CHAPTER I
INTRODUCTION

The concept of Supply Chain-Logistics Management has grown in stature from a sales function, to a subject, to a domain, to discipline of study and further now into a cross-section of the economic activities comprising production and consumption that go in circularity. Elaborating the above view, it is also put as a, “network of facilities and distribution options that executes the functions of procurement of materials facilitating the transformation of raw materials into intermediaries, assisting the transformation intermediaries into finished products and performing the distribution of these intermediate or finished products to users/customers”. Although the complexity of the supply chains varies greatly based on the industry, supply chains exist across organizations and industries. Cooper and Ellram [1993] compared “supply chain management to a well-balanced and well-practiced relay team”.

1. Definitions of Supply Chain Management

Definitions of Supply Chain Management are diverse and evolve with time. Definitions determine the domain in a clear perspective. A few definitions are listed below for clarity. Supply Chain Management (SCM) is, “the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible”. Supply chain management spans over all movement and storage of raw materials, intermediate inventory, and finished goods from end-to-end-the point-of-origin to the point-of-consumption.

The Council of Supply Chain Management Professionals (CSCMP) sees that Supply Chain Management “encompasses the planning and management of all activities involved in sourcing, procurement, conversion and logistics management activities”. SCM also includes, “coordination and collaboration with channel partners, that could be suppliers, intermediaries, third-party service providers and/or end customers”. In essence, Supply
Chain-Logistics Management integrates supply and demand management within and across the involved entities of organizations.

According to Cohen & Lee (1988) Supply Chain Management is, “the network of organizations that have both upstream and downstream links and different processes and activities that produces and delivers the value in the form of products and services in the hands of ultimate consumer”. Thus a shirt (or sewing machine) manufacturer is a part of supply chain that extends upstream through the weaves of fabrics (or bobbin, binder, spindle/winder, stopper makers) to the spinners (or stitch width/length dial makers), to the manufacturers of fibers (or the presser foot or bobbin cover makers), down-stream through distributors and through retailers to the final consumer/user.

Stein and Voehl describe the Supply Chain Management as, “the systematic effort to provide integrated management to the Supply Value Chain in order to meet customer needs and expectations, from suppliers of raw materials through manufacturing and on to end customers”.

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As Cooper, Lambert, and Pagh note that Supply Chain Management is, “the integration of business processes from end user through original suppliers that provides products, services, and information that add value for customers”. “Supply chain management is not just another name for logistics. It includes elements that are not typically included in a definition of logistics, such as information systems integration and coordination of planning and control activities”.

Larson and Rogers merged various ideas on Supply Chain Management into the following definition: “Supply chain management is the coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit”.

Fig. 1.1 Evolution of SCM
Bowersox, Closs and Stank define Supply Chain Management as, “a collaborative-based strategy to link inter-organizational business operations to achieve a shared market opportunity”. SCM is generally considered to involve “integration, coordination and collaboration across organizations and throughout the supply chain”. The concept includes a broad array of activities needed to “plan, implement, control sourcing, manufacturing, and delivery processes (logistics) from the origin point of raw material to the point of ultimate consumption”.

1.1 Types of Supply Chains

Supply chains can be classified as: Supply chain of a single product, Supply chain of a product-line, Supply chain of a composite product and Supply chain as an operational loop. These are briefly dealt below

- **Supply chain of a Single Product**: Raw material is procured from vendors, transformed into finished goods in a single step and then transported to distribution centers, and ultimately, customers. Realistic supply chains have multiple end products with shared components, facilities and capacities.

- **Supply chain of a Product-line**: Supply chain of a product-line with multi-single-products is the case with many fast moving consumer goods, home appliances or industrial accessories/components manufactured by a single firm.

- **Supply chain of a Composite Product**: For composite products like cars/crafts, construction works, power stations or missiles the supply chain is highly complex with diverse limbs & nodes and sub-networks within and outside the firm forming part of the supply chain. Balancing each pair of limbs & nodes and sub-networks is a great task.

- **Supply chain - As an operational loop**: Supply chain, as an operational loop, starts with the customer and ends with the customer. All materials, finished products, information and even all transactions flow through the loop. In reality, the supply chain (in both service and manufacturing organizations) is a complex and dynamic network of facilities and organizations with different, conflicting objectives.
Management of supply chains is crucial to competitive edge, timeliness, value addition, cost reduction quality enhancement and total customer delight. Thus it amounts to a “calling for an integrated approach from within and outside the organization concerned”.

1.2 Integrated Supply Chain Management

Traditionally, various departments of an organization, such as marketing, distribution, planning, manufacturing, and the purchasing department operate independently. These intra-organization outfits have their own supply chain objectives and these are often conflicting. An integrated supply chain can reduce the overproduction of products by efficient demand management, planning and inventory management. Integration unites these intra-organizational units or functional domains. A holistic situation emerges in effect. Integrated supply chain is an integrating process in any economic set up. The integration ensures positive synergism with diverse manifestation.

Usually, manufacturing operations are designed to concentrate on the production output and least consideration is given to inventory or distribution levels. Signed contracts have no correlation to the past data or purchase pattern adopted by the market in operations. This indicates the need for a definite mechanism for integration. Integrated Supply Chain Management does not stop here but extends beyond the walls of the firm to align with downstream or suppliers. Hence Supply chain management is a strategy through which such integration can be achieved.

An integrated supply chain management streamlines processes and increases profitability by delivering the right product to the right place, at the right time and at the lowest possible cost. Unlike commercial manufacturing supplies, supply planning is very dynamic and can often have last minute changes.

1.2.1 Stages of Integration in Supply Chain

Integrated supply chain emanates from a stage of total independence into a stage of total inter-dependence.
**Stage 1:** Complete functional independence where each enterprise function such as production or purchasing goes on in complete isolation from other functions. For instance, production function to optimize unit cost of manufacture by longer production goes on without calculating pile up of finished goods with costly implications for warehousing and working capital functions.

**Stage 2:** Companies recognize the need for limited combination between component functions such as distribution and inventory functions or purchasing and material control.

**Stage 3:** This is an extension of stage two and leads to establishment and implementation of end-to-end integration. A concept of linkage and coordination is achieved.

**Stage 4:** The linkage achieved in stage three is extended upstream to suppliers, co-stream within the organization and downstream to customers. It represents true supply chain integration. This concept is aka ‘co-managed inventory’ (CMI).

**1.2.2 Supply Chain Management Vis-a-Vis Vertical Integration**

Though supply chain management may appear to be similar to vertical integration, it is not. Vertical integration normally implies ownership of down-stream customers/users and upstream suppliers, so that ‘demand and supply’ stocks are stacked.

Vertical integration is a diversification strategy, but as companies increasingly focus on their ‘core businesses’, many functions are ‘out-sourced’ i.e. procured from outside. On the other hand, Supply chain is a chain-link of stakeholder firms/service providers/component suppliers/ intermediate, ultimate consumers/users, from inside and outside and irrespective of vertical or horizontal ownerships.

One definite outcome in this constantly changing business world is that organizations can no longer compete solely as individual entities. Increasingly, they need to rely on effective supply chains, networks, and networked economy to successfully compete in the global market (Baziotopoulos, 2004). Peter Drucker’s (1998) Management’s New Paradigms, emphasizes this concept of business relationships extending beyond traditional enterprise boundaries seeking to organize entire business processes throughout a value chain of multiple companies.
From 1980’s to 2000, globalization, outsourcing and information technology have enabled many organizations like Dell and Hewlett Packard, to successfully operate solid collaborative supply networks in which each specialized business partner focuses on only key strategic activities (Scott, 1993). This inter-organizational supply network can be acknowledged as a new form of organization. However, with the complicated interactions amongst the players, the network structure neither fits “market” nor “hierarchy” categories (Powell, 1990). From a system’s point of view, a complex network structure can be decomposed into individual component firms (Zhang and Dilts, 2004).

Changes in business environment of the 21st century have also contributed to the development of supply chain networks. Globalization and proliferation of multi-national companies, joint ventures, strategic alliances and business partnerships were found to be significant success factors, following the footsteps of “Just-In-Time”, “Lean Management” and “Agile Manufacturing” practices (MacDuffie and Helper, 1997; Monden, 1993; Womack and Jones, 1996; Gunasekaran, 1999). The fall in prices of ICT components has also led to changes in supply chain networks (Coase, 1998).

Many researchers have recognized these kinds of supply network structure as a new organization form, using terms such as “Keiretsu”, “Extended Enterprise”, “Virtual Corporation”, Global Production Network”, and “Next Generation Manufacturing System” (Drucker, 1998; Tapscott, 1996; Dilts, 1999). In general, such terms can be defined as “a group of semi-independent organizations, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration” (Akkermans, 2001).

1.3 Traditional SCM

Many manufacturing operations are designed to maximize throughput and lower the costs with little consideration for the impact on inventory levels and distribution capabilities. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is not a single, integrated plan for the organization---there were as many plans as businesses. Clearly, there is a need for a
mechanism through which these different functions can be integrated together. Supply chain management is a strategy through which such integration can be achieved.

Moreover, shortened product life cycles, increased competition, and heightened expectations of customers have forced many leading edge companies to move from physical logistic management towards more advanced supply chain management. Additionally, in recent years it has become clear that many companies plan to reduce their manufacturing costs as much as it is practically possible and supply chain management is the best solution to achieve the same. In addition to cost reduction, the supply chain management facilitates customer service, with scientific management of:

- Inventories
- Transportation systems
- Whole distribution networks so that organizations are able to meet or even exceed their customers' expectations.

The major objective of supply chain management is to reduce or eliminate the buffers of inventory that exists between originations through the sharing of information on demand and current stock levels. Broadly, an organization needs an efficient and proper supply chain management system to fulfill certain strategic/competitive plans.

To ensure the availability of right quantity of parts for production or products for sale, companies need to invest on efficient communication system to ensure orders are placed with the needed amount of time for completing the order. Supply chain management systems help companies to constantly see what is on stock and making sure that the right quantities are ordered to replace stock. Logistics enables a firm to have constant contact with its distribution team, which can consist of trucks, trains, or any other mode of transportation. It allows the firm to track the required materials and suggest cost effective solutions for the firm.

1.4 Logistics

Logistics has been an important part of every economy and every business entity with a cost average of about 12% of the World’s GDP. The worldwide trend in globalization has led many companies to outsource their logistics function to Third Party Logistics (3PL)
companies, so as to focus on their core competencies. It is moving in two directions namely Increase in the number of buyers of logistics services and Increase in the extent of usage of logistics services. The use of third party logistics service providers has gained prominence in this context. Specific logistics services such as warehouse management, shipment consolidation, fleet management, order fulfillment, product returns, carrier selection, logistics information systems, rate negotiation, product assembly, order processing, inventory replenishment, order picking, inbound transportation, outbound transportation, labeling and packaging, distribution, custom clearance and forwarding, import export management, customer service/support are outsourced. By understanding the reasons for outsourcing of logistics services, 3PL service providers can gain insight into the benefits sought and provide focused service. Thus an optimal network consists of:

- Optimal number of warehouses and Distribution Centers (DCs)
- Location of these warehouses and DCs
- Service areas of each warehouse and DC
- Routings of the goods (e.g. direct shipping or via consolidation)
- Type and amount of inventory to be stored at each location
- Allocation of production plants to warehouses and DCs

Previous studies have indicated that firms outsource logistics functions for a variety of reasons. Watson and Pitt (1989), Sheffi (1990), Foster and Muller (1990), and Bardi and Tracey (1991) suggested ways improve logistics outsourcing as listed below:

- Need to focus on core activities
- Better transportation solutions (e.g., consolidation)
- Cost savings
- Customized services
- Reducing inventory
- Gaining the use of sophisticated technology
Logistics planning attempts to take decision at three different levels, namely strategic, tactical and operational. Their planning, strategy, tactical levels and operations in weeks and days differentiate the levels. Logistics network configuration is concerned with designing the optimal network to satisfy service, warehousing and consolidating Information Flow – order processing, information sharing, IT systems integration, Internet and Relationship Management – performance measures and contract design

1.5 Sales & Distribution

Supply chain plays a major role in manufacturing flexibility and ensuring availability of goods and services by enabling the methodology to respond to unforeseen changes in demand and supply. A firm then, has the ability to produce goods at lower prices and distribute them to consumers quicker than companies without supply chain management thus increasing the overall profit.

As firms strive to focus on core competencies and become more more agile and flexible, they have reduced their ownership of sources of raw materials and distribution channels. These functions are progressively getting outsourced to other firms that can perform better and/or in a more cost effective manner. The effect has been to increase the number of companies involved in satisfying consumer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain-logistics management concepts. The purpose of SCM is improving trust and collaboration with supply chain partners, improving inventory visibility and velocity.

Several models have been proposed on activities required for managing material movements across organizational and functional boundaries. SCOR is a supply chain management model promoted by Supply-Chain Council. Another model is the SCM Model, proposed by Global Supply Chain Forum (GSCF). Supply chain activities can be grouped into strategic, tactical, and operational levels of activities.
• **Strategic:** Strategic network optimization includes location, size of warehouses, distribution centers and facilities. This further extends to suppliers, customers, communication channels for critical information used for decision making, shipping and third party logistics

• **Tactical:** Sourcing contracts and other purchasing decisions required for production including contracting, location scheduling, and planning process for quality of inventory.

• **Operational:** Daily production and distribution planning includes all nodes in the supply chain against production scheduling for each manufacturing facility in the supply chain. In addition to this, demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers, production operations, including the consumption of materials and flow of finished goods and outbound operations, including all fulfillment activities and transportation to customers.

1.6 **Industry overview**

There is an overall need for prevention of overproduction, supply demand setbacks, customer dissatisfaction and price rises. This clearly indicates the need for an integrated supply chain management and further leads to the implementation of applications that would help industries achieve the required result. The activities include the flow of information, materials and finances between different stages of a supply chain from suppliers to customers. When different stages of the supply chain plan locally without sharing information, the result is the “bullwhip effect”, whereby small fluctuations in consumer demand lead to larger fluctuations for the manufacturer and supplier. In some supply chains, orders to suppliers can fluctuate 10 to 20 times more than orders placed by the ultimate customer. The increased variability leads to long supply lead times, excess capacity, high transportation and warehousing costs, large inventories and dissatisfied customers.

B2B e-commerce can create value in a supply chain at two levels. It can increase visibility across the supply chain, while Internet can dampen the “bullwhip effect”. The resulting decrease in variability allows a supply chain to improve customer service while reducing
costs. Internet can also add value from increased collaborations. Collaboration is the ability of different stages of the supply chain to make decisions on product design, introductory pricing, production and distribution with participation from partners.

Emergence of integrated supply chain management has helped companies recognize the need for integration between adjacent functions like distribution, inventory management, production and customer feedback. This leads to the implementation of end-to-end integration. Everything is ‘out-sourced’ i.e. procured from outside the firm. This indicates the need for a supply chain solution.

**Location Decisions:** Geographically distributed production facilities, stocking points, and sourcing points are the very first step in creating a supply chain. The location of facilities determines the path of product flow and involves a commitment of resources to a long-term plan. These decisions are of great significance to a firm since they have a considerable impact on revenue, cost, and level of service by an optimization routine that considers production costs, taxes, duties and duty drawback, tariffs, distribution costs, production limitations, etc.

**Production Decisions:** Product types, plant area, choice of supplier distribution network are the key drivers for the choice of a production plant. These decisions help in determining the exact path(s) through which a product flows to and from these facilities. Another critical issue is the capacity of the manufacturing facilities, which largely depends on the degree of vertical integration within the firm.

These decisions include the construction of the master production schedules, scheduling production on machines, and equipment maintenance. Other considerations include workload balancing, and quality control measures at a production facility.

**Inventory Decisions:** Inventories exist at every stage of the supply chain as either raw material, in process between locations, semi-finished or finished goods. Their primary purpose is to act against any uncertainty that might exist in the supply chain. Since holding of inventories can cost anywhere between 20 to 40 percent of their value, their efficient
management is critical in supply chain operations. However, most researchers have approached the management of inventory from short-term perspective. These include deployment strategies (push versus pull), control policies; the determination of the optimal levels of order quantities and reorder points, and setting safety stock levels, at each stocking location.

**Transportation/Logistics Decisions:** Transportation modes are closely linked to inventory decisions. The best choice of a mode is often found calculating the cost of using a transport mode. This has the indirect cost of inventory associated with that mode. Though Air shipments may be fast, reliable and warrant lesser safety stocks, they are expensive. Shipping by sea or rail may be much cheaper, but they necessitate holding relatively large amounts of inventory and have an inherent uncertainty associated with them. Since transportation accounts to more than 30 percent of the logistics costs, operational efficiency makes a good economic sense. Shipment sizes, routing and scheduling of equipment are keys to effective management of the firm's transport strategy.

### 1.7 SCM PROCESS INTEGRATION

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. The purchase department places orders as requirements became appropriate and marketing, responds to customer demand, interfaces with distributors and retailers and attempts to satisfy this demand. Shared information between supply chain partners can only be fully leveraged through process integration. Process integration means collaborative working between buyers and suppliers, joint product development, common systems and shared information. According to Lambert and Cooper (2000), operating an integrated supply chain needs real-time information flows, which in turn achieves the best product flows. But, in many firms, management is concluding on optimizing product flows, which cannot be accomplished without
implementing a robust process approach to the business. The key critical supply chain business processes stated by Lambert and Cooper are as follows:

- **Procurement process**: Strategic plans are designed with suppliers to support the production flow and development of new products. In firms where operations extend globally, sourcing is managed on a global basis. This also leads to development of rapid information-communication systems including EDI and Internet linkages to faster transfer of possible requirements. Activities related to sourcing of products and materials from outside suppliers such as “planning, supply sourcing, negotiation, order placement, inbound transportation, storage and handling and quality assurance” needs a complete supply chain plan

- **Customer service management process**: Customer service renders the source of customer information, instant information on promising dates and product availability through interfaces with the production and distribution operations of the firm. This also helps in closing the loop through a proper feedback channel

- **Product development and commercialization**: Design conception to product delivery is the crucial phase for any product firm. Customers and suppliers in unison work with product development process. With latest technology in place “appropriate products must be developed and successfully launched at shorter time-schedules to remain competitive”. According to Lambert and Cooper, managers of the product development and commercialization process must: coordinate with customer relationship management to spot customer-articulated needs; choose materials as well as suppliers in conjunction with procurement, and up-gradation of production technology to manufacture and integrate into the best of supply chain flow

- **Manufacturing flow management process**: Manufacturing processes must be flexible and nimble to respond to market changes, and must oblige mass customization. Changes in the production flow process to lead to shorter cycle times, improved responsiveness and/or efficiency. Execution of SCM process across this operation assists in planning, scheduling and helping manufacturing operations, such as work-in-process storage,
handling, shipment, inventory at manufacturing sites and optimum flexibility in the coordination of all related activities inclusive of physical distribution operations.

• **Physical Distribution:** Point of sale (distribution channel or the customer) is the ultimate destination of a marketing channel. The availability of the product/service is utmost essential part of each channel participant. Physical distribution process enables providing time and space for customer service as an integral part of marketing. It links the marketing channel with its customers, viz., manufacturers, wholesalers, retailers and all.

• **Need for Outsourcing:** With implementation of coordinated SCM process, industry exhibits the need for sourcing out partners across various applications of SCM. This is not just outsourcing of material or component procurement, it includes outsourcing of services that customarily have been provided in-house. The logic is that the firm will increasingly focus on value chain activities where it has a distinctive competitive advantage and everything else get outsourced. “This movement has been particularly evident in logistics where the provision of transport, warehousing and inventory control is increasingly subcontracted to specialists or logistics partners”. These strategic decisions have be taken centrally while the monitoring and control of supplier performance and addressing day-to-day liaison and concerns with logistics partners managed locally.

• **Performance Measurement:** As logistics competency becomes critical factor in creating and maintaining distinct competitive advantage, logistics management becomes increasingly important, as the dividing line between profitable and unprofitable operations turns thinner. As Kearney Consultants (1985) noted firms engaging in comprehensive performance measurement realized improvements in overall productivity.
Thus internal measures are generally collected/analyzed by the firm comprising: Cost, Productivity measures, Asset measurement, Customer Service and Quality.

1.8 Emergence of IT enabled in SCM

Before the implementation of SCM software, the aspirations of supply chain software were limited to improving their ability to predict demand from customers and make their own supply chains run more smoothly. But the cheap, ubiquitous nature of the Internet, along with its simple, universally accepted communication standards have thrown things wide open. B2B explosion and the possibility of interconnectivity across various segments of the supply chain process optimize costs and opportunities for different industries. This has further led to intelligence sharing with their supply chain partners.

Supply chain visibility dominates the role of IT process and many players don't prefer to share their data. If this intelligence if formalized, supply and demand ration will be stabilized and retailers would have to pay less for their warehouses

1.8.1 SCM Software: Pre and Post Internet era

Before the Internet, the aspirations of supply chain software users were limited to improving their ability to predict demand from customers and make their own supply chains run more smoothly. But the Internet with its simple, universally accepted communication standards helped in connecting supply chains of your suppliers and customers in a single network that optimizes costs and opportunities for everyone involved.

Many SCM applications are reliant upon information stored in ERP software. Though theoretically information can be assembled from legacy systems, it can also be a nightmare to get that information flowing on a fast, reliable basis. ERP integrates information together in a single application, and SCM applications benefit from having a single major source for
up-to-date information. ERP’s cost led to the need for various SCM modules that could help firms to decide if these products meet their needs or if they need a more specialized system. Market handles lot of applications, which is very simple and automates a particular function of SCM. Most of these independent software’s are independent of the ERP applications and hence play a limited role in the need for integration and integrate information.

SCM automation is a complex task that extends beyond the capabilities of the corporate world. This process changes the way work is done across corporate world wherein only the largest and the powerful industrial houses would be able to survive. This also leads to the question as to whether industry can face this scenario and cope up with the changing trend in the ERP segment. This concern is primarily due to the consequences that the implementers face like Internal resistance to change, Issues in implementation and Lack of trained management. Further, the need for e-enabled SCM process gets priority due to the entry of global layers and the organizations fear of overseas low-priced competitors and the need for creation of new value for customers and at a preferred price. Other important factors that have been instrumental in kindling the need for SCM across the business system are:

- Balance volatile markets
- Fragmented niche market
- Technological innovations across product and process
- Shorter product life-cycles
- Increase in demand for tailor made or the need for ‘mass customization’
- Need for complete solutions by the customers
- Continuous change and high rate of competition in today’s business scenario

Organizations expect all the above-mentioned demands to be fulfilled at a lesser cost. This indicates the need for a new paradigm that can strategize and adapt to a large-scale unpredictable changes in the business environment. The best solution to this could be to re-engineer the organization structure to manage the supply chains and enable cross-functional teams for managing from source to final end market. There is now a great opportunity to start thinking of the supply chain as a value chain. Rather than accepting the conventional view that believes that all value-creating activities need to be conducted under the same
corporate roof, forward-looking organizations are taking a different view. Particularly as supply chains become global it will often make sense to move to a greater level of 'localization', i.e. the final finishing or configuration of the product being performed much closer to the point of demand.

Driven by e-commerce’s capabilities to empower clients, many companies are moving from the traditional "push" business model, where manufacturers, suppliers, distributors and marketers have most of the power, to a customer-driven "pull" model. This new business model is less product-centric and more directly focused on the individual consumer. To succeed in the business environment, companies have recognized that there is an ongoing shift in the balance of power in the commerce model, from suppliers to customers. Driven by e-commerce’s capabilities to empower clients, many companies are moving from the traditional "push" business model, where manufacturers, suppliers, distributors and marketers have most of the power, to a customer-driven "pull" model. This new business model is less product-centric and more directly focused on the individual consumer. To succeed in the business environment, companies have recognized that there is an ongoing shift in the balance of power in the commerce model, from suppliers to customers. E-commerce creates a much more efficient supply chain that benefits both customers and manufacturers. Companies can better serve customer needs, carry fewer inventories, and send products to market more quickly. Anything that simplifies the process of arranging transportation services will help build companies' business and enhance shareholder value. By making more information available about the commercial side of companies, businesses will make their web site a place where customers will not only get detailed information about the services the firm offers, but also where they can actually conduct business with the firm.

Effective supply chain management is the act of optimizing all activities throughout the supply chain, and it is the key to a competitive business advantage. Consequently, an organization’s ability to gain a competitive advantage is heavily dependent on coordination and collaboration with its supply chain partners. Yet, even today, a typical supply chain is too often a sequence of disconnected activities, both within and outside of the organization. To arrive at a remedy to this situation, it is important that an organization and its suppliers,
manufacturers, customers, and other third-party providers engage in joint strategic planning and operational execution with an eye to minimizing cost and maximizing value across the entire supply chain.

The philosophy of supply chain management (SCM) was founded on collaboration amongst supply chain partners Andraski, 1998; Stank, Keller, and Daugherty, 2001). Central to collaboration is the exchange of large amounts of information along the supply chain, including planning and operational data, real time information, and communication. Information is seen as the "glue" that holds together the business structures that allow supply chains to be agile in responding to competitive challenges (Child and Faulkener, 1998; Evans and Wurster, 1997). The backbone of the supply chain business structure is information technology (IT), which is used to acquire, process, and transmit information among supply chain partners for more effective decision-making. IT can be viewed as serving as an essential enabler of SCM activities (Mabert and Venkataramanan, 1998). Exponential growth of technological capability has provided numerous choices in IT applications geared toward improving functional integration, coordination, and decision-making. Selecting appropriate IT applications is a daunting task for managers given the wide array of rapidly changing and costly technologies, with often only anecdotal evidence of achievable performance measures. Decisions relative to adoption of specific IT applications need to consider alignment with the organization's competitive priorities (Grover and Malhotra, 1997; Huff and Beattie, 1985).

Organizational competitive priorities should drive the types of IT applications used, with the anticipation that they will directly lead to measurable benefits. Selection of proper IT applications should be based on a clear understanding of the business model and desired benefits Improvements in IT are significantly changing the role of logistics by breaking down organizational barriers and allowing information to flow freely between supply chain partners. As supply chain management and cycle time compression emerge as central strategies of logistics management, effective IT becomes necessary to support logistics processes (La Londe and Masters, 1994; Sheombar, 1992). Intermediate supply chain activities, such as distribution, are being reformulated to truly add value to the chain
(Benjamin and Wigand, 1995). These logistics activities, termed "supply chain" or "value chain," are enabled and supported by the use of IT (Lewis and Talalayevsky, 1997). A high level of IT capability has been shown to provide a clear competitive advantage and can be a differentiating factor in terms of firm performance (Earl, 1993; Kathuria, Anandarajan, and Igbaria, 1999). Bowersox and Daugherty (1987) identified information technology as one of the common factors associated with advanced logistics practices. Clinton and Closs (1997) used the Bowersox and Daugherty typology to relate firm practice to organizational strategy. The Clinton and Closs study confirms differences between strategies based on a number of factors, including information technology. An integrated IT system is identified as a key component of this framework. The highest-level runs within this framework operate seamlessly across boundaries due to IT capability that enables information to flow in real time. Specifically, the type of IT used largely determines the nature and quality of interactions the firm has with customers, suppliers, and trading partners. Some authors refer to IT as the firm's "digital nervous system" (Prahalad and Krishnan, 1999). However, while IT is a critical element of SCM, IT is not a source of value by itself Rather, the proper selection of IT supports and enhances the functioning of value-added processes.

The importance of aligning IT applications between characteristics of the application and the needs of the business has consistently been emphasized in the literature (Malone and Rockart, 1991; McFarlan, 1984; Thurwachter and Rich, 2000). Managers are often faced with the challenge of selecting appropriate IT applications and setting realistic expectations of performance measures. Exacerbating the difficulty of this process are rapid changes in technology, proliferation of software intended to improve SC functioning, and a plethora of self-proclaimed success stories (Hayes and Wheelwright, 1984; Tibey, 1999).

To remain competitive, companies are investing millions of dollars in technologies such as Enterprise Resource Planning (ERP) systems, network software, and IT solutions with e-business capabilities. Major advances in computer hardware, broadband technology, and software have made IT solutions possible, although expensive, for corporate-wide applications. Understanding profiles of companies aggressively using these technologies,
how these companies compete, the applications they use, and benefits they have achieved, is of high importance.

1.8.2 Acceptance of IT in SCM

Information technology can be defined as technology used to acquire, process, and transmit information for more effective decision making (Grover and Malhotra, 1997). A number of methods can be used to classify information technologies. One functional classification is provided by Barki, Rivard, and Talbot (1993) where IT is aggregated into six categories: transaction processing systems, decision support systems, inter-organizational systems, communication systems, storage and retrieval systems, and collaborative work systems. Kendall (1997) offers a simpler classification whereby IT is divided into production-oriented information technologies and coordination-oriented information technologies.

Similar to Kendall's classification, information technologies can be classified in two broad categories: operations-oriented information technologies and marketing-oriented information technologies. Operations-oriented information technologies are those that aid decision-making and enable tasks to be accomplished more efficiently, within and between organizations. Marketing-oriented information technologies are those that aid selling, advertising, promotion and negotiation.

“Each of the five major supply chain steps previously outlined composes dozens of specific tasks, many of which have their own specific software. Some vendors have assembled many of these different chunks of software together under a single roof, but no one has a complete package that is right for every firm”.

Applications that simply automate the logistics aspects of SCM are less dependent upon gathering information from around the firm, so they tend to be independent of the ERP decision. But chances are, you'll need to have these applications communicate with ERP in some fashion. It's important to pay attention to the software's ability to integrate with the Internet and with ERP applications because the Internet will drive demand for integrated
information. For example, if you want to build a private website for communicating with your customers and suppliers, you will want to pull information from ERP and supply chain applications together to present updated information about orders, payments, manufacturing status and delivery.

1.8.3 Issues in implementing IT across SCM process

Many local software vendors who had been offering their own specific software dominate software market. Some vendors have assembled many of these different chunks of software together under a single roof, but no one has a complete package that is right for every firm. Initially most of the established software players offered packages at an exorbitant price. While products from large ERP vendors like Sap’s Advanced Planner and Optimizer (APO) can perform many or all of these tasks, because each industry's supply chain has a unique set of challenges, many companies decide to go with targeted best of breed products instead, even if some integration is an inevitable consequence. There are some hurdles, which come in way while installing the SCM software’s in the organizations. They are:

- **Gaining trust from suppliers and partners**: Supply chain automation is uniquely difficult because its complexity extends beyond firm's walls. People in an organization will need to change the way they work along with suppliers. Only large manufacturers can force such radical changes in suppliers operations. Most companies sell to outsiders in the system. Moreover, goals in installing the system may be threatening to suppliers.

- **Internal resistance to change**: If selling supply chain systems is difficult on the outside, it isn't much easier inside. Operations people are accustomed to be dealing with phone calls; faxes and ideas scrawled on paper, and will most likely want to keep it that way. If people are convinced on using the software, they tend to work around it. Telephones and fax machines cannot be disconnected for supply chain software. There is a diabolical twist to the quest for supply chain software acceptance among employees. New supply chain systems process data as they are programmed to do, but the technology cannot absorb a firm's history and processes in the first few months after an implementation. Forecasters and planners need to understand that the first bits of
information they get from a system might need some tweaking. If they are not warned about the system's initial naiveté (simplicity), they will think it is useless.

1.9 Emergence of SCM

The underlying enabler of supply chain integration is the fast and timely exchange of information between supply chain partners. This information may take the form of transactional documents such as purchase orders, ship notices, and invoices, as well as planning-related documents like demand forecasts, production plans and inventory reports. It is this sharing and coordination of information and planning activities that can enable cost reduction, value enhancement, and the execution of advanced collaborative planning activities. In the past, the cost and complexity of executing electronic data interchange (EDI) transactions made this type of information exchange suitable for only the larger firms. The ubiquity of Internet-based communication tools now makes it possible for organizations of all sizes to exchange information. However, challenges still exist and being able to successfully deal with all the new technologies is one of these challenges. But now these challenges can be overcome and the opportunities become endless once companies are able to exchange information efficiently with their suppliers, customers, and partners. Applications like vendor managed inventory (VMI), collaborative planning, e-procurement, shipment tracking and tracing, electronic order management, and bill presentment and payment can be built upon a core data exchange platform, enabling companies to reap true cost reduction and service improvement within their organization. Previously, this lack of collaboration resulted in companies having to manually input transactional data.

The benefits of participating in public e-marketplaces require precise systems integration. Buyers, meanwhile, grappled with the lack of connectivity to their back-end systems. Though the systems were able to search multiple suppliers for the lowest prices on goods and services, for closing deals phone and/or fax were used to avoid paying e-market transaction fees. This is a flaw in the public business model.
The re-shaping the global business scenes and economic upheaval in the Far East, Latin America & China created a tidal wave of change in the competitive environment. Organizations that once felt insulated from overseas low-priced competitors now feel the need for creating new value for customers at a lower price. To meet the challenge of simultaneously reducing cost and enhancing customer value requires a radically different approach to the way the business responds to marketplace demand, one of the keys to success is the creation of an agile and responsive supply chain on a global scale. This sections section discusses the same below.

1.9.1 The Agile Supply Chain

There is now widespread recognition of the role that supply chain management can play in enabling organizations to compete in volatile markets. However, experience suggests that there are significant barriers both within the firm and between its upstream and downstream partners in achieving the required level of responsiveness across the chain as a whole. Continuous change is a phenomenon with which the supply chains have had to cope for some time. But due to high rate of competition in today’s market the logistics environment of the new millennium will have to contend with:

- Turbulent markets that change rapidly and unpredictably
- Highly fragmented 'niche' markets instead of mass markets
- Ever greater rates of technological innovation in products and processes
- Shorter product life-cycles
- Growing demand for tailored products - 'mass customization'
- The delivery of complete 'solutions' to customers, comprising products and services.

These challenges mean that a new operating paradigm is needed. The key factor is agility – that is rapid strategic and operative adaptation to large scale uncertainty and unpredictable changes in the business environment. Agility implies responsiveness from one end of the supply chain to the other. It focuses upon eliminating the barriers to quick response, be they organizational or technical.
How do global supply chains achieve agility? In a sense the very process of globalization has retarded agility. For example, many companies in their search for lower production costs have moved much of their manufacturing and assembly offshore and the main driver for such moves often being low labor costs. However, in this process, they run the risk of extending their lead-times significantly thus generating the need for more inventory in the pipeline. As a result their agility is reduced. Some organizations have actually sought to reverse this trend by bringing manufacturing back closer to their main markets - Dell Computer being a case in point. Other companies are using low cost sources of supply to manufacture products where there is a predictable demand and using more local, flexible facilities for producing less predictable, more volatile products.

To overcome the potential loss of agility through extended global supply chains, companies need to adopt a number of guiding principles.

1.9.2 Removing organizational barriers

Too many companies get stalled in their attempts to streamline their supply chains because of their out-molded organizational structures. It is not possible to even contemplate a seamless global pipeline if there are quasi-independent national subsidiaries making their own decisions on sourcing, distribution facilities and inventory. Similarly, it is still the case that for many businesses the functional ‘barons’ still wields significant power. As a result decisions are taken which are based on a narrow definition of 'optimization' - in other words the focus is on improving performance within a function without regard for its wider supply chain impact. Thus, factories are often designed and built to maximize the economies of scale rather than enhancing flexibility of response. In a global marketplace this tunnel vision can lead to a damaging loss of competitiveness. The solution can be re-engineering the organization structure so that supply chains are managed on a truly integral basis with cross-functional teams being given the responsibility for managing the pipeline from source to final market.
1.9.3 Make the supply chain the value chain

The idea that companies should focus on their core competencies is rapidly taking hold. As a result there is a greater willingness to out-source than was previously the case. This trend has been particularly observable in global corporations where there has been recognition that the complexity of managing a worldwide logistics chain requires specialist resources. There is now a great opportunity to start thinking of the supply chain as a value chain. Rather than accepting the conventional view that believes that all value-creating activities need to be conducted under the same corporate roof, forward-looking organizations are taking a different view. Particularly as supply chains become global it will often make sense to move to a greater level of 'localization', i.e. the final finishing or configuration of the product being performed much closer to the point of demand. To enable this to be achieved on a global basis, specialist third party logistics service providers have emerged who can now act as extensions of the firm's value chain. In structuring cost-effective and agile global supply chains the question of where in that chain the value creation should take place becomes crucial.

By working more closely with specialist providers, greater levels of customer value can often be achieved at less cost to the supply chain as a whole. Hewlett Packard has adopted this concept for many of its products such as the Desk Jet printer, even going to the lengths of re-designing it so that a generic semi-finished global version could be built centrally with localization being performed by regional partners.

1.9.4 Shift the de-coupling point

A major problem in all supply chains, but significantly worse for global business, is that they have little visibility of 'real' demand. Since global supply chains tend to be extended with multiple points of inventory between the place of production and the final market place, they tend to be forecast driven rather than demand driven. In other words decisions on production and distribution are based upon forecasts or orders. The point to which real demand penetrates upstream in a supply chain is termed the decoupling point. These
decoupling points also tend to dictate the form in which inventory is held. Thus demand penetrates right to the point of manufacture and inventory is probably held in the form of components or materials. In the lower example demand is only visible at the end of the chain; hence inventory will be in the form of finished product. Ideally, information from the marketplace should flow as far upstream and in as close to real time as possible. In this way all the parties in the supply chain work to the same information and reduce their dependency on the forecast. At the same time opportunities for postponing the final configuration of finished inventory should be investigated. The aim of the global supply chain should be to carry inventory in a generic form, i.e. standard semi-finished products awaiting final assembly or localization. Managing the global supply chain requires a level of agility and responsiveness several magnitudes greater than that required in the old model of 'local for local' manufacturing. Emphasis will increasingly have to be placed on creating a business model that recognizes that competitive advantage is created through the management of the supply chain as a single entity rather than through fragmented, locally-focused decision making units.

1.10 Allied concepts supporting the growth of technologically superior SCM

Current revolutions in SCM can be paralleled with the Internet of Things (IOT), which is changing business models, increasing output, and automating processes across manufacturing industries. Manufacturers who invested in IOT devices and solutions saw an increase in revenues. Smart Manufacturing is using IOT devices to improve the efficiency and productivity of manufacturing operations. Business Intelligence research expects current manufacturing of IOT devices to triple by 2020. Manufacturers are currently using IOT solutions to track assets in factories, consolidate control rooms, and increase analytics functionalities through predictive maintenance. Fuelled by prevailing devices and open wireless technologies like Bluetooth, radio frequency identification (RFID) and sensors, IOT is stepping out of its infancy. It is transforming static Internet, to a fully integrated Internet. Sensors have always been an integral part of factory setup for security, automation, climate control, etc. Sensors measuring critical water parameters are installed at important locations to ensure high supply quality and avoid accidental contamination.
The most notable is Radio Frequency Identification, or RFID. RFID tags are essentially barcodes on steroids. Whereas barcodes only identify the product, RFID tags can tell what the product is, where it has been, when it expires, whatever information someone wishes to program it with. RFID technology is going to generate mountains of data about the location of pallets, cases, cartons, totes and individual products in the supply chain. It's going to produce oceans of information about when and where merchandise is manufactured, picked, packed and shipped. It's going to create rivers of numbers telling retailers about the expiration dates of their perishable items-numbers that will have to be stored, transmitted in real-time and shared with warehouse management, inventory management, financial and other enterprise systems. In other words, it is going to have a really big impact. In current systems, 10 items on the shelf are compiled in an enterprise planning software system. With RFID, 10 items, their age, lot number, and expiration date and warehouse origin is known. In 1,000 people, RFID knows their names.

Radio frequency identification (RFID) can be broadly categorized as an 'e-tagging' technology. RFID enables passive object tagging and automatic data capture, using RF sensing as opposed to optical sensing in the case of barcodes. RFID is fast, reliable, and does not require physical sight or contact between reader/scanner eliminating the problems mentioned for barcodes. The range of sensing RFID tags from a reader varies from a few centimeters to a few meters, depending on the frequency and the type of tags (active or passive). The amount of data that can be stored inside RFID tag ranges from few bits to 1 MB for active tags. The main benefit of RFIDs is that, unlike barcodes, electronic readers can read RFID tags automatically. Imagine a truck carrying a container full of widgets entering a shipping terminal in China. If the container is equipped with an RFID tag, and the terminal has an RFID sensor network, that container's whereabouts can be automatically sent to Widget Co. without the truck ever slowing down. It has the potential to add a substantial amount of visibility into the extended supply chain. The benefits are divided into two parts namely Benefits to Organization and maximizing warehouse space.

- **Inventory Management:** Maintain a real-time view of tagged inventory as it flows through the supply chain; Track discrete movement of tagged inventory; Trigger
alerts around inventory movement based on business rules you construct; allowing just-in-time practices.

• **Maximizing warehouse space:** With the high costs associated with storage real estate, the goal is to maximize warehouse space. This will improve utilization without undermining the ease with which goods can be moved in and out.

• **Minimizing goods shrinkage:** Theft combined with imprecise inventory management can create a significant shortfall in actual versus expected goods available. Within the retail environment goods shrinkage is widely perceived to account for up to one per cent of stock, representing a significant dent in profit margin.

• **Benefits to Consumers:** Two major benefits are presented.
  
  o **Value Innovation in customer service:** Marks & Spencer, a British retailer, has just extended a trial in which tags are applied to suits, shirts and ties for men, allowing retailers to monitor and replenish stock levels with far more accuracy at the end of each day to make sure that every size, style and color remains in stock. Beyond improving efficiencies, the smart tags could help to drive sales. One example of improving customer service: a customer could take a tagged suit to a kiosk, which could then suggest a matching shirt and tie.

  o **Minimizing errors in delivery:** Misdirected deliveries or incorrect orders can immediately result in on-shelf out-of-stock situations leading to reduced sales and damaged customer relationships. Indeed, for organizations relying on the delivery of specific components to fulfill their own order schedule, such errors can have a serious impact on customer satisfaction.

RFID tags represent a significant step forward from traditional bar code technology and offer highly reliable data most notably, the US Department of Defense requires their suppliers to ship products with RFID tags from 2006 onwards. Therefore, the broad adoption of RFID is on its way. By 2010, RFID should be ubiquitous throughout industries. Right now the two biggest hurdles to widespread RFID adoption are the cost of building the infrastructure and the lack of agreed-upon industry standards. The Key SCM Future technologies are listed below

• EDI (for exchange for information across different players in the supply chain)
• Electronic payment protocols
• Internet auctions (for selecting suppliers, distributors, demand forecasting, etc.)
• Electronic Business Process Optimization
• E-logistics
• Continuous tracking of customer orders through the Internet
• Internet-based shared services manufacturing; etc.

Manufacturing Mobility paradigm grew with Apple’s radicalized modern world. Manufacturing mobility refers to ways a manufacturer can connect and improve. Top uses of mobility in manufacturing are in shipping and logistics. Employees are using mobility applications to improve workflows and new ways to connect with consumers. Fig. 1.2 depicts the Advantages of mobility in manufacturing.

![Fig 1.2 Advantages of mobility in manufacturing](image)

Manufacturers thus need to pay attention to mobility in manufacturing. Fig. 4 depicts the benefits of Mobility Manufacturing in multiple angles based on a report from VDCiResearch.

1.11 Importance of the Study

Supply chain plays a major role in tackling unforeseen changes in demand and supply, to bring flexibility in operation, which would lead to economies of scale in production. With increased focus on core competencies and process flexibility, industries are reducing their ownership of raw materials and channel commitments. These functions are increasingly being outsourced to other firms that may fail to perform the activities effectively. The
manufacturing segment has to prevent excess production and manage supply efficiency for improving the trust level of the supply chain partners and user base.

The Study’s importance rests on its focus on the important role played by e-enabled SCM / IT – Enabled SCM in Garment Industry and how it’s impact is on the whole business.

1.12 The Choice of Garment Industry

India has been a global player in the Indian textile and garment market. India is the world’s second largest exporter of textiles and clothing. With rising government focus and favorable policies, by 2021, Indian domestic textile and apparel industry is estimated to reach US$ 223 billion by 2021. India’s overall textile exports during FY 2015-16 stood at US$ 40 billion. Rising income levels are driving the organized retail market. Overall, in a textile industry, there are both organized and unorganized players in the market. There are two broader segments: handloom, handicrafts and other allied operations that are closely knitted to spinning, apparel and garment segment.

![Indian Textile Industry - Growth](image)

To achieve economies of scale, the garment segments apply modern techniques. With more than 40 million direct workers and million indirect beneficiaries, it is essential for garment industry to adapt to latest technologies improve efficiency. The complex ecosystem of the garment industry creates the need for an extensive distribution network. Fig 1.3 gives the interactive market and manufacturing ecosystem.
It is very clear from the above figure that the presence of complete textile value chain in the garment industry clearly indicates the need for Intensive/Extensive and Exclusive distribution process. Moreover, with major businesses focusing on the rising retails, technological support is a must to manage the entire supply chain process. This is one segment where intensive supply chain process and logistics needs are most important. With suppliers, manufacturing processes, retail business, export business and customers forming the garment industry ecosystem, it is very clear that SCM and Logistics have a role to play at all levels of business. Based on the need, each firm in the garment industry needs customization of SCM. There is no ‘One size fits all’ solution. Moreover, there has been no uniform technology adoption across garment industry. This gives a bigger scope to understand the technology adoption readiness and issues and how by adopting the new age e-enabled SCM will help the garment industry to compete globally.

1.13 Research Gaps

The purpose of this research is to continue in this field of study and solve real problems with e-enabled implementations, and eventually create analytical tools for these systems. System processes and data integration are necessary tools for supply chain management and prerequisite for implementing its process. Application for supply chain process modeling in analytical layer, which must interact with ERP, will cause to implementing standard
processes and supply chain collaboration. This research attempts on information transparency impact on enterprise business process, reduce operational costs. This research also aims to study the effects of ERP in supply chain decision-making, and ERP’s role in implementing standard supply chain processes and SCM collaboration. Research gaps were identified by the research through certain research reconnaissance measures followed, the extensive literature review done and also discussion with industry experts. Further, the researcher analyzed various literatures related to the mentioned trends and issues that are discussed in the introduction chapter. Based on the output, questions were planned.

1.14 Objectives of the Study

Shortened product life cycles, increased competition, and heightened expectations of customers have forced many leading edge companies to move from physical logistic management towards more advanced supply chain management. SCM includes purchases, marketing, distribution, planning and manufacturing where individual objectives might conflict. Many manufacturing operations are designed to maximize throughput and lower costs with little consideration for the impact on inventory levels and distribution capabilities. Hence a comprehensive study is basically a necessity when one embarks on a study of SCM and Logistics intertwined. The objectives must be focused, elaborate, intensive and extensive proving needed height, depth, breadth and pointed focus. Four objectives formulated for the study are as below:

The objectives of the study are as given below:

i. To examine the facets of e-procurement in garment industry in terms of the technology aspects of Supply Chain – Logistics Management, their features, the value chains, expectations upon benefits and challenges.

ii. To discuss the e-manufacturing aspect in garment industry in terms of the linked-in Supply Chain – Logistics Management Technologies like IoT, ERP, SCM Software, Big Data Analytics and related ones and the utilities and challenges.

iii. To elucidate the e-Customer Relations Management (CRM) facet in garment industry in terms of the Supply Chain – Logistics Management Technologies in e-CRM, the benefits and challenges and Industry responses there to.
iv. To study the e-Logistics as Supply Chain Component in garment industry, the
technology emergence and shades therein, the challenges, implementation aspects,
benefits and the industry disposition towards all the above and related factors.

1.15 Hypotheses of the study

The hypotheses of the study pertained to testing the tests of mean score of opinions on
different issues against hypothesized mean of 3.5 on the 5 point scale, test of difference
between means of two populations and testing of association or relationship.

1.16 Research Methodology

The research methodology adopted is hybrid. Mixing qualitative and quantitative facets of
research is beneficial when the topic is bit technology oriented, so that quality responses are
possible.

1.16.1 Qualitative Research

Qualitative research involved getting to the highest and depth of any issue/topic/problem
studied with information from the horse’s mouth. In-depth interview at several sittings with
selected willing experts in the field, composing of: The study is focused on extensive in-
depth qualitative primary data analysis from the owners/promoters, heads of each
department – Procurement, Manufacturing, Customer Relationship and Logistics divisions
of the Garment/ Garment connected IT firms, spread over months. This helped the
researcher to get into the core of the phenomena studied, the ambi of the issues and a
thorough understanding is enabled.

In-depth one-on-one interviews: Researcher chose to go for an In-depth interview, one-on-
one, technique as this session required more understanding and required expert opinions to
gather detailed information from similar service providers. An In-depth interview
methodology is often employed in situations when surveying business owners, high-level
executives, community and business leaders, key opinion influencers, technicians,
specialists, and other professionals about complex or highly sensitive topics happen. This
research methodology is also used as a technique for learning more about an industry’s specific characteristics and practices directly from those individuals who specialize in them.

**Process of in-depth interview:** The process for conducting an in-depth interview followed the same general process as for other research instruments:

- Identifying stakeholders who will be involved
- Identify information required and who will provide them
- List stakeholders to be interviewed

In this case, since the researcher made all the interviews personally, therefore, no set of guidelines were prepared in the form of interview protocol. But an interview guide was prepared to explore the issues to be discussed. Most of the questions were open ended and probing was done based on the allegations or comments that were received from the other set of target audience. All the in-depth interviews were conducted after taking a formal approval from the concerned person and fixing an appointment for the interview. In most of these cases, the researcher was not able to stick to the specific question guide that was prepared as the discussion topics widened based on the answers given by the target audience.

**Interview Coverage:** Though the key focus was on the respondent’s area of specialty, respondents understanding and knowledge on other allied departments & operations were also sought for and considered. In certain firms, the key person was responsible for multiple activities. Majority of respondents were first approached over telephone or in person, explained about the research and an appropriate timing was fixed. Based on that, on an average, each respondent would have been met at least twice to get better understanding and with more questions. Each time, depending on the respondent, an average of 45 minutes to one hour was spent with each respondent. In certain companies, the respondent was kind enough to take the researcher through the office; in such situations, more number of hours was spent and it helped to understand the process.
**Instrument used:** A discussion brief was framed to understand the market views of the channel players across the two short listed sectors. Before the discussion guide was framed, a detailed pilot survey was done with the experts in the field. They were consulted and based on their response; the final discussion brief was formed. The survey explored the perception of various channel communities across different industrial segments. This helped the researcher to discuss the pros and the pain points of the industry with the respondents. Responses were based on the researcher’s one to one discussion with the respondents.

**Discussion brief instead of a structured questionnaire:** With the kind of respondents short listed, it was quite difficult to get their responses from a structured questionnaire format. Also the market experience with these target audience had helped the researcher to go with a discussion brief rather than a structured questionnaire. These audiences need more informal talk rather than a disciplined plan of action. The questions were noted in the form of a discussion brief.

**Getting to the Respondents:** For this research most of the respondents across the category were the channel community and in some cases, the end users of the respective section. For the researcher, getting through the respondents for in-depth interview was totally a different experience! The database of these candidate respondents was collected through various sources; company database, internet search, word of mouth reference and observation during the research process. Selected names were validated before discussion was initiated. It was not easy for the researcher to collect data across the channel community. Lot of resistance was faced from this set of target candidate respondents. It took lot of efforts to convince them and required lot of explanation from the part of the researcher before they were ready to share details about their industry and discuss about various pros & cons of the IT enabled operation across different operations. In a few cases, a tentative note was mailed to the concerned person in advance so that he can be prepared for the interview. There were some interviews that were scheduled over the phone. Most of the respondents across this category were the IT experts of software firms that either sold direct ERP software or small time vendors who developed certain modules based on the local requirement of firms in that particular cluster. In many cases the researcher had to spend the whole day sitting with the channel partner to get data in a convinced form. Due care was taken to ensure that the
respondent did not lose his/her cool and was able to answer the researcher with correct information. Care was also taken to ensure that the respondent was not disturbed in their day to day activity. Post the discussion, many channel partners gave word of mouth reference to different players. Options were also available to discuss with the end user community who visited the channel partners. In this, special effort was taken to reach the different levels of channel partners. In most of the cases, special efforts were taken to talk to the last mile reseller about the need for sustained supply chain process.

Confidentiality: For the respondents who belonged to the top management, the researcher promised information security, when that was sought. In certain cases, the issues or comments were mentioned without quoting the name of the person and the company they represented. However, the respondents were confident of sharing their experience and comments for this research. Table 1.1 lists the sample respondents for in-depth interview.

The information obtained is presented as received in direct speech or converted into indirect speech. Further these are related with the quantitative research based data, if available.

1.16 Quantitative Research

Quantitative Research is widely used academic research. Again as knowledge of the industry is very much expected of the respondents of the survey falling under this category, selected 35/50 respondents were only contacted as deliberate sample respondents drawn from 30 plus number of firms mostly in garment and few from IT related.

Non-probability, purposive judgmental/snowball sampling: The second set of respondents included personnel from the distribution channels and end user community across different sectors. The researcher started to target this candidate respondents with the intention of following a non-probability, purposive judgmental sampling. During the course of the pilot study, it was observed that this segment of candidate respondents required, in addition to judgmental sampling, a different type of approach rather than sticking on the purposive judgmental sampling type.

Hence non-probability, snowball approach was also adopted based on leads from respondents chosen by judgment.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name (Mr./Ms./Er.)</th>
<th>Position, Institution &amp; Place</th>
<th>Issues on which views sought</th>
<th>No. of Sittings /Calls and hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sheshadiri</td>
<td>Best Apparels, Tirruppur</td>
<td>Use of technology</td>
<td>Twice, more than 45 minutes each time</td>
</tr>
<tr>
<td>2</td>
<td>Venkatraman</td>
<td>Senior Manager, Evolv Clothing</td>
<td>Gap between procurement &amp; Manufacturing floor</td>
<td>Because of vast experience &amp; interest, met multiple times &amp; when ever had doubt, reached out to him</td>
</tr>
<tr>
<td>3</td>
<td>Kannan</td>
<td>Production Supervisor, SKL Exports</td>
<td>Expectations from employees on new technologies</td>
<td>2-2.5 hours</td>
</tr>
<tr>
<td>4</td>
<td>Laksmanan</td>
<td>Logistics Manager, Dollar Apparels</td>
<td>Connectivity issues, technology support by 3PL/4PL logistics players</td>
<td>45 minutes</td>
</tr>
<tr>
<td>5</td>
<td>Chitra,</td>
<td>Purchase Head Dignity Innovations</td>
<td>OnPremise vs Cloud, technology penetration</td>
<td>2 times; 1 hour &amp; 45 minutes.</td>
</tr>
<tr>
<td>6</td>
<td>M.Govindaraj</td>
<td>Owner, BeyondEx Solutions</td>
<td>Overall technology roll &amp; new age technologies</td>
<td>Multiple times; more than 1 hour each time. Highly enterprising person</td>
</tr>
<tr>
<td>7</td>
<td>Vinitha</td>
<td>Marketing Head, Ramco Systems</td>
<td>Overall technology roll &amp; new age technologies</td>
<td>Easy access to her helped seeking lot more clarifications; met multiple times</td>
</tr>
<tr>
<td>8</td>
<td>Raju</td>
<td>MD, Zoho CRM</td>
<td>CRM for other departments</td>
<td>Met Raju once and his colleagues multiple times. More than 5-6 hours would have been spent</td>
</tr>
<tr>
<td>9</td>
<td>Balaji</td>
<td>Evolv, Accessories division</td>
<td>Flow of accessories and quality issues</td>
<td>Met once for 40 minutes</td>
</tr>
<tr>
<td>10</td>
<td>Ragavendar</td>
<td>Consultant, Zipper, Lining &amp; Embroidery</td>
<td>Quality management and return of rejected goods and supply chain process</td>
<td>Met thrice and poke for more than 1 hour each time</td>
</tr>
</tbody>
</table>

**Source:** Primary Data

The major reason for choosing this type of research approach was the fact that the population was comparatively known to each other and was also scattered. Hence, the initial identified target audiences helped the researcher to identify the next potential target audience who also met the criteria of the research.
This particular sampling is the most prevalent method among the sales, where referrals to another similar audience will give a comfort level for the researcher to sit and discuss the research points.

**Structured Questionnaires:** Four structured questionnaires, one each for e-Procurement, e-Manufacturing, e-CRM and e-Logistics are used. These are given in Appendix A, b. c and D respectively. In the absence of secondary data the objectives of the research work are achieved by measuring the perceptions and experiences of SCM practitioners from industries/ organizations. The SCM constructs identified from the perspectives of the four major component domains of SCM are measured using scaling technique. The questionnaires have two parts each, first sought details on the Identification (personal/employment/industry affiliations, etc) aspects and the second on views on e-Procurement, or e-Manufacturing or e-CRM or on e-Logistics as the case may be.

Across each category, 50 respondents (35 for e-CRM) were served/e-served with the relevant questionnaire and filled in questionnaires received. The data are obtained as agreement/disagreement to opinion statements that are dealt with Likert Summated Scale analysis.

The questionnaire was finalized after two rounds of fine-tuning based on pre-survey testing. The final draft questionnaire was pilot tested and the Corn Bach Alpha worked out to 0.71 and as this was a satisfactory score, the questionnaire was found satisfactory and adopted. The survey method adopted in this work has been through personal calls /telephonic calls/e-mail. Those respondents who were approached through mail have completed the questionnaire and returned the mail.

**Table 1.2** gives a clear indication of the kind of research approach and type &number of respondents of the study.

**Research Design:** The study is descriptive as to qualitative part and inferential as to quantitative part. Mean tests and Chi-square tests were done, as these are only relevant. The research problems/phenomena identified have been addressed through a descriptive, conclusive and single cross-sectional research design.
Table 1.2  Kind of Research Approach and Type & Number of Respondents

<table>
<thead>
<tr>
<th>Type of Respondents</th>
<th>Qualitative Study</th>
<th>Quantitative Study</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners/Promoters of the Firms</td>
<td>Yes. In-depth one-on-one interview, Discussion made with research brief in hand. No aided research; free flow research</td>
<td>No</td>
<td>10</td>
</tr>
<tr>
<td>Consultants</td>
<td>Yes. In-depth one on interview, Discussion made with research brief in hand. No aided research; free flow research</td>
<td>No</td>
<td>5</td>
</tr>
<tr>
<td>Software Developers</td>
<td>Yes. In-depth one on interview, Discussion made with research brief in hand. No aided research; free flow research</td>
<td>No</td>
<td>10</td>
</tr>
<tr>
<td>Procurement Department Head/Executives</td>
<td>No.</td>
<td>Yes, through questionnaire; Liket scale</td>
<td>50</td>
</tr>
<tr>
<td>Manufacturing Department Head/Executives</td>
<td>No.</td>
<td>Yes, through questionnaire; Liket scale</td>
<td>50</td>
</tr>
<tr>
<td>Logistics Department Head/Executives/Consultants</td>
<td>No</td>
<td>Yes, through questionnaire; Liket scale</td>
<td>50</td>
</tr>
<tr>
<td>Customer Service Relationship Dept. Head/Executives</td>
<td>No</td>
<td>Yes, through questionnaire; Liket scale</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: Primary Data

1.17 Limitations of the Study and Course Corrections

The study is bit-technology oriented. The e-tools, e-technology, e-applications, e-formats, and all e-aspects of SC-LM (Supply Chain-Logistics Management) are covered. The e-domains are ever changing. The technology providers are at break-neck speed in launching new ones in the place accustomed ones (be it tech. or tools or apps.), making the users at tenterhooks all the time. Hence the quality of information obtained through the structured questionnaire through e-mails/phone calls/personal calls, despite the researcher’s eruditeness in selection of respondents is not free of shortcomings of the order of upto 10%.
Theoretically, this sample indicates a level of bias in this form of study as the people tend to associate with sample of similar mindset and selection characteristics.

To mitigate this due attention was given to the biased issue and the researcher ensured that each respondent was targeted not just for referrals, but gave their considered opinions free of any bias. Every respondent was briefed on the objective and accordingly referrals were made and the chain-referrals yielded the required results. Sophisticated tools of analysis or statistical tests are not used, partly because the research design depended on hybrid methodology.

The quantitative methodology involved samples of size 50 or less, not big enough for grandeur statistical tools and as no time series data are involved simpler tools of testing, mean test chi-square tests are adopted.

1.18 Chapters: The dissertation has 7 chapters as below.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter I</td>
<td>INTRODUCTION</td>
</tr>
<tr>
<td>Chapter II</td>
<td>REVIEW OF LITERATURE</td>
</tr>
<tr>
<td>Chapter III</td>
<td>e-PROCUREMENT IN GARMENT INDUSTRY</td>
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<tr>
<td>Chapter IV</td>
<td>e-MANUFACTURING IN GARMENT INDUSTRY</td>
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<td>Chapter V</td>
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<td>e-LOGISTICS IN GARMENT INDUSTRY</td>
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<td>Chapter VII</td>
<td>CONCLUSION</td>
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