpha - Initial**	**CITC Final**	**Cronbach's Alpha – Final**
SCIPB1	0.470	**0.820**	*Item Dropped*	**0.822**
SCIPB2	0.660		0.620	
SCIPB3	0.649		0.669	
SCIPB4	0.612		0.640	
SCIPB5	0.688		0.668	

Table – 5.23 CITC Item Purification results for Supply Chain Management Practices Perceived Benefits

An Exploratory Factor Analysis (EFA) was then conducted using principal components as means of extraction. The Kaiser-Meyer-Olkin (KMO) score of 0.811 indicated an acceptable sampling adequacy. The total variance explained by the single factor for SCIPB stood at 65.667%. Furthermore, all the items were loaded on their respective factors and there were no items with cross-loading greater than 0.50, which was acceptable for our study. The EFA results are as shown in Table - 5.24.

Kaiser-Meyer-Olkin (KMO) : Measure of Sampling Adequacy Score = 0.811		
Item Code	**SCIPB**	**Cronbach's Alpha**
SCIPB2	0.788	**0.822**
SCIPB3	0.824	
SCIPB4	0.804	
SCIPB5	0.825	
Eigen Value	***2.627***	
%age of Variance	***65.667***	

Table – 5.24: EFA results for Supply Chain Management Practices Perceived Benefits

The next step is to test the 5 items of in Complementary Factor Analysis (CFA) for measurement model fit. The CFA model for SCIPB was then tested using IBM® SPSS® AMOS™ 19.0and Onyx 1.0-972. The results indicated poor model fit indices as summarized in Table-5.25; thus modification indices were utilized for improving the model fit. The resultant model is as represented in Figure-5.10 with results as summarized below (in Table-5.30); henceforth there was no need for any modifications in the model constructs. Furthermore all the factor loadings (λ) were above 0.50 and significantly important.

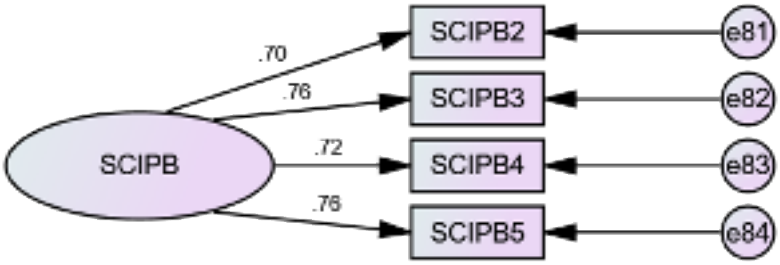


Figure – 5.10: CFA model for Supply Chain Management Practices Perceived Benefits

Model Fit	χ^2	df	χ^2/df	RMSEA	RMR	GFI	AGFI	NFI	CFI
Initial	0.512	2	0.256	0.000	0.003	1.000	0.999	1.000	1.000

Table – 5.25: CFA model fit results for Supply Chain Management Practices Perceived Benefits

5.7 Summary of Constructs / Items after Statistical Measurements

The following constructs / items were finally obtained after performing statistical tests and measurements:

S.No.	Category Code	Sub-Category Code	Item Code	Parameters
1.	TechInf	--	*TechInf1*	*Item Dropped*
2.			TechInf2	Our firm utilizes the technology, such as, TPS, EDI, etc..
3.			TechInf3	Our firm utilizes the technology, such as, ERP / SAP, etc..
4.			TechInf4	Our firm utilizes the technology, such as, Email, Paging, Fax, etc..
5.			TechInf5	Our firm utilizes the technology, such as, Online Billing, e-commerce, e-transactions, etc..
6.	OrgInf	ToMgSu	ToMgSu1	Our firm's top management understands the utility of SCM.
7.			ToMgSu2	Our firm's top management considers SCM as an important tool.
8.			ToMgSu3	Our firm's top management supports the usage and implementation of SCM tools.
9.			ToMgSu4	Our firm's top management acts as an active member for SCM groups in the State
10.			*ToMgSu5*	*Item Dropped*
11.		OCS	*OCS1*	*Item Dropped*
12.			OCS2	Our firm's organizational culture encourages employees learning.
13.			OCS3	Our firm's organizational culture encourages employees help each other.
14.			OCS4	Our firm's organizational culture encourages team-work for problem solving.
15.			OCS5	Our firm's organizational culture evaluates the employees on team-basis most of the time.
16.		OES	OES1	Our firm's organizational empowerment encourages employees to innovate at work place.
17.			OES2	Our firm's organizational empowerment provides freedom to employees at their work place.
18.			*OES3*	*Item Dropped*
19.			OES4	Our firm's organizational empowerment encourages employees at every levels to participate in work plans.
20.	SCPB	--	*SCPB1*	*Item Dropped*
21.			*SCPB2*	*Item Dropped*

22.			*SCPB3*	*Item Dropped*
23.			*SCPB4*	*Item Dropped*
24.			*SCPB5*	*Item Dropped*
25.			*SCPB6*	*Item Dropped*
26.			SCPB7	Enhances our ability to innovate.
27.			SCPB8	Improves our ability to handle exceptional business circumstances.
28.			SCPB9	Improves our firm's ability to adapt to environmental changes.
29.			SCPB10	Facilitates business transactions with our suppliers.
30.			*SCPB11*	*Item Dropped*
31.			*SCPB12*	*Item Dropped*
32.			*SCPB13*	*Item Dropped*
33.			SCPB14	Improves at building customer / supplier relationship management in our firm.
34.	EC	EU	EU1	Our firm faces intense competition in the industry.
35.			EU2	Our firm faces unpredictable nature of customer needs.
36.			EU3	Our firm faces unpredictable deliveries from our suppliers.
37.			*EU4*	*Item Dropped*
38.			*EU5*	*Item Dropped*
39.		CP	*CP1*	*Item Dropped*
40.			CP2	Our major competitor has implemented SCM practices.
41.			CP3	Our major trading partner has implemented SCM practices.
42.			CP4	Our firm with SM practices is able to meet the increasing demands of the market.
43.		TP	*TP1*	*Item Dropped*
44.			TP2	Our trading partner knowledge and expertise id valuable to us.
45.			TP3	Our trading partners respect the confidentiality of the information they receive from our firm.
46.			*TP4*	*Item Dropped*
47.			TP5	Our firm DOES NOT have to closely supervise transactions with the trading partner.
48.	KC	--	KC1	Our firm has access to sufficient amount of SCM practices knowledge.
49.			KC2	Our firm has access to the feedback about the products.
50.			KC3	Our firm has convenient ordering system for our customers / suppliers for efficient inventory management.
51.			KC4	Our firm has regular communication with our customer / suppliers for effective financial management.
52.	SCMP	SSP	*SSP1*	*Item Dropped*
53.			SSP2	Our firm implements SCM because with it our firm wishes to strengthen relationship with our trading partners.
54.			SSP3	Our firm implements SCM because with it our firm believes that our relationship with trading partner is profitable.
55.			*SSP4*	*Item Dropped*
56.			*SSP5*	*Item Dropped*
57.		BFA	BFA1	Our firm believes that with SCM implementation our firm can handle non-standard orders.
58.			*BFA2*	*Item Dropped*
59.			*BFA3*	*Item Dropped*
60.			BFA4	Our firm believes that with SCM implementation our firm can rapidly adjust to production capacity in response to the change in customer demand.
61.			*BFA5*	*Item Dropped*
62.		SCKD	SCKD1	Our firm believes that with SCM implementation our firm can help exchange information with our suppliers.
63.			SCKD2	Our firm believes that with SCM implementation our firm can help maintain long-term partnerships.
64.			SCKD3	Our firm believes that with SCM implementation our firm can help provide stable procurement relationships.
65.			SCKD4	Our firm believes that with SCM implementation our firm can share market information among departments within the firm.
66.		SCPA	SCPA1	Our firm believes that with SCM applications help to have integrated inventory management system.

67.			SCPA2	Our firm believes that with SCM applications help to have integrated logistics support system.
68.			SCPA3	Our firm believes that with SCM applications help to have automated order refilling system.
69.			SCPA4	Our firm believes that with SCM applications help to have automated accounting system.
70.			SCPA5	Our firm believes that with SCM applications help to have integrated data sharing system.
71.			*SCPA6*	*Item Dropped*
72.	SCIPB	--	*SCIPB1*	*Item Dropped*
73.			SCIPB2	I believe SCM Practices helps provide short-order-to-delivery cycle times.
74.			SCIPB3	I believe SCM Practices helps provide high-customer-service levels.
75.			SCIPB4	I believe SCM Practices helps provide short-customer-response-time.
76.			SCIPB5	I believe SCM Practices helps provide quick response to the requirements of our firm's target markets.

Table – 5.26: Retained &Left over Items / Constructs after Statistical Measures / Tests

The statistical analysis revealed that the following points needs due consideration and attention so as to effectively manage the Supply Chain Management Practices across Industrial Units:

The units should understand the relevance of technology, such as, JIT, APS, CRM, etc., and its very relevance for competitive advantage; The analysis revealed that top management had been less aware and coordination among Supply Chain Management Practices and the implementation of SCM utilities Also, the managers were of the opinion that their firm's organizational culture did not supported decentralized structure as well as the firm's organizational culture did not evaluate the employees on team-basis most of the time.

The statistical measures further revealed that, there was an illusion among mangers that SCM did not have the ability to improve and create new SCM Practices in their firm's, or improves their market credibility; or facilitate their relationship with their trading partners; or improve their ability to explore market potential; or even enable them to make better business decisions; or decrease their SCM handling costs; or improves and facilitate collaboration across their supply chain; or even improve their ability to keep promises on deliveries and improves the overall business decision making model of their firm.

The measures further revealed that the managers were of the opinion that their firm did not face unpredictable quality of supplied products; neither did their firms faces fluctuating customer orders; nor does many other firms in our industry have implemented SCM practices. Furthermore, their firm and their trading partner had limited or no understanding of each other's requirements; nor their trading partners were willing to provideassistance to their firm whenever required. The analysis also revealed that their firm's did not implement SCM because with it their firm'sdid not wish to collaborate on the benefits obtained from its usage.Also it was highlighted that the firm's did not implement SCM because with it their firm and their trading partner did not wanted to share risks that occur in SCM.Also the managers responded that their firm's did not implement SCM because with it they were of the opinion that their firm will not have harmonious relationship with their trading partners.

The statistical analysis further revealed that the mangers were of the following opinion that, their firm's believes that with SCM implementation their firm cannot meet special customer requirements; or their firm's believes that with SCM implementation their firm cannot produce products with multiple features; and their firm's believed that with SCM implementation their firm cannot introduce new products quickly. Moreover, the mangers revealed in their responses that their firm's believes that with SCM applications will not help them to have synchronized production schedules; or these SCM Practices will in no way help filling orders on-time.

5.8 Casual Model and Hypothesis Framing / Testing

This section is in continuation to the previous section of data analysis. Shin and Collier (2000) stated that structural equation models decompose the empirical correlation or covariance among the variables to estimate the path coefficients. In order to provide the literature with a good causal model, the researcher first provides accepted measurement

models as validated in focuses on the assessment of structural model of the study (the set of dependent relationships linking the model constructs). Structural equation modelling (SEM) has wildly been used to study the complex interrelations among variables (Joreskog, 1977) in this study. The entire structural equation model was assessed with all valid responses collected and used in the analysis. Secondly, the final structural equation model with the substantial hypothesis about the relationships among the constructs has been presented. The testing principle for structural equation model is that the researcher states a model based on theoretical foundations as presented in the research methodology. If the discrepancy between those two models is small, the theoretical model is statistically well fit, and thus substantially meaningful (Zhang, 2001).

5.8.1 Structural Model for Hypotheses

The following two hypothesis have been framed for the study under reference:

H_1: Industrial Units considering SCM as a strategic choice for long term growth is positively correlated with their performance.

H_2: Financial flow and Inventory flow of Industrial Units become smooth as a consequence of improved supply chain relationship.

For the structural model for hypotheses (H_1, &H_2), the following dimensional constructs have been regarded as Independent Variables (Exogenous): Supply Chain Management Practices Perceived Benefits (SCIPB)and Knowledge Complementarily for Financial and Inventory Flow (KC); whereas Supply Chain Management Practices Implementation (SCMP) has been regarded as Dependent Variable (Endogenous). Endogenous latent variables are affected by exogenous variable in the model, either directly or indirectly.

Hypotheses	Relationship	Statement
H_1	SCIPB → SCMP	Industrial Units considering SCM as a strategic choice for long term growth is positively correlated with their performance.
H_2	SCMP → KC	Financial flow and Inventory flow of Industrial Units become smooth as a consequence of improved supply chain relationship.

Table – 5.27: Structural Model Relationships and Statements of the proposed Hypotheses

The model was tested using one-tail test, a t-value greater than 2.33 is significant at the level of 0.01; and a t-value greater than 1.65 is significant at 0.05; and a t-value of 1.28 is significant at the level of 0.10. The t-value is calculated from the estimates of the model, where t-value is given as model path estimate (parameter) divided by the standard error. The results for the proposed hypotheses and propositions are as given in Table-5.28.

Hypotheses	Relationship	Standardized Estimate	t-value	p-value	Significance (Yes/No)
H_1	SCIPB → SCMP	0.066	= (0.066/0.018) = 3.667	< 0.05	YES
H_2	KC → SCMP	0.067	= (0.067/0.018) = 3.722	< 0.05	YES

Table – 5.28: Result for the proposed Hypotheses and Propositions

5.7.4 Summary of the Objectives and Hypotheses Testing

The structural models developed using IBM® SPSS® AMOS™ 19.0 for testing the hypotheses and propositions have been represented in the figures (Fig 5.11 – 5.12) at the end of this section.

The objectives framed for the research work were systematically concluded with construct of two hypotheses. Moreover, mediation of Supply Chain Management Practices with respect to Perceived Benefits and Financial and Inventory flow across units was also examined.

Now we shall discuss the theoretical and practical implications of accepting / rejecting each of the hypotheses along with justifications for Objectives framed and concluded during the research work.

Objective-1:Understand the scope of Supply Chain Management &CKMPin Indian manufacturing industries.

> ***Outcome for Objective-1:***The CITC, EFA and CFA analysis revealed the constructs that are of importance as regards to the implementation and understanding of Indian manufacturing industries. Also, the statistical analysis revealed the parameters that needs to be concentrated upon so as to strengthen the overall successful implementation of SCM Practices across Indian manufacturing industries.

Objective-2: Present a comprehensive literature review to identify present stage of research and paradigms that are coming up.

> ***Outcome for Objective-2:***The literature review that was studies as a part of the research work provided a detailed structure of Supply Chain management Practices that are presently being adopted across industries in Indian and other countries of the world. The review also presented spot light on the issues that needs utmost concern as regard to Indian scenario. The review also helped understand and develop a platform to enable the research work gain a path for further scrutiny in the area of study.

Objective-3: Formulate a set of propositions for analysing the issues as a part of further research.

> ***Outcome for Objective-3:***The statistical outcomes revealed parameters that needs attention and as also the parameters that are presently being under-utilized as regards to implementation of Supply Chain Management. The parameters that needs further analysis as per the study under reference shall enable in further research of the area

under reference. The parameters of concern have been separately identified and presented in Tabular Form and marked as “Items Dropped”. These dropped items can be further analysed using descriptive and discriminant analyses for further research purpose.

Objective-4: To provide a common platform for the academicians as well as practitioners for optimized outcomes in the implementation of best practices across manufacturing industries in India.

Outcome for Objective-4:The Statistical Outcomes of the research work has helped formulate two hypotheses. The hypotheses so framed provides a valuable intake from the study under reference. The constructs correlations and covariances outcomes shall help the academicians as well as the industrialists to identify the concerns that need immediate attention. It would also help the duo to understand and execute the very relevance of CKMP. The models generated in the research work shall enable the academicians as well as the industrialists to execute and implement the best practices that could help them gain a competitive advantage in the market place.

***Objective*-5:**To develop a comprehensive and sustainable model for CKMP utilization across Indian industries.

Outcome for Objective-5:The research work presents a comprehensive and sustainable model for the study under reference. The model details all the constructs that have been used in the study under reference. However, a further research needs to be conducted to find the best suitable combination for the various paths shown in the comprehensive model.

The following hypotheses were framed and concluded:

Hypotheses (H_1):*Industrial Units considering SCM as a strategic choice for long term growth is positively correlated with their performance.*

This relationship is found to be significant with t-value = 3.667, but with a very weak relationship between the two constructs, which indicates that what benefits organizations perceive affect their implementation of SCM but not that to that extent which is expected. This result proved to be a thought provoking and could be understood as such: first, Industrial Units perception towards SCM change due to instability situations in which the Industrial Units operate as a whole. During the decision making stage when weighing the probability of adopting SCM, Industrial Units may have perceived many of the potential benefits that SCM can bring, such as facilitating business transactions, increasing understanding to business context, improved supplier relationships, smooth day-to-day activities, etc. However, after the organization has made investment to put up such a management system, they may find that SCM is not omnipotent as initially expected to solve all of their business problems, particularly during the initial implementation stage when the system is not stable and the employees are not familiar with SCM operations. It is natural when the organization has not fully taken advantage of the benefits of SCM, people do fell certain level of disappointment, which could be exaggerated in answering survey questions. A major reason for their adoption of SCM was the requirement from their major competitor or the funding agency for continuing doing business with. For these organizations, they were pushed to implement SCM (and not by their own choice), and tended to ignore many of the possible operational benefits from SCM. But as a whole, our results revealed that Industrial Units can regard SCM as one of the approaches to boost supply chain performance of their firms.

Hypotheses (H_2):*Financial flow and Inventory flow of Industrial Units become smooth as a consequence of improved supply chain relationship.*

This relationship was found to be significant with a weak relationship strength,also the results revealed the t-value as 3.722. From the results the researcher concluded that the internal functional integration and external integration with upstream suppliers and downstream customers are major issues in supply chain management (Hill and Scudder, 2002). As an inter-organizational system, SCM requires joint commitment from all those who are involved in the functioning of Industrial Units. The process of integrating SCM benefits and perceived benefits is also a relationship building process between actual benefits acquired and the overall efficiency of the SCM in the firm. The practical implication is that interested organization can view SCM adoption and implementation as an approach to facilitate supply chain integration. Management should seriously consider educating employees and encourage them to work as teams and collaborate across functional and organizational boundaries.

Proposition: The study was extended to further study if there existed coherence as regards to Perceived Benefits expected from Supply Chain Management Practices being adopted in the industrial units with regard to Knowledge Complementarity (information flow among vendors / suppliers, etc.).

The analysis revealed that though there existed a significant relationship between the Expected Benefits from the implementation of Supply Chain Management Practices in the Indian Industrial Units, however there was a gap for the overall implementation of Knowledge Sharing and Discrimination. The analysis revealed that though the industries were involved in the implementation of Supply Chain Management Practices within their domain and boundaries, however were quite hesitant in discriminating the information with their partners, which was resulting in mismatch and complete implementation of CKMP. The

analysis revealed that Knowledge Sharing, Acquisition, Extraction and Discrimination models needs to be exampled and promoted in the industrial units in general and the top management should be trained to understand the relevance of information and knowledge sharing for getting the optimum benefits of Supply Chain Management Practices for global and local competition.

The statistical analysis resulted in the estimate values as follows:

The Direct Effect between SCIPB and KC was found to be not-significant with Estimate=-0.046, S.E.=0.028 and p=0.103, thereby depicting that mediation effect was not possible between the direct and the indirect effect. It was also seen that the indirect relationship between SCIPB and SCMP was significant with Estimate=-0.064, S.E.=0.017, p=0.000 (<0.05), however the indirect effect relationship between SCMP and KC is not-significant with Estimate=0.014, S.E.=0.023, p=0.540. Hence, there existed no mediation effect for SCIPB-SCMP-KC.

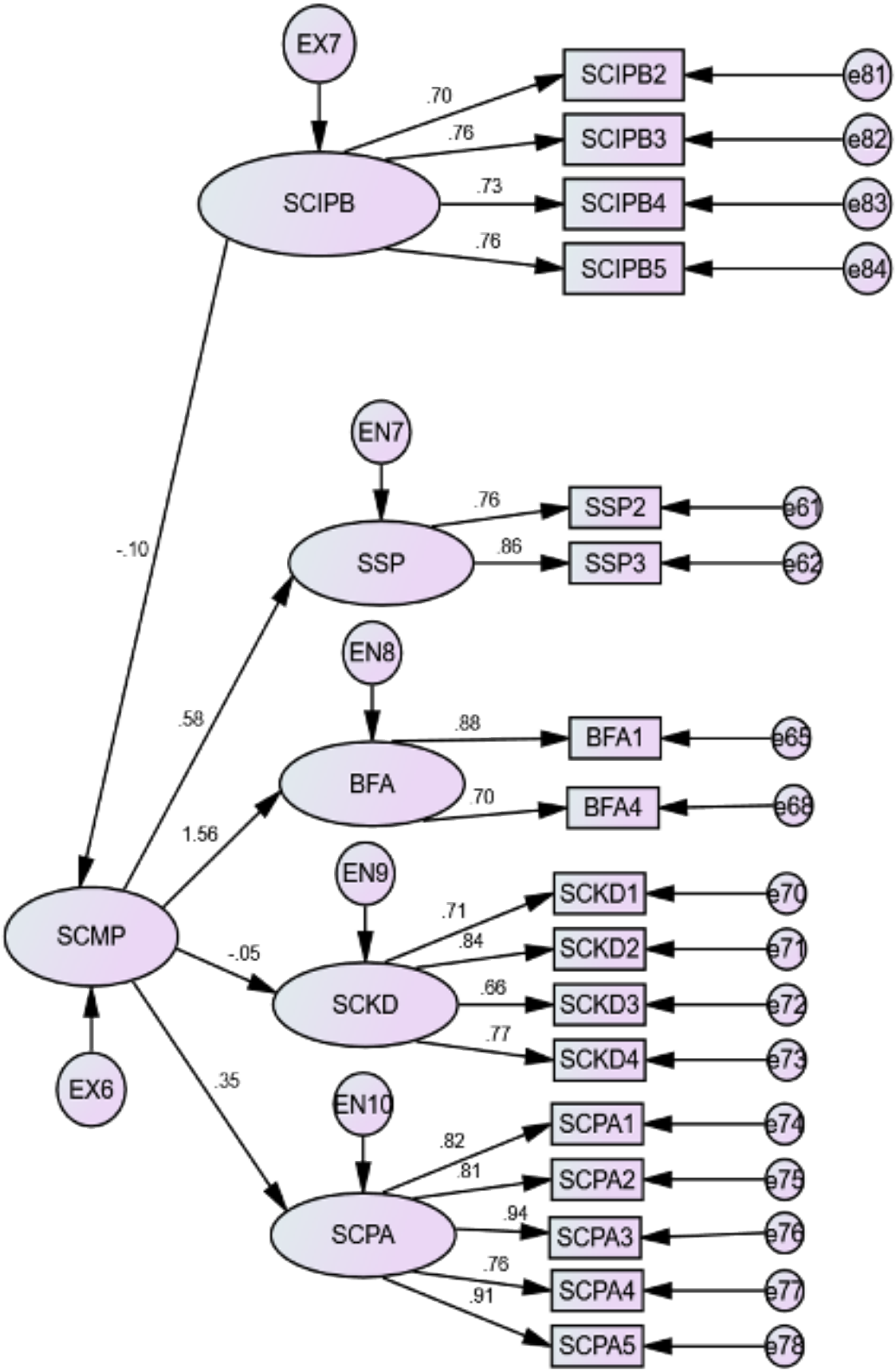


Figure – 5.11: Structural Model for testing Hypotheses – H_1

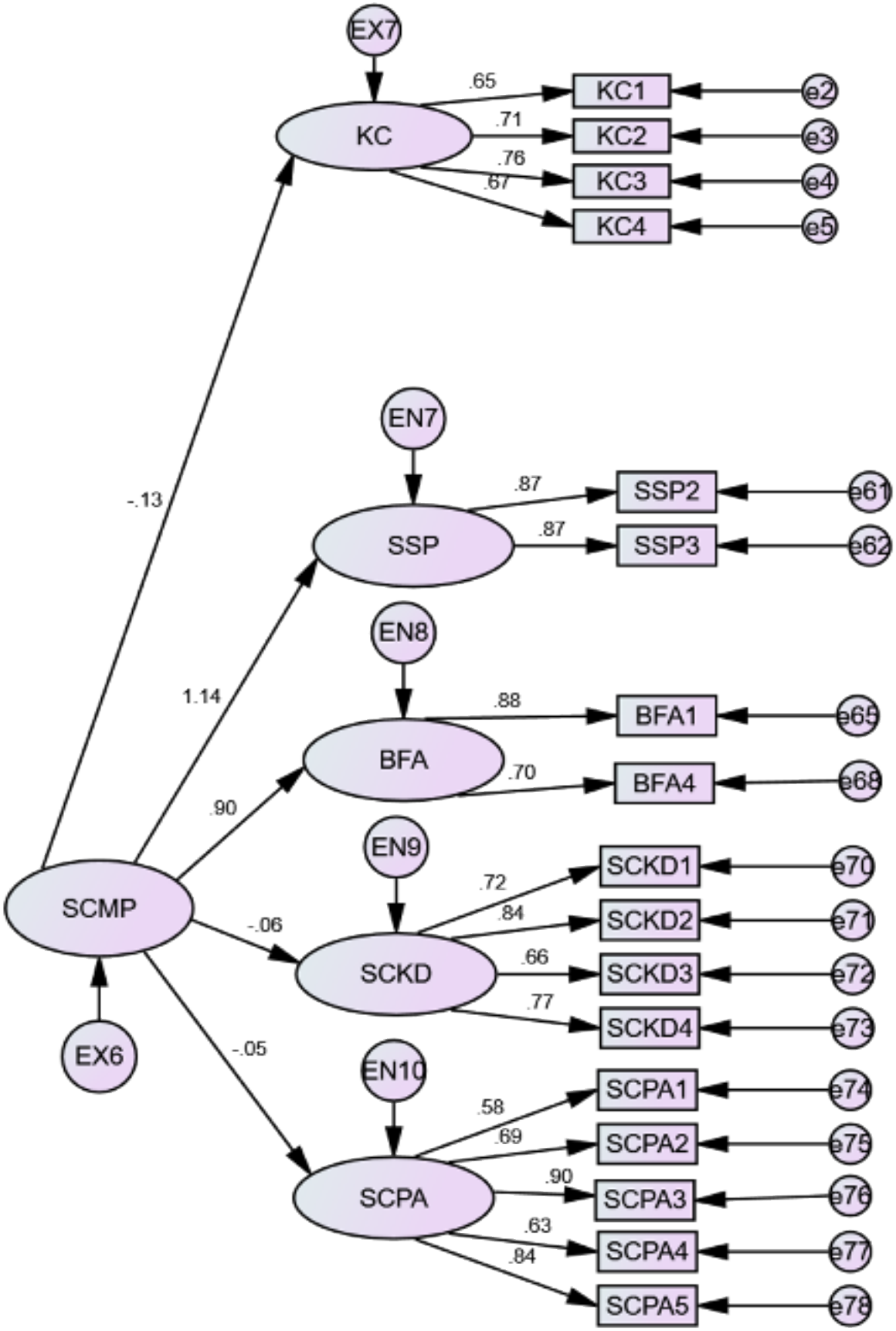


Figure – 5.12: Structural Model for testing Hypotheses – H_2

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Appendices

Covering Letter

Dear Participant,

I invite you to participate in a UGC Research Project entitled "Collaborative Knowledge Management Practices across North Indian States in Supply chain Management" I am a research fellow at Central University of Jammu and am in the process of writing research Paper. The Purpose of this Project is to find the Management Practices in supply chain management at various Industries across North India.

The enclosed questionnaire has been designed to collect information on various activities relating to supply chain management at Industries.

Your participation in this research project is completely voluntary. You may decline altogether, or leave blank any questions you don't wish to answer. There are no known risks to participation beyond those encountered in everyday life. Your responses will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective combined total. No one other than the researchers will know your individual answers to this questionnaire.

If you agree to participate in this project, please answer the questions on the questionnaire as best you can. It should take approximately 5 mins to complete. Please return the questionnaire as soon as possible in the enclosed business reply envelope. (OR give instructions as to what to do with the completed survey).

If you have any questions about this project, Please feel free to contact PRINCIPAL INVESTIGATOR (Dr. Gaurav Sehgal, HOD MBA SCM).

Thank you for your assistance in this important endeavour.

Appendices

APPENDIX
Questionnaire

PLEASE FILL IN THE FOLLOWING GENERAL INFORMATION ABOUT YOUR FIRM AND YOURSELF

1. **Which of the classification best describe your business?**

A. Food and beverage Products B. Pharmaceutical products C. Personal care products D. Cement, Paint Products E. Logistics F. Electronic and Electrical Equipment and Components G. Machinery and Computer Equipment and Components H. Others please specify_____

2. **Which best describe your principle Product?**

A. Manufacturing B. Service C. others Please Specify _____

3. **How long has your firm been in business?**

Specify Number of Years_____

4. **Include yourself, approximately how many people does your firm currently employee?**

Specify Number of Employees_____

5. **What is your position?**

A. CEO/President B. Director C. Marketing Manager
D. HR E. Sales Manager F. Others please specify _____

6. **The Years you have worked for this Company**

Specify Number of Years _____

7. **Please indicate number of tiers in your supply Chain**

Specify Number of tiers _____

8. **Annual Sales Turnover of your firm (year 2017) _____**

Appendices

Questionnaire for CKMP Adopters

The numbers used in the scale represent the strength or degree of your assessment, perception or opinion, as the case may be to the question items. The scales used in the study are as follows.

1	2	3	4	5
Very Low	Low	Medium	High	Very High

1. Please rate the extent of the availability and utilization of the following technological tools in your firm to support Knowledge collaboration with your trading partners.

		Very low	Low	Medium	High	Very High
		1	2	3	4	5
1	A system that provides communication support to groups of people that are engaged in common tasks or are sharing common resources, goals, values etc. For example: web conferencing, email, paging system					
2	A Computer based system that provides an interface to a shared environment to support the multiple users engaged in a common tasks (or goals) and have a critical need to interact closely with each other sharing information, exchanging request with each other and checking with each other on their status. For example: Groupware, wiki systems, XML/RSS feed					
3	A system that transforms knowledge into structured data controls the organization and storage of such data in knowledge databases. The purposes of the system is to support the structuring of knowledge database in a standard format and to provide tools for knowledge input, verification, storage and retrieval.					
4	A central gateway that enables knowledge users to search and access knowledge repositories through retrievals, query and other manipulations					
5	An interactive, flexible and adaptable computer based information systems, specifically developed for supporting the solution of a non structured management problem problem for improved decision making. It utilizes data, provides an easy-to-use interface, and allows for the decision makers own insights. For example: a system used by an engineering firm to analyze its bids on several projects and help the firm to decide if the bids are competitive with their costs.					

2. Please rate the extent of the support from your firm's top management to the adoption and implementation of CKMP

Top Management of our Firms		Very low	Low	Medium	High	Very High
		1	2	3	4	5
1	Is interested in sharing knowledge with our trading partners					
2	Consider sharing knowledge with our trading partners to be important					
3	Support CKMP with resources needed					
4	Regards CKMP as a high priority item					
5	Directly participates in sharing knowledge with others					

Appendices

3. Please rate the extent of the employees Collaboration and Shared Practices in your firm						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our Firms encourages employee learning					
2	Our Firms encourages teamwork for problem solving					
3	Our Firms encourages employee to help each other in their work					
4	Our Firms encourages employee on the basis of work team performance					
5	Our Firms has a decentralized organizational structure					

4. Please rate the extent of the employees freedom in creating and applying new knowledge to their work						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our Employees are active in generating innovative ideas about their work					
2	Our Employees are utilizing innovative ideas to their work					
3	Our firm encourages Employees to generate and apply new knowledge to their work					
4	Our Employees of all the level have the freedom to plan their own work					

5. Please rate the extent of your agreement with each of the following statements						
Our Firms believe that collaborating with trading partners for knowledge management will		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Improve our ability to create new supply chain knowledge					
2	Improve knowledge storage efficiency					
3	Improve our access to supply chain knowledge					
4	Facilitate knowledge transfer with our trading partners					
5	Enable us to make better business decisions					
6	Improve the overall quality of our firms supply chain knowledge					
7	Decrease our knowledge management cost					
8	Enhance the relationship with our trading partners					
9	Improve our ability to innovate					
10	Facilitate business transactions with our trading partners (i.e. simplified billing and delivery process and shorter order-to –delivery times)					
11	Improve our ability to handle exceptional business circumstances (i.e. nonstandard orders, employees strikes)					
12	Improve our firm's ability to adapt to environmental changes (i.e. changes in industrial trend or market conditions)					
13	Increase our understanding to business context (i.e. increase our knowledge of the external environment, competitors and trading partners)					

Appendices

6. Please rate the extent of your agreement with each statement about the COMPETITIVE PRESSURE your firm experiences for implementing CKMP						
Our firm is pushed to implement CKMP because		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Many other firms in our industry have implemented CKMP					
2	Our major competitors have implemented CKMP					
3	Our major trading partners have implemented CKMP					
4	Our trading partners give us incentives (or punishments) for implementing (or not implementing) CKMP					
7. Please rate the extent of your agreement with each statement about the ENVIRONMENTAL UNCERTAINTY your firm Experiences.						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our Customers needs are unpredictable					
2	Our Customer's orders fluctuate (i.e. in terms of quantity ,product features)					
3	Our Supplier's deliveries are unpredictable (i.e. in terms of delivery time, quantity)					
4	Our Suppliers product quality is unpredictable					
5	Competition is intense in our industry					
6	Our Competitor's actions are unpredictable					
7	Our firms faces international competition					
8	Product technology changes in our industry					
8. Please rate the extent of your agreement with each statement about the RELATIONSHIP between your firm's KNOWLEDGE and that of your trading partners						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our Firms and our trading partners possess different supply chain knowledge					
2	Our Employees understand our trading partners knowledge					
3	Exchanging knowledge with our trading partners is easy					
4	Our trading partners knowledge is valuable to our firms					
9. Please rate the extent of your agreement with each statement about your firm's TRUST's in your trading partners						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our trading partners have been open and honest in dealing with our firms					
2	Our trading partners respect the confidentially of the knowledge and information they receive from your firm					
3	Our firm does not have to closely supervise transactions with our trading partners					

Appendices

10. Please rate the extent of your agreement with each statement about your your trading partners COMMITMENT to the relationship with your firm						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our trading partners have made sacrifices for our firm in the past					
2	Our trading partners are willing to provide assistance to our firm					
3	Our trading partners abide by agreements that we have with them					
4	Our trading partners have invested a lot of resources in the relationship with our firm					
5	Our trading partners keep their promise to us					
11. Please rate the extent of your agreement with each statement about your firms and trading partners VISIONS on mutual relationship.						
Our Firms and our trading partners have a shared understanding about		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	The aim and objectives of the supply chain					
2	The importance of collaboration across the supply chain					
3	The ways to improve the supply chain					
12. Please rate the extent to which your firm collaborates with your trading partners for CREATING new supply chain knowledge						
Our firm and our trading partners collaborate		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our trading partners have made sacrifices for our firm in the past					
2	Our trading partners are willing to provide assistance to our firm					
3	Our trading partners abide by agreements that we have with them					
4	Our trading partners have invested a lot of resources in the relationship with our firm					
5	Our trading partners keep their promise to us					
13. Please rate the extent to which your firm collaborates with your trading partners for new supply chain STORAGE						
Our firm and our trading partners		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Maintains shared knowledge repositories/databases					
2	Utilize the same knowledge platforms for knowledge storage					
3	Collaborate for knowledge repository /database maintenance					
4	Coordinate about the type of knowledge stored in our knowledge repositories/databases					
5	Coordinate about the format of knowledge storage in our knowledge repositories/databases					

Appendices

14.Please rate the extent to which your firm collaborates with your trading partners for ACCESSING supply chain Knowledge						
Our firm and our trading partners		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Utilize the same technology platform's for accessing knowledge repositories/databases					
2	Have mutual agreements on accessing to each other's knowledge					
3	Have easy access to the desired knowledge					
4	Have fast access to the desired knowledge					
5	Have access to sufficient amount of knowledge					
15. Please rate the extent to which your firm collaborates with your trading partners for DISSEMENTING supply chain Knowledge						
Our firm collaborates with our trading partners to		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Provide training to our employee about our knowledge					
2	Publish newsletter etc. To disseminate knowledge					
3	Set up events (i.e. seminars, conferences and workshops) to facilitate knowledge dissemination					
4	Maintain references desk or help line to facilitate knowledge dissemination					
16. Please rate the extent to which your firm collaborates with your trading partners for APPLYING supply chain Knowledge						
Our firm coordinates with our trading partners for		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Making sourcing decisions					
2	Customers relationship management					
3	New product /process development					
4	Making logistics support arrangements					
5	Productions and inventory planning					
6	Facility capacity planning					
17. Please rate the extent to which your satisfaction from the supply chain Knowledge that you obtain from CKMP						
The Knowledge obtain from our knowledge management system is		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Free from error					
2	Complete and through					
3	Up-to-date					
4	Easy to understand					
5	Useful for its purpose					

Appendices

	18. Please rate the extent of integration between the FUNCTIONS of these supply chains (i.e. between shipping and inventory or purchasing and raw material management)					
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	The internal functions have automated data sharing systems					
2	These supply chains have integrated inventory management systems					
3	These supply chain have integrated logistics support systems (i.e. share-real time delivery and shipment status from multiplier suppliers)					
4	These supply chains synchronize productions schedules across organizational boundaries					
5	These supply chains support inter functional data sharing					
6	These supply chain have accounting systems that are integrated with purchasing					
7	These supply chain have automatic order refilling systems					

	19. Please rate the extent of integration of your firm with these SUPPLIERS					
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our firm exchanging information with these suppliers					
2	Our firm and these suppliers from long term partnerships					
3	These suppliers participate in our production planning processes					
4	These suppliers participate in our procurement process					
5	Our firm has an automated ordering system with these suppliers					
6	Our firms has a stable procurement relationship with these suppliers					

	20. Please rate the extent of integration of your firm with these CUSTOMERS					
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	These customers give us a feedback about our products					
2	Pour firm has a convenient ordering system for these customers					
3	These customers share market information with our firm					
4	These customers provide inputs for our production planning processes					
5	Our firm has regular communication with these customers					

Appendices

21.Please rate the extent of your agreement with the following statements about your SUPPLY CHAIN PARTNERSHIP						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our firm wishes to strengthen our relationship with these trading partners					
2	Our firm believes that our relationships with these trading partners					
3	Our firm and these trading partners share the risks that occur in the supply chain					
4	Our firm and these trading partners share benefits obtained from the knowledge collaboration					
5	Our firm has harmonious relationship with these trading partners					
22. Please rate the extent of your agreement with the following statements about SUPPLIER PERFORMANCES in these supply chain						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	These suppliers delivers materials to us on time					
2	These suppliers delivers materials to us in the quantities we order					
3	These suppliers deliver materials to us in the sequences we order					
4	These suppliers provides high quality materials to us					
5	These suppliers provide materials to us at reasonable costs					
6	The number of our suppliers have reduced over the past three years					
23. Please rate the extent of your agreement with the following statements about FLEXIBILITY of these supply chain						
These supply chains are able to		**Very low**	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Handle non standard orders					
2	Meet specials customers requirements					
3	Produce products with these multiple features (e.g. options, sizes and colour)					
4	Rapidly adjust production capacity in response to changes in customer demand					
5	Introduce new products quickly					
6	Respond to the requirements of our firm's target markets					
24. Please rate the extent of your agreement with the following statements about CUSTOMER RESPONSIVENESS of these supply chain						
		Very low	**Low**	**Medium**	**High**	**Very High**
		1	2	3	4	5
1	Our firm fills customer orders on time					
2	Our firm has a short order-to- delivery cycle time					
3	Our firm has high customer service levels					
4	Our firm has a short customer response time					

Appendices

KNOWLEDGE MANAGEMENT QUESTIONNARIE

Instruction: Please complete this form by providing score from 1 to 5 according to these definitions below.

1	2	3	4	5
Doing Very Poorly or Doing None at All	Doing Poorly	Doing Adequately	Doing Good	Doing Very Good

KM LEADERSHIP						
		1	2	3	4	5
1	The organization has shared Knowledge, Vision, and Strategy strongly Linked to the organization's vision, mission, and goals.					
2	Organizational arrangements have been undertaken to formalize KM initiatives (i.e., a central coordinating unit for knowledge/information management, Chief Knowledge/Information Officer, ICT team, quality improvement teams/Communities of Practice, knowledge networks).					
3	Financial resources are allocated for KM initiatives					
4	The organization has a policy for safeguarding knowledge (i.e., Copyrights, patents, KM, and knowledge security).					
5	Managers role-model the values of knowledge sharing and collaborative Working. They spend more time disseminating information to their staff and facilitating the horizontal flow of information between their staff and with staff of other departments/divisions/units.					
6	Management promotes, recognizes, and rewards performance improvement, organizational and employee learning, sharing of knowledge, and knowledge creation and innovation.					
KM PROCESS						
		1	2	3	4	5
7	The organization determines its core competencies (strategically important capabilities that provide a competitive advantage) and aligns it to their mission and strategic goals.					
8	The organization designs its work systems and key processes to create value to customers and achieve performance excellence					
9	New technology, knowledge shared in the organization, flexibility, efficiency, and effectiveness are factored into the design of processes.					
10	The organization has a policy for safeguarding knowledge (i.e., Copyrights, patents, KM, and knowledge security).					
11	The organization implements and manages its key work processes to ensure that customer requirements are met and business results are sustained					
12	The organization continually evaluates and improves its work processes to achieve better performance, to reduce variations, to improve products and services, and to be updated with the latest in business trends, developments, and directions.					

Appendices

KM PEOPLE						
		1	2	3	4	5
13.	The organization's education, training, and career development program builds employee knowledge, skills, and capabilities, supports achievement of overall objectives, and contributes to high performance.					
14	The organization has a systematic induction process for new staff that includes familiarity with KM and its benefits, the KM system, and KM tools					
15	The organization has formal mentoring, coaching, and tutoring processes					
16	The organization has a database of staff competencies					
17	Employees are organized into small teams/groups (i.e., quality circles, work improvement teams, cross-functional teams, communities of practice) to respond to workplace problems/concerns.					
KM TECHNOLOGY						
		1	2	3	4	5
18	Management has established an IT infrastructure (i.e., Internet, intranet, and website) and has developed capabilities to facilitate effective KM.					
19	The IT infrastructure is aligned to the organization's KM strategy.					
20	Everyone has access to a computer					
21	Everyone has access to the Internet/intranet and an email address					
22	Information delivered in the website/intranet is updated on a regular basis					
23	Intranet (or a similar network) is used as a major source of organization-wide communication to support knowledge transfer or information sharing					
KNOWLEDGE PROCESSES						
		1	2	3	4	5
24	The organization has systematic processes for identifying, creating, storing, sharing, and applying knowledge .					
25	The organization maintains a knowledge inventory that identifies and locates knowledge assets or resources throughout the organization					
26	Knowledge accrued from completed tasks or projects is documented and shared					
27	Critical knowledge from employees leaving the organization is retained					
28	The organization shares best practices and lessons learned across the organization so that there is no constant re-inventing of the wheel or work duplications					
29	Benchmarking activities are conducted inside and outside the organization, the results of which are used to improve					

	organizational performance and create new knowledge					

LEARNING AND INNOVATION						
		1	2	3	4	5
30	The organization articulates and continually reinforces the values of learning and innovation.					
31	The organization regards risk taking or committing mistakes as learning opportunities, so long as they are not performed repeatedly					
32	Cross-functional teams are organized to tackle problems/concerns that cut across the different units in the organization.					
33	People feel empowered and that their ideas and contributions are generally valued by the organization.					
34	Management is willing to try new tools and methods					
35	Individuals are given incentives to work together and share information					
KM OUTCOMES						
		1	2	3	4	5
36	The organization has a history (and maintains measures) of successfully Implementing KM and other change initiatives.					
37	Measures are in place for assessing the impact of knowledge Contributions and initiatives.					
38	The organization has achieved higher productivity through reduced cycle time, bigger cost savings, enhanced effectiveness, more efficient use of resources (including knowledge), improved decision-making, and Increased speed of innovation.					
39	The organization has increased its profitability as a result of Productivity, quality, and customer satisfaction improvements.					
40	The organization has improved the quality of its products and/or services as a result of applying knowledge to improve business processes or customer relationships					
41	The organization has sustained its growth as a result of higher Productivity, increased profitability, and better quality product and services.					