GIFT

ROLE OF INFORMATION TECHNOLOGY (IT) IN SUPPLY CHAIN MANAGEMENT (SCM): A CASE OF PHARMACEUTICALS INDUSTRY OF BANGLADESH

DOCTOR OF PHILOSOPHY

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DEPARTMENT OF MANAGEMENT INFORMATION SYSTEMS (MIS)

FACULTY OF BUSINESS STUDIES

UNIVERSITY OF DHAKA

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Dedicated to:

My beloved parents Amir Hossain, Halima Hossain

and

My wife Rumana Islam & My daughter Raaida Zara Hossain

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March 02, 2013

CERTIFICATE

This is to certify that the thesis entitled **"Role of Information Technology (IT) in Supply Chain Management (SCM): A Case of Pharmaceuticals Industry of Bangladesh"** submitted by **Md. Akram Hossain** for the award of the degree of Doctor of Philosophy was done under my supervision and guidance. I certify that the work is original and has not been submitted for the award of any degree or diploma. The thesis represents entirely an independent work on the part of the candidate. No portion of thesis is a reproduction from any other source, published or unpublished without proper acknowledgement.

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DECLARATION

I do hereby declare that the thesis entitled **"Role of Information Technology (IT) in Supply Chain Management (SCM): A Case of Pharmaceuticals Industry of Bangladesh"** submitted to the University of Dhaka for the award of the degree of Doctor of Philosophy is my original work done under the guidance and supervision of **Dr. Md. Hasibur Rashid,** Professor of the Department of Management Information Systems (MIS), University of Dhaka. This work has not been submitted by me in any University or Institutions for the award of any degree or diploma.

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ROLE OF INFORMATION TECHNOLOGY (IT) IN SUPPLY CHAIN MANAGEMENT (SCM): A CASE OF PHARMACEUTICALS INDUSTRY OF BANGLADESH

Submitted by

MD. AKRAM HOSSAIN

For the degree of PhD of

the University of Dhaka

March, 2013

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ABSTRACT OF THE STUDY

A supply chain encompasses all the parties that involved, directly or indirectly, in fulfilling a customer request. Effective supply chain management is important to build and sustain competitive advantage in product and services of the firms. In the business environment, information technology (IT) plays an important role for firms' performance. It provides information flow which makes the supply chain more robust and resilient without undermining its efficiency. This research argues that Information technology can play a vital role in managing the different elements of Supply chain management (SCM) and as a result performance/benefit of supply chain will improve.

This study attempts to prove the impact of information technology (IT) in supply chain management (SCM). The criteria include the applications of IT to get the high firm performance comprising marketing performance, financial performance, and customer satisfaction.

Pharmaceutical sector is technologically the most developed manufacturing industries in Bangladesh and the third largest industry in terms of contribution to government's revenue. The industry contributes about 1% of the total GDP. There are about 250 licensed pharmaceutical manufacturers in the country; however, currently a little over 100 companies are in operation.

The aim of the research is to apply the IT based effective supply chain management in the Pharmaceuticals industry of Bangladesh. In this study choice of personal interview strategy for data collection was stated. Here, 30 executives from 3 pharmaceutical companies were successfully interviewed. The study coded and processed the data collected using a special data entry and analysis through SPSS package. The major statistical tools are included, among others, descriptive statistics and Cronbach's alpha test.

The study has evaluated the supply chain management of three pharmaceuticals companies –Beximco Pharmaceuticals Ltd, Incepta Pharmaceuticals Ltd and ACI Pharmaceuticals Ltd. The evidence, obtained from the field visits, was presented in details. On the basis of this evidence and observations, made during the field survey, the effectiveness of IT use in supply chain management was assessed. Analyses divulged that Incepta Pharmaceuticals Ltd has the most effective organization in implementing IT in supply chain management. Incepta uses SAP software in supply chain management and benefited in several ways such as minimize inventory cost, reduce reporting time, decision making faster and accountability is transparent. The second successful pharmaceutical company seems to be Beximco. Beximco employs customized software in supply chain management and benefited in few extent such as meet dead line, reducing time for approving raw-materials and reducing lead time. On the other hand, ACI Pharmaceuticals Ltd uses Sales and Depot Management software in supply chain management and unable to employ any type of ERP software. ACI is facing several problems in supply chain management such as resource shortage, insufficient vendor support, hidden cost, forecasting error and so on.

The study developed a model named "Model of the Role of Information Technology (IT) in Supply Chain Management (SCM)". This theoretical development will not only help the academic world but also help the practicing manager to improve the performance of supply chain management.

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ACRONYMS

Active Pharmaceutical Ingredients (APIs)

Advanced Chemical Industries (ACI)

Advance Planning System (APS)

Business Application Programming Interfaces (BAPIs)

Bangladesh Online (BOL)

Compound Annual Growth Rate (CAGR)

Computer Aided Design (CAD)

Corporate Social Responsibility (CSR)

Customer Relationship Management (CRM)

Directorate of Drug Administration (DDA)

Drug Policy (DP)

Electronic Data Interchange (EDI)

Enterprise Resource Planning (ERP)

Food and Drug Administration (FDA)

Gross Domestic Product (GDP)

Information and Communication Technology (ICT)

Information Systems (IS)

Information Technology (IT)

Initial Public Offering (IPO)

Intercontinental Marketing Services (IMS)

International Marketing Department (IMD)

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Just in Time (JIT)

Least Developed Countries (LDCs)

Materials Requirement Planning (MRP)

Management Information Systems (MIS)

Mass Customization (MC)

National Drug Policy (NDC)

Novel Drug Delivery Systems (NDDS)

National Health Service (NHS)

Operational Data Store (ODS)

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Procure to Pay (P2P)

Quality Assurance (QA)

Quality Control (QC)

Research and Development (R&D)

Return on Investment (ROI)

Radio Frequency Identification (RFID)

Sales and Depot Management System (SDMS)

SAP Business Analytics (SAP BA)

SAP Business Warehouse (SAP BW)

SAP Strategic Enterprise Management (SAP SEM)

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CHAPTER ONE: INTRODUCTION & BACKGROUND

1.0 Introduction

This chapter is the beginning part of the thesis. Here I explain the background of Supply Chain Management (SCM), Role of Information Technology (IT) in the Supply Chain Management (SCM), and The Pharmaceuticals Industry of Bangladesh. This discussion can justify the title of the thesis. Here also included why this research is conducted.

1.1 Supply Chain Management (SCM)

Supply Chain Management (SCM) can be viewed from several perspectives. Like most management philosophies, definitions of SCM must take into account a wide spectrum of applications incorporating both strategic and tactical objectives. A supply chain is the set of values adding activities connecting the enterprise's suppliers and its customers. The principle of supply chain activity is receiving input from firm's suppliers – add value – deliver to customers (Chopra and Meindl, 2007). A supply chain encompasses all the parties that involved, directly or indirectly, in fulfilling a customer request. The supply chain includes manufacturer, suppliers, transporters, warehouses, retailers and even customers themselves. Within each organization, such as a manufacturer, the supply chain includes all function involved in receiving and filling a customer request. These functions includes new product development, marketing, operation, distribution, finance, customer service and other function that related to serving customer request (Chopra and Meindl, 2007). Effective supply chain management is important to build

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and sustain competitive advantage in product and services of the firms. Gunasekaran and Ngai (2004); Sufian (2010) stated that the performance of supply chain was influenced by managing and integrating key element of information into their supply chain.

''Supply chain management is the management of the interconnection of organizations which relate to each other through upstream and downstream linkages between the different processes that produce value in the form of products and services to the ultimate consumer''(Slack, Chambers, & Johnston, 2001)

1.1.1 Principles of Supply Chain Management (SCM):

According to Anderson, D.L., Britt F.F, and Favre, D.J. (2007) an effective Supply Chain Management (SCM) should have seven principles. These are as follows:
Principle 1: Segment customers based on the service needs of distinct groups and adapt the supply chain to serve these segments profitably.

Principle 2: Customize the logistics network to the service requirements and profitability of customer segments.

Principle 3: Listen to market signals and align demand planning accordingly across the supply chain, ensuring consistent forecasts and optimal resource allocation.

Principle 4: Differentiate product closer to the customer and speed conversion across the supply chain.

Principle 5: Manage sources of supply strategically to reduce the total cost of owning materials and services.

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Principle 6: Develop a supply chain-wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of products, services, and information.

Principle 7: Adopt channel-spanning performance measures to gauge collective success in reaching the end-user effectively and efficiently.

1.1.2 Supply Chain Stages:

A supply chain included various stages, and these stages work with a flow. Flow of a supply chain is given below:

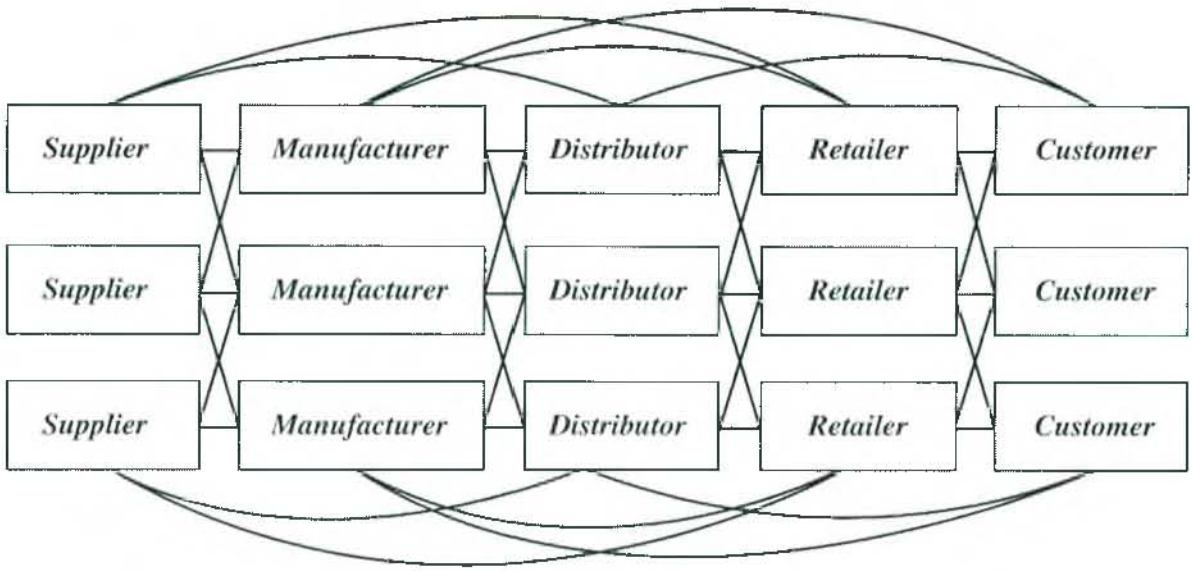

Figure 1.1.1: Supply Chain Stages:

Source: Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning, & Operation. (4th ed)* NJ: Prentice-Hall. Inc. pp.4-5.

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1.1.3 Objectives of the Supply Chain Management (SCM):

The basic objective of a supply chain is giving below:

- Customer the only source of revenue
- Sources of cost include flows of information, products, or funds between stages of the supply chain
- Effective supply chain management is the management of flows between and among supply chain stages to maximize total supply chain surplus (Chopra, S., & Meindl, P. 2010, pp. 5-6).

1.1.4 Process View of a Supply Chain:

Process view of supply chain included two things – cycle view and push/pull view of supply chain (Chopra, S., & Meindl, P. 2010).

***Cycle View*:** Processes in a supply chain are divided into a series of cycles, each performed at the interfaces between two successive supply chain stages. It can explain in following way – figure 1.1.2 and figure 1.1.2A

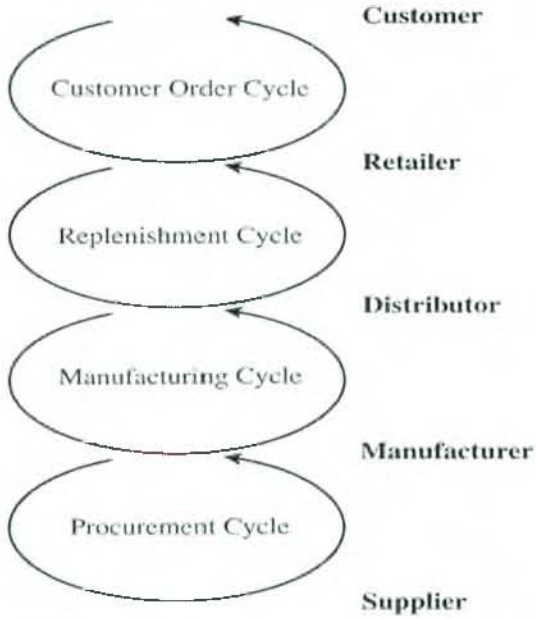

Figure 1.1.2: Supply Chain process cycles
Source: Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning, & Operation. (4th ed)* NJ: Prentice-Hall. Inc. pp 11-12.

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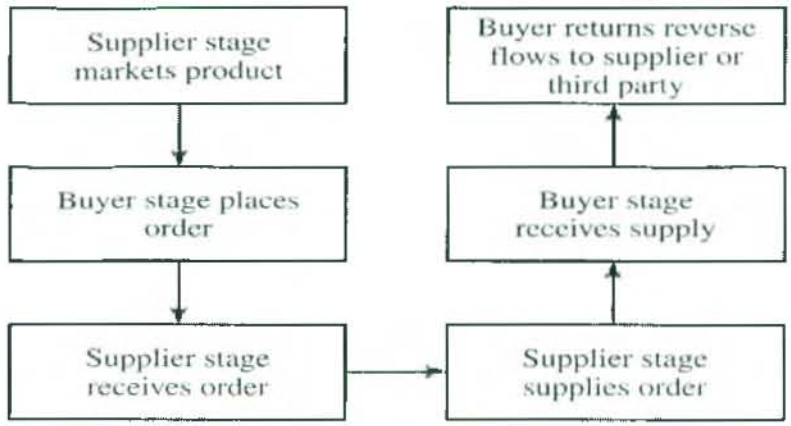

Figure 1.1.2A: Sub-processes in each supply chain process cycle

Source: Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning, & Operation. (4th ed)* NJ: Prentice-Hall. Inc. pp.11-12

Push/Pull View: Processes in a supply chain are divided into two categories depending on whether they are executed in response to a customer order (*pull*) or in anticipation of a customer order (*push*). . It can explain in following way – figure 1.2 and figure 1.2A

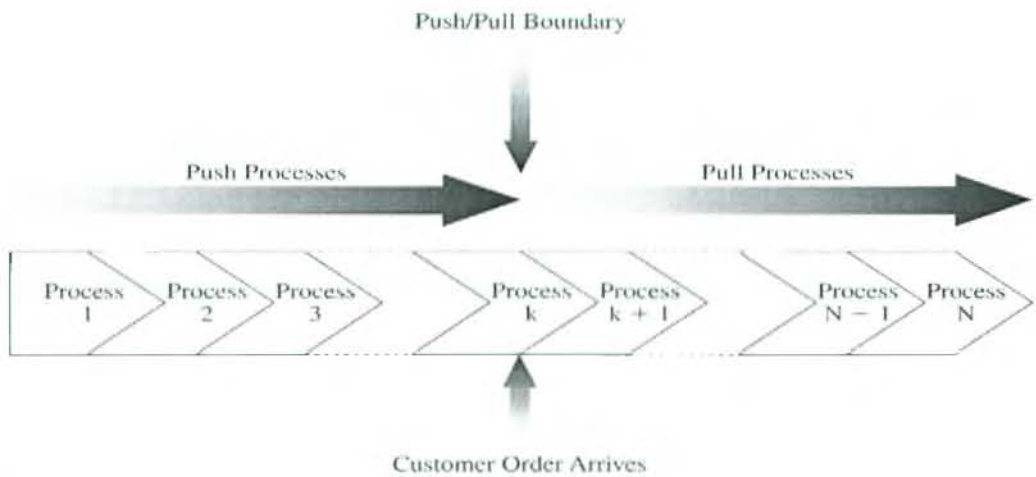

Figure 1.1.3: Push/Pull View of Supply Chain Processes

Source: Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning, & Operation. (4th ed)* NJ: Prentice-Hall. Inc. pp.13-14.

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1.1.5 Drivers of Supply Chain Performance:

To improve the performance of a supply chain, here some drivers play the vital role. These drivers are as follows (Chopra, S., & Meindl, P. 2010, pp.48-51):

- Facilities

The physical locations in the supply chain network where product is stored, assembled, or fabricated

- Inventory

All raw materials, work in process, and finished goods within a supply chain

- Transportation

Moving inventory from point to point in the supply chain

- Information

Data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain

- Sourcing

Who will perform a particular supply chain activity

- Pricing

How much a firm will charge for the goods and services that it makes available in the supply chain

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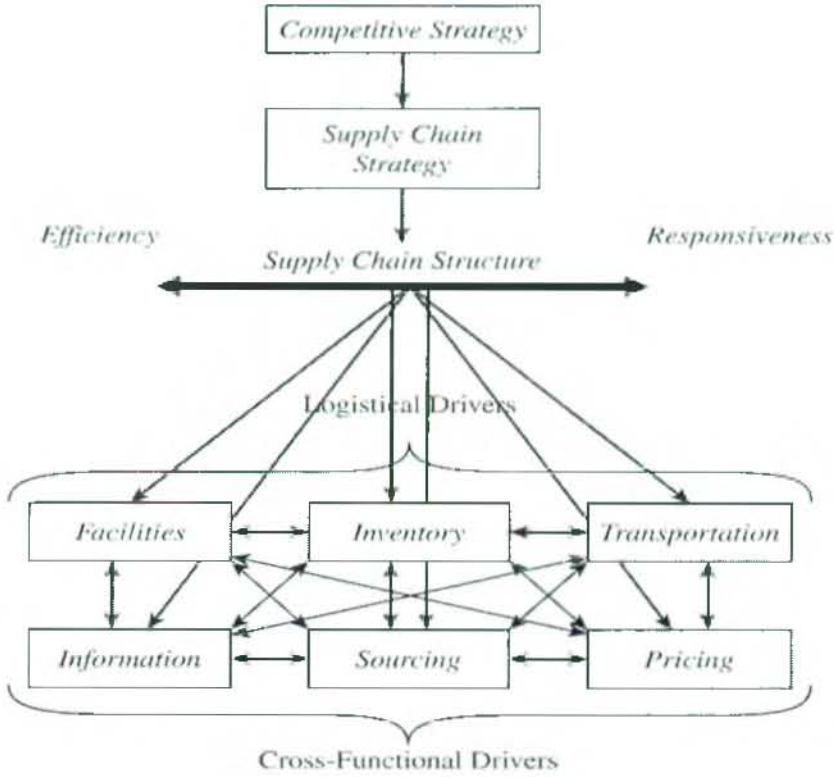

Figure 1.1.4: A Framework for Structuring Supply Chain Drivers

Source: Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning, & Operation. (4th ed)* NJ: Prentice-Hall. Inc.pp-51-52.

Supply chain management deals with the management of materials, information and financial flows in a network consisting of suppliers, manufacturers, distributors, and customers. The co-ordination and integration of these flows within and across companies is critical in effective supply chain management. In the last few years, the co-ordination and integration of these flows has attracted significant interest on the part of researchers, management, consultants and practitioners in both academia and industry (Hausman, 2000).

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So, the supply chain conceptually covers the entire physical process from obtaining the raw materials through all process steps until the finished product reaches the end consumer. Most supply chains consist of many separate companies, each linked by virtue of their part in satisfying the specific need of the end consumer.

1.1.6 Current Issues and Trends in Supply Chain Management:

Competitive manufacturers can no longer afford the inbuilt capacity and inventory buffers that have characterised their supply chains in the past. To avoid those buffers and make the supply chain more efficient, they require up-to-date, accessible information, the ability to collaborate with customers and suppliers, and a deep understanding of the whole manufacturing environment. That understanding did not emerge and develop easily. In the past, process manufacturers treated their plants as stand-alone units in the production of components and intermediates. That thinking underwent gradual evolution and, as a consequence, in today's business environment, manufacturers in a number of industrial sectors are increasingly realising that they must manage their extended supply chains by:

- Considering all of the plants which contribute to a manufactured product;
- Considering the wants and needs of not only their customers and suppliers but also their customers' customers and their suppliers' suppliers;
- Developing integrated systems which link them to both suppliers and customers.

There are major opportunities to transform supply chain management from a series of periodic and isolated events to an efficient enterprise-wide process that reduces delays,

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cuts cycle times and increases profits (Blomqvist, 2000). Companies are realising the need of the ability to make faster, smarter decisions at all levels. Inside the plant gates, companies should generate accurate plans and schedules based on current market and operating conditions. Across the supply chain, companies should optimise their enterprise-wide supply chain by considering all of their plants as a unified manufacturing enterprise, including the flow of materials across multiple plants and storage facilities to develop a coherently functioning enterprise. In this global enterprise, manufacturers should easily link to customers, suppliers and on-line exchanges creating a collaborative, flexible extended enterprise. However, to do this requires a comprehensive range of supply chain methods and tools.

Key to achieving this clear vision and understanding of the entire supply chain is the creation of an extended and integrated information system. This will improve each company's access to information about what is happening up and down the chain. Information technology (IT) systems play a critical role in this as they deliver the networks which allow the integration required between the companies involved. Despite a growing understanding of the role of IT systems in different areas of supply-chain management, IT directors should not underestimate the benefits that full integration can bring. Integration has become a necessary condition to compete and win the race for market share (Yusuf, 1996). For many businesses, Enterprise Resource Planning (ERP) systems are seen as a key step to the provision of this integrated system. Put in other words, ERP is viewed as Manufacturing resource planning (MRPII) further extended to include all resources which may be constraining the enterprise's capability.

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1.2 Information Technology (IT) and Supply Chain Management (SCM)

To achieve effective supply chain integration, the firms need to implement information technology (Handfield and Nichols, 1999); Sufian (2010). Brandyberry et al. (1999) suggested that by using technology of information, the firms could managing the flow and impact of numerous supply chains dimension, such as quality, cost, flexibility, delivery, and profit. Byrd and Davidson (2003) found that information technology impact the supply chain effectiveness. They stated that the development and long-term utilization of information technology lead to better firm performance in terms of return on investment (ROI, return on equity (ROI) and market share. Vickery et al. (2003) showed that supply chain coordination and integration is facilitated by using integrated information technology, which directly impacts a financial performance of the firms. According to Sufian (2010) to achieve a competitive advantage and better performance, supply chain management strategy need support the business strategy.

Supply chain management (SCM), based on the need for coordination between supply chain partners (Narasimhan and Jayaram 1998; Vakharia 2002; Prahinski and Benton 2004), has been particularly impacted by the growth and development of information technology (IT). IT has enabled buyers and suppliers to share large amounts of information, such as operations, logistics and strategic planning data. This has fostered real-time collaboration and integration between supply chain partners, has provided forward visibility and has resulted in improvements in production planning, inventory management and distribution. IT, which allows for the transmission and processing of

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information necessary for synchronous decision making between firms, can be viewed as the backbone of the supply chain business structure (Mabert and Vankataramanan 1998; Grover and Malhotra 1997; Kearns and Lederer 2003).

1.2.1 Information Technology, Computers and the Supply Chain:

There are two seemingly parallels, but ultimately converging paths of technical development. Both lead to expanding organizational frontiers. One is data telecommunications. The other is management computer systems. For telecommunications, there has been a progression of data transfer from the firm in isolation to EDI , providing the first direct computer to computer data links and now Web based communication, which facilitates communication broadly both within and between firms, regardless of physical location. Simultaneously, there have been four more or less distinct stages of management computer systems, represented by stand alone, EDI, ERP and internet systems. Here the following table 1.2.1 given fundamentals stages in the development of supply chain management and include impact of the computer systems in Supply chain Management.

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Table 1.2.1: Stages in the Development of Supply Chain Management

Stage	Time Frame	Parties	Communication method	Results
Stand alone applications	1960-70	All suppliers and customers	Verbal and written communication outside the organization	Excessive inventories, stockouts and backorders
EDI	1970's	Individual partner agreements with selected partners who could be suppliers and/or customers	Electronic data communication, but required common protocols and data formats. Limited to suppliers who can invest in infrastructure	Reduced data errors,automatic exchange of data, compressed time for processing information and increased responsiveness to customers
SCM	Late 1980's	All suppliers and and customers or major suppliers and customers	Variety of methods including EDI, internet , broadband communication and dedicated circuits	SCM attempts to optimize both internal processes and the interfaces among all suppliers and customers. The objective is coordinated operations and for the chains competing with each other as opposed to individual companies. Attempts to harness the power of IT.
ERP, SCM software and the internet	1990's	ERP for internal organization, Internet to provide communication between organizations	ERP is aimed at managing all internal transactions in an electronic environment. It is very costly to implement.	ERP promises internal efficiencies , complexity in controls and transactions. ERP requires EDI or internet for external connectivity as ERP is limited by organizational boundaries

Source: Chandrashekar, Ashok and Philip B. Schary, "Toward the Virtual Supply Chain: The Convergence of IT and Organization", International Journal of Logistics Management, 10(2),1999, p.29.

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Stand alone applications Stage:

Stand alone systems characterize a pre-supply chain era when many of the current computer applications such as MRP were developed. Data were entered in batch every time the application software was run. These legacy systems still exist in many firms today.

EDI Stage:

Electronic Data Interchange (EDI) came into use to allow computer to computer data communication without the need for reentry. Applications were specific to individual supply chains, installation was costly and standardized messages were developed to handle specific data transactions. Because of the nature of transmission over dedicated phone lines, EDI systems offer a high level of data security.

SCM Stage:

The third stage, Supply Chain Management (SCM), manages the flow of transactions as "the extended enterprise". SCM includes both software, and communication via the internet plus connections to suppliers and customers, The Internet is becoming instrumental in enlarging the full scope of the supply chain through its ease of access and use.

ERP, SCM software and the internet

The fourth stage, which enhances the effectiveness of SCM is the development of SCM software including Enterprise Resource Planning (ERP). ERP designates a transaction based management software system for the individual firm. Data flow through the

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enterprise in real time. In its early development, organizational barriers represented a major barrier to its use as a supply chain network. However, later development in SCM software appears to be surmounting this barrier.

Systems such as ERP and even SCM have been criticized for their focus on supply , to the neglect of market coordination. Recent developments in the use of point-of-sale data, customer collaboration, and demand planning and sales force automation software are now beginning to encourage a flow of transactions from customer to the supplier network, with potential viability to all parties. In the scenario of ERP/SCM systems, customers place orders directly through an order management system, which passes them to production planning, schedules production and issues purchase orders. At the same time, the order management software generates delivery plans. The additional capacity of internet communication makes possible exchange of complex messages such as CAD product drawings between supply chain partners.

More general adaptations of Internet include the development of intranets for internal communication within the organization, and extranets for customers and suppliers in the in the supply chain. Entry can be restricted to authorized parties through electronic gateways controlled by host managements (Chadrashekar and Schary, 1999).

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1.2.2 Benefits of IT in Supply Chain Management (SCM):

If any organization introduces Information Technology in Supply Chain Management (SCM) the organization can get a lot of benefits which is not available in current SCM.

1. 2.2.1 IT and Supply Chain

A review of the existing literature shows the abundance of papers dealing with IT in SCM. According to Simchi Levi et al (2003) the objectives of IT in SCM are:

- providing information availability and visibility;
- enabling a single point of contact for data
- allowing decisions based on total supply chain information; and
- enabling collaboration with supply chain partners

The most typical role of IT in SCM is reducing the friction in transactions between supply chain partners through cost effective information flow. Conversely, IT is most importantly viewed to have a role in supporting the collaboration and coordination of supply chains through information sharing. Third, IT can be used for decision support. In this instance the analytical power of computers is used to provide assistance to managerial decisions (Auramo, Jaana, 2005).

1. 2.2.2 Benefits of IT in SCM

Levary (2000) suggests that IT in SCM provides a reduction in cycle time, a reduction of inventories, a minimization of the bullwhip effect, and improvement in the effectiveness of distribution channels.

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We can introduce five propositions on the use and benefits of e-business technologies in SCM.

1. A key operational impact of IT in SCM is the enhancement of service level.
2. IT in SCM improves operational efficiency
3. IT in SCM improves information quality
4. IT in SCM enables agile supply chain operating models
5. Use of IT has to be coupled with process redesign to receive strategic benefits.

1.2.3 Types of Inter firm Collaborations in SCM:

SCM is referred to as "the systematic, strategic coordination of the traditional 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" (Mentzer, Dewitt, Keebler, Min, Nix, & Smith, 2001). This definition draws on two critical theoretical underpinnings behind the importance of collaboration between firms in the supply chain. On the one hand, researchers find that learning takes place not only within a firm but also between firms (Lee, Johnson, & Grewal, 2008). Through collaboration, a firm can acquire and assimilate knowledge from its supply chain partners to enhance its own routines and further upgrade its internal knowledge base. Thus, systematic and strategic collaborations on supply chain activities likely result in the creation of new knowledge. The literature further argues that firms collaborate and coordinate for the purpose of reducing the total costs that each of the firms could incur (Williamson, 1975). Previous research in inter firm management suggests that trust and commitment accrued from collaborative relationships reduce the costs of information search, negotiations, and monitoring,

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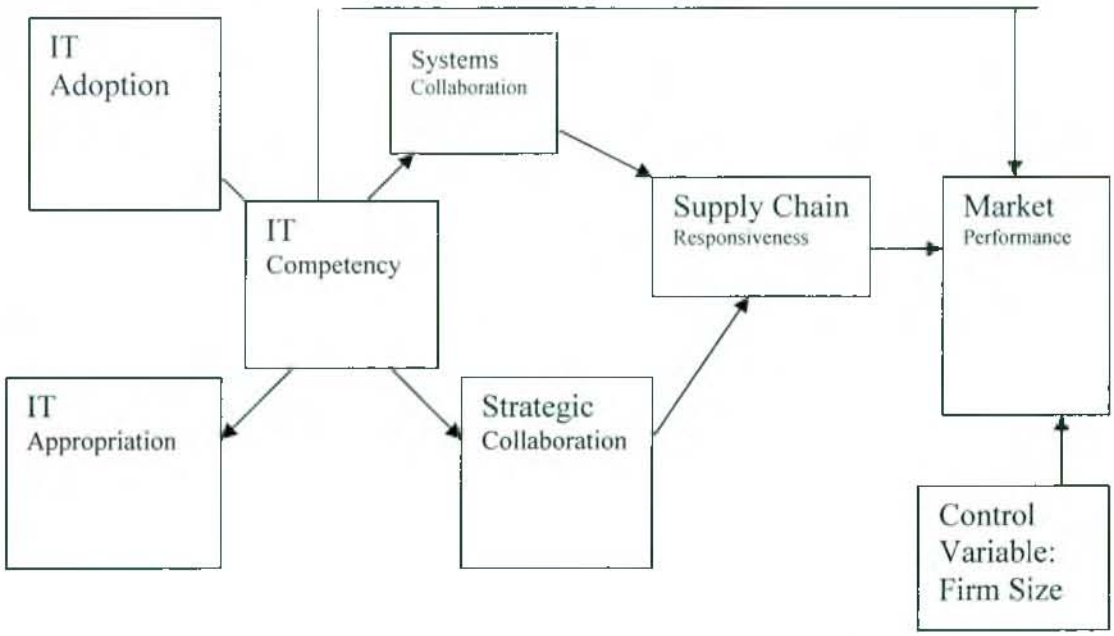
among others (e.g., Geyskens, Steenkamp and Kumar, 2006). As shown in Figure 1.2.1, the continuous collaboration in systems and strategy along the supply chain enables supply chain members to improve supply chain responsiveness and thus enhance market performance.

Figure 1.2.1 Types of Inter firm Collaborations in SCM



Source: Kim, Daekwan and Lee, Ruby P.(2010), " Systems Collaboration and Strategic Collaboration: Their Impacts on Supply Chain Responsiveness and Market Performance", *Decision Sciences*, 41(4), pp.957-964.

1.2.3.1 Systems collaboration

This study views systems collaboration as the extent to which supply chain partners strive to make and keep their communication systems compatible with each other to be ready for interfirm forecasting and planning (Sanders & Premus, 2005; Rai et al., 2006) in addition to routine electronic transactions and information exchange within the

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supply chain. Subsequently, systems collaboration often aims to eliminate potential barriers due to the incompatibility in supply chain communication technology (Frohlich, 2002).

Collaboration among supply chain partners at various information systems levels is important as it integrates the individual systems of supply chain partners to provide the infrastructure necessary for effective strategic collaborations and interfirm information exchange (Kim et al., 2006). Because supply chain partners may have their own SCM systems (e.g., electronic data interchange [EDI], automatic replenishment systems, and warehouse management systems) a platform capable of recognizing and accommodating supply chain partners' various systems allows a firm to seamlessly and effectively communicate with its partners (Bowersox, Closs, & Stank, 1999; Bowersox, Closs, & Cooper, 2002).

A review of recent studies also shows that the advent of the Internet and improved IT has pushed forward the role of e-business in SCM (e.g., Vakharia, 2002). More integrative communications systems result from the integration of e-business with SCM, thus nurturing opportunities for increased interactions within and between firms. Reflecting this trend, researchers suggest that collaboration across firms at an information systems level likely influences firm success (Sanders & Premus, 2002, 2005).

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1.2.3.2 Strategic collaboration

Strategic collaboration is defined as the extent to which supply chain partners actually forecast demand and plan business activities jointly while taking into account each other's long term success (Johnson, 1999; Sanders & Premus, 2005). Strategic collaboration is essential to align the interests of different partner firms with those of the entire supply chain. Extant research argues that collaborative strategic relationships are important for several reasons (Swink, Narasimhan, & Wang, 2007).

First, strategic collaboration cultivates trust and commitment between supply chain partners, which can enhance learning and knowledge development. Second, developing strategic plans together with supply chain partners allows the partners to clearly understand and efficiently play out their roles. Third, collaboration in strategic planning motivates supply chain partners to be more involved in achieving common goals rather than finding individual short-term opportunities (Stank, Crum, & Arango, 1999; Mentzer et al., 2001; Sanders & Premus, 2002). Fourth, strategic collaboration helps reduce operating costs (Kahn, Maltz, & Mentzer, 2006). For example, forecasting demands jointly with supply chain partners reduces a wide range of costs from stocking raw materials to tracking inventories (Aviv, 2001).

1.2.3. 3 Relationships between systems collaboration and strategic collaboration

Because strategic collaboration involves sharing more important information for demand forecasting and planning across supply chain partners, it requires the supply

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chain partners to be more proactive in providing real-time access to market information, pricing, and inventories among other data. Systems collaboration, on the other hand, increases transparency between partners, allowing for more efficient operations and resource management (Lamming, Caldwell, Harrison, & Phillips, 2001). Without systems collaboration among supply chain partners, coordinating and planning for important supply chain activities, such as strategic planning and demand forecasting, may become challenging as a result of inadequate communications and information sharing.

Further, investing in a relationship is not without costs and certain strategic collaborative relationships can be idiosyncratic in nature, making it more difficult for the firm to switch from one relationship to another (Rokkan, Heide, & Wathne, 2003). For a strategic collaboration to occur, it likely requires the firm to share its knowledge, which can be too risky for the firm if its partner appropriates its core knowledge and then walks away from the relationship (Lee & Johnson, 2010). In contrast, systems collaboration requires less resource commitment and strategic effort. As previous research suggests, a firm's level of commitment varies from stage to stage in a relationship life cycle (e.g., Heide & John, 1992). In an earlier stage of a relationship, for example, the firm may not have established norms and common goals with its partners. The firm at this stage most likely collaborates with its partner at a less strategic level, such as systems collaboration as opposed to strategic collaboration, to explore the partner firm's true level of commitment to the relationship and to identify the potential to nurture a more intimate relationship for further collaboration (Wathne & Heide, 2004). Thus, having collaborative information systems with other partners sets a stage

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for the firm to establish and institutionalize a more involved interfirm relationship (i.e., strategic collaboration) (Ahuja, 2000).

1.2.3.4 IT Competency and Inter firm Collaborations

This study investigates a firm's IT competency in its supply chain communication systems (SCCS) as an enabler of interfirm collaborations. SCCS are one of the key elements of SCM systems with the primary purpose to facilitate interfirm communication and interactions for joint electronic transactions and potential collaboration between supply chain partners, and thereby reducing costs of holding inventory, materials, etc. (Bowersox et al., 2002). Most elements of a typical SCM system use a collection of information from various systems, thus allowing the firm to coordinate both within and across its supply chain partners to facilitate the implementation of joint activities along the supply chain (Bowersox et al., 2002). SCCS, however, offer an interface to link internal corporate systems and other elements of SCM systems with those of supply chain partners.

Drawing on previous research (Tippins & Sohi, 2003), this study conceptualizes IT competency for SCCS as a second-order construct. Furthermore, this study adopts a dual-view: IT adoption and IT appropriation, separating IT adoption from the rest of firm IT processes and strategies to be consistent with the IT literature (Daft, 1978; Zmud, 1982; Swanson, 1994).More specifically, this study differentiates and incorporates two different dimensions of IT resources and capabilities. *IT adoption* is defined as the degree to which a firm deploys the most advanced SCCS technology in

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the industry (Tippins & Sohi, 2003). Due to the wide availability of different technologies and systems employed by different firms, we believe a firm that adopts advanced SCCS ahead of competitors likely yields higher returns, making the SCCS a valuable firm resource. *IT appropriation*, on the other hand, refers to the extent to which a firm utilizes its SCCS to the highest capacity (Tippins & Sohi, 2003).

In this conceptualization, a firm is viewed as an actor who employs sophisticated IT (IT adoption) and is able to appropriate its benefits (IT appropriation) to develop IT competency, the second-order construct. Supporting this view, scholars argue that some IT related knowledge and skills are potential resources that facilitate a firm's efforts to build and integrate other types of resources within the firm (Dierickx & Cool, 1989; Eisenhardt & Martin, 2000). According to them, the combined role of IT adoption and IT appropriation underscores a firm's capability to generate more benefits than the combined sum of individual benefits, advocating the second-order approach for IT competency.

Previous research suggests that IT competency can potentially improve systems collaboration. Although supply chain partners may adopt different supply chain systems, a firm's IT competency helps the firm recognize differences and take advantage of the benefits derived from their shared systems. For instance, EDI alone can be implemented at multiple levels and types including proprietary versus nonproprietary EDI, Internet-based versus non Internet-based EDI, automated versus non automated EDI, and internally integrated EDI with other corporate information systems versus stand-alone EDI. However, such technological platforms can be integrated into SCM systems, utilizing not only a firm's other elements of SCM systems

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(e.g., automatic replenishment systems, transportation execution systems, and warehouse management systems), but also other internal corporate systems (e.g., enterprise resource planning [ERP] systems and customer relationship management [CRM] systems) as the sources of various information for its supply chain activities (Bowersox et al., 2002). Thus, through the use of advanced IT infrastructure (e.g., continuous additions of new functions and features to the firm's SCM system), its built-in and advanced functions help recognize and bridge the gaps between multiple information systems, making the firm more ready to collaborate at diverse information systems levels (Frohlich, 2002; Wu, Yeniyurt, Kim, & Cavusgil, 2006).

Akin to systems collaboration, IT competency may also enhance strategic collaboration. Strategic collaboration is a type of interfirm integration that involves more intensive and long-term upper level management commitment and involvement (Swink et al., 2007). A firm and its supply chain partner should view each other as a long-term partner such that they would put efforts together in setting up strategic plans, forecasting demands, and defining goals. Thus, with the support of IT competency, systems collaboration reduces the chance of miscommunications between partners when formulating strategic plans, allows the firm to process and assess information for more effective joint planning and decision making, and facilitates better and faster coordination between firms in the supply chain to project future demands. As a result, IT competency is vital to enhancing systems collaboration and strategic collaboration.

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1.2.3.5 Supply Chain Responsiveness as a Process Outcome

In today's hypercompetitive markets where customers are demanding and competition is fierce, it becomes more difficult for a firm to be responsive to market changes and create superior performance by its own effort. Instead, collaborative efforts and strategic foresights put together by the firm and its supply chain partners are more likely to enhance supply chain responsiveness (Burke & Vakharia, 2002). Such joint efforts and strategic foresights denote the dynamic capabilities of the entire supply chain rather than the firm alone in combining the resources of multiple connected supply chain partners in response to market challenges and opportunities (Hult et al., 2007), which underscores the notion of supply chain responsiveness.

Supply chain responsiveness implies that a firm's ability to remain responsive comes from not only the firm itself but also its supply chain partners (Kim et al., 2006). According to the literature, a collection of firms can derive better performance without additional inputs such as by shifting complementary resources more effectively within the supply chain (Richardson, 1990). Thus, instead of counting on an individual firm's effort, it requires the entire supply chain's endeavor to be able to respond to customer demands and environmental challenges effectively (Mentzer et al., 2001; Burke & Vakharia, 2002). As a recent study concludes, a firm no longer competes against another firm; rather, it is a supply chain that competes against another supply chain (Hult & Ketchen, 2007).

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Previous research shows that unless the firm integrates information systems with its major supply chain partners to allow for more information and data sharing, the firm will hardly stay competitive in the market in the long run (Hult et al., 2007). A healthy and collaborative information system fosters the entire supply chain to be more responsive to opportunities and threats arising from customers and competitors (Richardson, 1990; Bowersox et al., 1999; Kim et al., 2006). For example, systems collaboration enables supply chain partners to share information on the interface of manufacturers, customers, and logistics partners, making the entire supply chain more responsive to the change of ordering procedures, inventory status, and demands. Thus, having a system-level interfirm collaboration with compatible technology that can foster effective communication and coordination between supply chain partners is important in improving supply chain responsiveness (Richey, Daugherty, & Roath, 2007).

Similarly, supply chain responsiveness can also result from strategic collaboration. Close collaboration at the strategic level of activities between supply chain partners indicates their strong commitment to success, and thereby leads to a more responsive supply chain (Hult and Ketchen, 2007). Specifically, strategic collaboration is the result of greater insight and comprehension of information and knowledge sharing with the explicit purpose of making more informed interfirm decisions (Richardson, 1990). The increased understanding of each other's objectives and strategic roles helps reduce role ambiguities. By understanding which roles to play out within the supply chain, the firm develops its belief in the value and strategic direction of the supply chain as a whole rather than a set of individual firms. This more demanding yet cohesive relationship enables the entire supply chain to more effectively and efficiently respond to the

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challenges of increased competition, replicating the notion of interfirm complementarities in the literature (Richardson, 1990; Nonaka, Takeuchi, & Takeuchi, 1995).

1.2.3.6 Market Performance as a Final Outcome

The literature suggests that IT competency, encompassing the ingredients of IT adoption and appropriation, by itself is a source of competitive advantage (Tippins & Sohi, 2003) that can result in superior market performance (e.g., sales growth, market development, and market share). Specifically, IT adoption relates to the installation of information systems and infrastructures to promote supply chain activities within and between organizations. Simple adoption of advanced IT may generate a competitive advantage. However, IT adoption coupled with IT appropriation could offer more potential (Kim et al., 2006) because IT appropriation reflects a firm's ability to use IT with an intention to learn from and with supply chain partners to create knowledge and other benefits superior to those of competitors . Such combination and configuration of IT resources and the capability of the firm to appropriate their benefits should lead to positive market performance (Sanders, 2005).

In addition to internal IT competency, extant research suggests that a firm can distinguish itself from competitors by bundling and mobilizing its supply chain resources to not only respond more timely to changing customer needs and competitor strategies, but also launch new products more efficiently and effectively to the market (Lee, 2008). Thus, supply chain responsiveness can be a process outcome that reflects

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the capabilities of a firm to combine resources of different firms in the supply chain to take on actions in light of market changes (Hult et al., 2007). It underscores the importance of shared efforts between an individual firm and its partners in response to external challenges. Similar to a firm's individual market responsiveness that is found to directly contribute to positive firm performance in the literature (Homburg, Grozdanovic, & Klarmann, 2007), supply chain responsiveness is likely to create the same synergy. In other words, by increasing responsiveness in the supply chain, the firm's market performance, which corresponds to its specific market goals such as sales growth, market development, and market share, can be enhanced (Kim et al., 2006).

Further, we suggest that supply chain responsiveness as a process outcome to reflect a firm's capabilities to respond to market challenges is an important mediator, affecting the impact of interfirm collaboration on market performance. Although some studies maintain that integrative efforts may lead to superior firm performance, other studies caution that such a relationship is unlikely to be established without taking into account other factors (Swink et al., 2007). For example, Sanders and Premus (2005) find that interfirm collaboration (i.e., collaboration with supply chain partners) by itself does not directly lead to firm performance. Rather, it has to go through intrafirm collaboration efforts to achieve positive performance. Similarly, in their empirical study, Kim et al. (2006) do not find support for the direct relationship between interfirm coordination and market performance.

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These previous studies point to the same direction for the need to explore the unexplained relationship between interfirm collaboration and performance. We believe that supply chain responsiveness plays a role here. That is, supply chain responsiveness that denotes the capability of a firm to deploy resources available along the supply chain to identify and react to market changes, is likely an important missing link overlooked in the literature. Previous research suggests that a supply chain's ability to quickly and effectively respond to changing market needs is a necessary condition of market performance (Hult et al., 2007). Thus, if a firm can convert both systems collaboration and strategic collaboration, two accessible resources, into supply chain responsiveness, a strategically more important organizational routine than simple transaction-based coordination, superior market performance could result.

1.2.3.7 Control Variable

Firm size is often used as a control variable as it is found to determine firm performance (Kimberly, 1976). That is, larger firms could, *ceteris paribus*, derive greater synergy effects from various firm resources including financial and human resources that can lead to enhanced performance. Larger firms can also take advantage of economies of scale in their business activities helping them perform better in the market. Therefore, firm size, measured by the total number of employees in a respondent firm, is included as a control variable when we test the effects of interfirm collaborations on supply chain responsiveness and market performance (Kim and Lee, 2010).

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1.3 Pharmaceutical Sector in Bangladesh

Pharmaceutical sector is technologically the most developed manufacturing industries in Bangladesh and the third largest industry in terms of contribution to government's revenue. The industry contributes about 1% of the total GDP. There are about 250 licensed pharmaceutical manufacturers in the country; however, currently a little over 100 companies are in operation. It is highly concentrated as top 20 companies produce 85% of the revenue. According to IMS, a US-based market research firm, the retail market size is estimated to be around BDT 84 billion as on 2011.

Bangladesh pharmaceutical companies focus primarily on branded generic final formulations, mostly using imported APIs (Active Pharmaceuticals Ingredient). Branded generics are a category of drugs, including prescription products, that are either novel dosage forms of off-patent products produced by a manufacturer that is not the originator of the molecule, or a molecule copy of an off-patent product with a trade name. About 85% of the drugs sold in Bangladesh are generics and 15% are patented drugs - the structure differs significantly from the international market. Branded generic drugs represent about 25% on average of worldwide pharmaceuticals sales'; however, given the popularity in emerging markets like China, India and Latin America, branded generic drugs may well dominate the total sales within a decade(BRAC EPL Stock Brokerage Ltd, 2012) .

Bangladesh manufactures about 450 generic drugs for 5,300 registered brands which have 8,300 different forms of dosages and strengths. These include a wide range of

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products from anti-ulcerants, flouroquinolones, anti-rheumatic non-steroid drugs, non-narcotic analgesics, antihistamines, and oral anti-diabetic drugs. Some larger firms have also started producing anti-cancer and anti-retroviral drugs. Domestic manufacturers account for 97% of the drug sales in the local market while the remaining 3% are imported. This is a complete turnaround over from two/three decades back when imports used to dominate the market. The imported drugs include essential live saving drugs and other high quality drugs. The ratio will further increase in favor of the local production as some of the big players are poised to manufacture these high quality drugs in-house in the future (BRAC EPL Stock Brokerage Ltd, 2012) .

1.3.1 Market Size and Growth:

As stated earlier, the size of the retail market reached BDT 84.0 billion as on 2011 based on IMS report. The report further stated that, retail sales in the domestic market achieved 23.6% growth in 2011 following 23.8% and 16.8% growth in 2010 and 2009 respectively. High growth in the last three years (78.8% cumulative and 21.4% CAGR) meant that the Bangladesh Pharmaceutical market doubled in just over four years. The retail market also crossed USD 1.0 billion in size in 2011. It is one of the fastest growing sectors in the country with an annual average growth rate of 17.2% over the last five years and 13.1% over the last decade.

However, considering that IMS does not include rural market in their survey, the actual size of the market will vary slightly (5%-10%). It is estimated that the retail market

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represent 90% of the total market; in that respect the total market size (including rural market) is expected to be over BDT 90.0 billion at present.

Table 1.3.1 Retail Market Size & Growth

Year	Size (BDT b)	Growth
2011	84.0	23.6%
2010	68.0	23.8%
2009	54.9	16.8%
2008	47.0	6.9%
2007	44.0	15.8%
2006	38.0	4.1%
2005	36.5	17.5%
2004	31.1	8.6%
2003	28.6	5.9%
2002	27.0	10.2%
2001	24.5	

Source: Square Pharmaceuticals Annual Reports & IMS Report 2012

1.3.2 Drivers behind Market Growth:

The table 1.3.2 shows some selected health indicators for Bangladesh. Most of the indicators improved over the last decade which is among some of the factors that contributed to the growth of the sector.

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- There has been a gradual demographic shift - life expectancy improved from 64.7 in 2000 to 68.3 in 2009 which highlights the increased health consciousness among the people. Also the income level of the population increased over the last decade which allowed them to spend more for healthcare.

- The base was also low as healthcare expenditure was less than 3% of GDP in 2000 with total pharmaceutical sector size of BDT 24.5 billion only in that year.

- Increased medical coverage of population with new hospitals.

- Emergence of private healthcare service - a number of top class hospitals started operating which includes Apollo Hospitals, Square Hospitals, United Hospitals and others. These hospitals became very popular with the mass population due to their quality service; they have been a major factor contributing to increased healthcare expenditure.

- Although government expenditure as a % of total healthcare expenditure did not improve in the last decade, there has been increased expenditure in absolute terms. Growth in private expenditure was the primary reason behind fall in public % of expenditure.

- Income base of the population has been growing over the last decade. Health expenditure per capita doubled in the last decade, indicating people's willingness to spend more to remain healthy.

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Table 1.3.2 Selected Health Indicators for Bangladesh

Health Indicators	2009	2008	2005	2000
Life Expectancy	68.3	68	66.9	64.7
Government % in total health exp.	31.7%	31.4%	34.9%	39.0%
Health exp. as % of GDP	3.35%	3.32%	3.21%	2.82%
GDP per Capita (Current US$)	607.8	546.9	428.8	363.6
Health exp. per capital (Current US$)	18.4	16.5	12.1	9.1
Median Age (2011 estimate)	23.3	-	-	-
Poverty Level	31.5%	NA	40.0%	48.9%

Source: World Bank 2011

1.3.3 Drivers for Future Growth:

Table 1.3.3 compares the indicators with other regions of the world and shows that Bangladesh is way behind other countries. Government spending proportion is much lower than that in other regions - it is one possible area where future growth may come from. Moreover, the total health expenditure to GDP ratio and health expenditure per capita of Bangladesh (both of which gradually increased from 2000) is very low in comparison to developed and developing countries. Since the base is still very low, we expect the recent growth in the local retail market to continue in the current decade. Some other factors that will also boost the industry growth include:

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- Increase in number of modern hospitals
- Increase in level of service/treatment provided in the hospitals with improved/more modern diagnostic equipments
- General people are getting more health conscious
- Growing income level of the people
- Export of pharmaceutical products

Table 1.3.3 Comparison of health indicators (2009) with other regions:

Health Indicators	Bangladesh	World	South Asia	EU	USA
Life Expectancy	68.3	69.4	65	79.4	78.1
Government % in total health exp.	31.7%	60.8%	32.9%	76.1%	48.6%
Health exp. as % of GDP	3.35%	10.03%	3.99%	10.31%	16.21%
Health exp. per capital (Current US$)	18.4	863.6	40.2	3,370.7	7,410.2

Source: World Bank, 2012

1.3.4 Growth Projections:

Table 1.3.4 shows the healthcare expenditure as % of GDP for neighboring countries to Bangladesh as well as some other developed countries as well. Bangladesh is way below in the list of countries with only Pakistan below in terms of healthcare expenditure percentage. If we assume that Bangladesh is going to achieve 6.5% real GDP growth rate over the next five years and healthcare expenditure to reach 5% of

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GDP by that time, then healthcare expenditure in nominal value will grow at 15.4% annually over the next five years.

Bangladesh has been achieving around 6% GDP growth rate over the last decade. The current government has set target to achieve even higher growth rate in this decade, with a vision to achieve double-digit growth within 2018. As such, it is likely that the actual growth in GDP in the next five years will be greater than the projected 6.5% - in that case the growth in healthcare expenditure is likely to be more than our simple estimated value of ~15%.

At present, the retail pharmaceutical market size is about 1% of GDP and health expenditure is about 3.35% of GDP. Therefore, the pharmaceutical sector revenue accounts for ~30% of the healthcare expenditure. If we assume that the ratio will remain constant over the years, pharmaceutical revenue will also grow at par - at 15.4% annually over the next five years.

Table 1.3.4 Healthcare exp as % of GDP

Region	2009	2005	2000
USA	16.21%	14.72%	13.41%
World	10.03%	9.73%	9.23%
UK	9.34%	8.25%	7.04%
Japan	8.35%	8.16%	7.69%
Afghanistan	7.36%	8.76%	8.29%
Nigeria	5.82%	6.60%	4.56%
Nepal	5.81%	5.91%	5.06%
Thailand	4.31%	3.55%	3.40%
India	4.17%	4.03%	4.61%
Sri Lanka	3.96%	4.04%	3.72%
Bangladesh	**3.35%**	**3.21%**	**2.82%**
Pakistan	2.62%	2.78%	3.02%

Source: World Bank , 2012

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1.3.5 Major Players:

Based on the IMS report for the fourth quarter 2011, Square Pharmaceuticals (DSE: SQURPHARMA) holds the top market share in the retail market - 18.7%, followed by Incepta Pharmaceuticals (INCEPTA) - 9.3%, Beximco Pharmaceuticals (DSE: BXPHARMA) - 8.8%, Opsonin Pharma (OPSONIN) - 5.1% and Renata (DSE: RENATA) - 4.9%. The top five companies held 46.8% market share in 2011, slightly more than their 46.2% market holding in 2010 - indicating cumulative revenue growth in excess of the sector growth. Among the top five, three are listed in DSE – Square, Beximco and Renata (Table 1.3.5).

Table: 1.3.5 Major players in the retail market

Company	Market Size (BDT m)	Growth in 2011	Market Share 2011	2010
Square Pharmaceuticals	15,725.8	20.5%	18.7%	19.2%
Incepta Pharmaceuticals	7,851.5	28.6%	9.3%	9.0%
Beximco Pharmaceuticals	7,415.0	30.5%	8.8%	8.4%
Opsonin Pharma	4,275.4	27.2%	5.1%	4.9%
Renata	4,076.8	26.1%	4.9%	4.8%
Eskayef Bangladesh	3,980.3	18.9%	4.7%	4.9%
ACI	3,578.2	24.9%	4.3%	4.2%
Acme Pharmaceutical	3,500.7	13.7%	4.2%	4.5%
Aristopharma	3,412.8	26.3%	4.1%	4.0%
Drug International	3,070.2	18.9%	3.7%	3.8%
Top 10 Companies	56,886.5	23.6%	67.7%	67.7%
Top 20 Companies	71,382.5	24.1%	84.9%	84.6%
Others Companies	12,661.6	20.7%	15.1%	15.4%
Total Sector	84,044.1	23.6%		

Source: IMS & World Bank 2012

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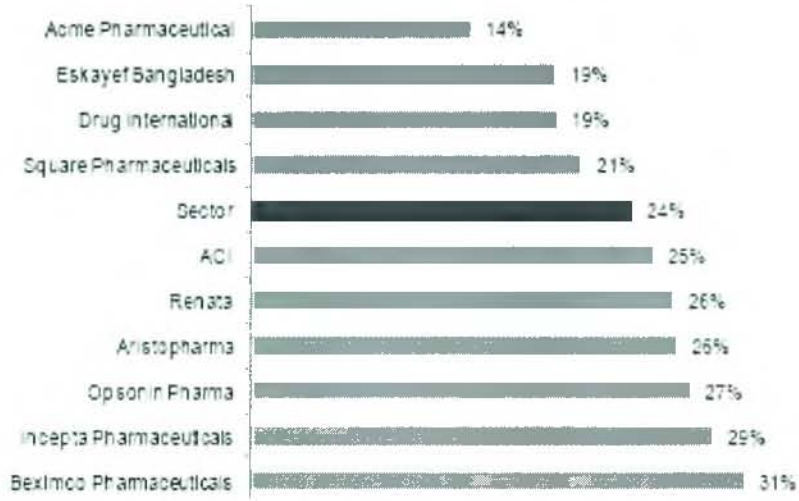
Figure 1.3.1 Growth of top ten companies in 2011



Source: IMS report 2012

In the case of growth, Beximco Pharmaceuticals holds the top growth rate 31%, followed by Incepta Pharmaceuticals 29% (Figure 1.3.1).

1.3.6 Export and Import:

Bangladesh's overall export earnings from pharmaceuticals reached USD 46.0 billion for the calendar year 2011, recording a growth of 16.1% over USD 39.6 billion in calendar year 2010. Exports earnings in Q1'2012 were USD 10.9 billion, 5.7% up from the same period previous year.

Pharmaceutical export from Bangladesh recorded 25.5% growth annually over the last seven years. However, the growth was not steady across all the years - in fact in FY2009 pharmaceutical export dropped 1.8% following the global financial crisis. In FY2011 also, the growth was only 1.0% because of sovereign debt crisis in Europe.

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Apart from these two years where trade slowed down significantly worldwide, pharmaceutical export was robust in all other years.

Table 1.3.6: Pharma Export (USD m)

	2011	2010	2009
Q1	10.4	9.4	8.8
Q2	12.4	8.7	8.5
Q3	12.3	10.1	10.2
Q4	10.9	11.4	12.7
Total	46.0	39.6	40.1

Source: Export Promotion Bureau, 2012

1.3.7 TRIPS:

The World Trade Organization's (WTO) Trade-Related Aspects of Intellectual Property Rights (TRIPs) agreement permits Bangladesh to reverse-engineer patented generic pharmaceutical products to sell locally and export to markets around the world. The 1994 WTO agreement TRIPS requires signatories to implement patent protection for almost all products, including pharmaceuticals. However, article 66 provides Least Developed Countries (LDCs) with a breathing space before introducing full product patent protection. Bangladesh is therefore exempt until 2016 from the requirement to observe patent protection on reverse-engineered generic products destined for the local market. Bangladesh imports approximately 80% of its Active Pharmaceutical Ingredients (APIs) for domestic production, 20% of which are patented.

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Bangladesh also enjoys some export advantages from TRIPS with regards to exporting following pharmaceutical goods:

- Bangladesh can export generic drugs to markets where the patent owner has not filed for protection. Most drugs on WHO's Model List of Essential Drugs are not patented, as affordability is one of the criteria used in designating medicines as "essential."
- Bangladesh can export to other LDCs or non-WTO members which have not implemented product patent protection, for example Myanmar.
- Bangladesh can also export to a country which has issued a compulsory drug license and awarded the production contract to Bangladesh. TRIPS grants governments the right to issue a compulsory license for public health purposes, which occurs when a government overrides a patent and grants another entity the right to produce the patented product. It may do all of this without paying royalties to the patent owner.

The cost of importing APIs will most likely rise as TRIPS phases in. However, it is likely that WTO would extend the facility for another 10 years on ground of public health situation and technology transfer issue for producing patent drugs in the LDCs. WTO will review extension of TRIPS agreement waivers by the end of 2013. In case the TRIPS agreement is not extended beyond 2015, the local manufacturer will face a number of constraints including:

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- Import cost of patented APIs are likely to increase.
- The cost of manufacturing patented drugs will also increase as the companies are likely to pay royalty to the original manufacturer.
- Export of patented products will become costly.

However, the cost pressure is likely to be associated with a lower proportion of drugs as less than 20% drugs are patented in the current market. Moreover, a number of blockbuster drugs have already lost patent or are about to lose patent in the international market within this year, including Plavix, Lipitor, Seroquel, Actos, Enbrel, Singulair, Levaquin, Zyprexa and Concerta. With passage of time, more drugs are set to lose patent rights, as such the post TRIPS era (if it happens in 2016), is not likely to have a devastating impact in the pharmaceutical market in Bangladesh (BRAC EPL Stock Brokerage Ltd, 2012).

1.4 Objective of the Study

Review of previous research indicates that many research has been conducted on how to manage the different elements of supply chain management and also how to improve the performance of supply chain management, nevertheless, the role of Information technology in these area has received inadequate attention. Globalization of world economy has made the supply chain more complicated from the managerial point of view and at the same time the development of information technology is much faster than the organization can cope with it.

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In Bangladesh, pharmaceuticals sector is a developing sector. Here some of the leading pharmaceuticals company follows Enterprise Resource Planning (ERP), and they are properly managing the whole part – inbound and outbound of a supply chain. This study will find out the actual scenario of using IT in SCM of pharmaceuticals sector in Bangladesh and also find out the problem of traditional supply chain of this sector.

Objective:

The potential objective of this research is to apply the IT based effective supply chain management in the Pharmaceuticals industry of Bangladesh.

For achieving this objective, the study will further may be divided into the following list of objectives:

- To identify the current supply chain management on IT in the pharmaceuticals industry of Bangladesh.
- To develop the application of IT in SCM of the pharmaceuticals industry in Bangladesh.
- To examine the implications of the findings on the supply chain management and also on information technology.

This research will give emphasis on the benefits of IT based SCM and provides some recommendations for the pharmaceuticals sector of Bangladesh.

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1.5 Organization of the Study

The study is divided into six chapters: Chapter 1 presented the Supply Chain Management (SCM), IT and supply chain management, the relation between computer and supply chain, benefits of IT in supply chain management, types of interfirm collaboration in supply chain management, overview of pharmaceutical industry in Bangladesh; The market size and growth, market growth, future growth, growth projections, major players, export and import of pharmaceutical industry has been reviewed. This chapter also included the objective of the study. Having rationalizes the research objective, then the Chapter 2 concentrates on the literature review. It provides stages of supply chain management development, an initial theoretical discussion of the ways in which software and internet tools can impact upon SCM initiatives, as well as providing a summary overview of some of the major software and internet-based tools available. The major e-sourcing software applications for instance ERP software like SAP and Oracle, the benefits of ERP, application of SAP and Oracle in pharmaceutical sectors, EDI, benefits of EDI, internet use in operations, IT and Pharmaceuticals industry supply chain management are also covered here. Having identified the gaps in previous research, in Chapter 3. In addition, in this chapter the conceptual framework and research framework on IT and supply chain has been described. Argument of the thesis, research question and the research methodology has also been described. After that, Chapter 4 concentrates on the description of IT and supply chain management in three pharmaceutical companies - Beximco Pharmaceuticals Ltd, Incepta Pharmaceuticals Ltd and ACI Pharmaceuticals Ltd; and analysis of data through SPSS

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package. The major statistical tools used included, among others, descriptive statistics and Cronbach's alpha test. Having description and data analysis Chapter 5 represents the findings of the study and describe the finding of three pharmaceutical companies - Beximco Pharmaceuticals Ltd, Incepta Pharmaceuticals Ltd and ACI Pharmaceuticals Ltd. After findings, Chapter 6 concentrated summary, conclusions and implications of the study. The study also recommends few things in the closing. Lastly this thesis included references and appendix.

1.6 Summary

The chapter presented the overview of supply chain management, the use information technology and computer in supply chain management, development of IT in supply chain management, benefits of IT in supply chain management, types of inter firm collaboration in supply chain management and the overview of pharmaceuticals industry in Bangladesh. The market size and growth, market growth, future growth, growth projections, major players, export and import of pharmaceuticals industry has been reviewed. Here also included the justification of thesis title and basic objective of the study. In this chapter also included the organization of the thesis. To this end, the forthcoming chapter will review of literature in the perspective of IT, SCM, pharmaceuticals industry supply chain and software & Internet-based tools to assist with the effective implementation of SCM initiatives.

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CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter concentrates on literature review of Information Technology (IT) and Supply Chain Management (SCM), the development stages of supply chain management, various information technologies used in supply chain management i.e. application of e-business tools, software and internet tools for effective supply chain management and supply chain management in pharmaceuticals industry. Here I explain all parts of this chapter according to review of previous literatures. I also included my field work experiences in the discussion of each section.

2.1 Review of Literature

So far we know, a large number of research studies, articles relating to various aspects of supply chain have been published at home and abroad. However, critical reviews of the relevant research studies/articles have been made in this study.

Lincoln and Bhattacharjee (2007) assessed the structure and performance of pharmaceutical industry in Bangladesh. They also focused on international trade, raw material, production scenario, informal trade, tariff structure and impact of WTO provisions on pharmaceutical industry in Bangladesh.

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Ahmad et al (2009) developed a scale for the measurement of service quality in pharmaceutical supply chain. Jambulingam et al (2009) show the importance of both procedural and distributive aspects of fairness on the part of pharmaceutical wholesalers as perceived by the pharmacies. Each aspect of fairness plays a more prominent role for fostering a particular type of trust, which in turn, leads to loyalty.

Kumar et al (2009) analyzed the pharmaceutical supply chain using the DMAIC process for improvement of the reverse logistics in a recall to avert the possibility of harm to a consumer. Rossetti and Handfield (2011) examined the major forces that are changing the way biopharceutical medications are purchased, distributed, and sold throughout the supply chain. The relationship between these forces is mediated by operations strategy concerning inventory policy, supply chain visibility, and desired service levels.

Klein and Rai (2009) focused on strategic information flows between buyers and suppliers within logistics supply chain relationships and on subsequent relationship specific performance outcomes. They found that buyer and supplier strategic information flows positively impact the relationship-specific performance of both sharing and receiving parties. Specifically, each party gains financially from improved management of assets, reduced costs of operations, and enhanced productivity. Buyer dependence on the supplier increases buyer strategic information flows to the supplier. Additionally, buyer IT customization and both buyer and supplier trusting beliefs in the receiving party positively impact strategic information sharing with partners. They suggested that partnerships for supply chain services engage in cooperative initiatives to

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generate relational rents and are an alternative to conventional "arms length" transactional exchanges.

Sanders (2005) evaluated the benefits gained by suppliers when investing in inter-organizational IT that is aligned with their primary buyer or network leader. He found IT alignment between supplier and buyer has a direct positive impact on both strategic and operational performance measures of the supplier. In addition, IT alignment impacts these performance measures indirectly as it encourages integration between firms.

Li et al (2009) presented a conceptual framework that hypothesizes the nature of the relationships between a firm's use of Internet based information technology (IT), supply chain planning capability, and operational performance. They suggested that IT's use in exploiting existing opportunities has both a direct effect and indirect effect, mediated through supply chain planning capabilities, on operational performance.

Hong et al (2010) examined the use of specific supply chain information technologies (IT) for e-commerce, e-procurement, and enterprise resource planning (ERP), when implementing lean practices to achieve mass customization (MC). They suggested that lean practices can reasonably predict MC performance. They also suggested that e-commerce use is a better predictor of performance than e-procurement or ERP for service focused manufacturers. E-commerce and e-procurement appear to be reasonable predictors of MC performance in product manufacturers.

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Kim and Lee (2010) conceptualized systems collaboration and strategic collaboration as two essential types of inter firm collaboration. They also examined the multiple roles of systems collaboration and strategic collaboration, and how they directly and indirectly influence a firm's supply chain responsiveness and market performance. They suggest that the sequential relationships among IT competency, inter firm collaboration, and supply chain responsiveness have significant market performance implications.

Rai et al (2006) suggested that integrated IT infrastructures enable firms to develop the higher order capability of supply chain process integration. This capability enables firms to un-bundle information flows from physical flows, and to share information with their supply chain partners to create information based approaches for superior demand planning, for the staging and movement of physical products, and for streamlining voluminous and complex financial work processes. Furthermore, IT enabled supply chain integration capability results in significant and sustained firm performance gains, especially in operational excellence and revenue growth.

Rai et al (2012) identified a set of IT functionalities-single location shipping, multi location shipping, supply chain visibility, and financial settlement- that can be used to manage the flows of physical goods, information, and finances across locations inter-firm logistics processes. They proposed interfirm IT capability profiles and interfirm communications have both a direct and an interaction effect on relational value.

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Thun (2010) investigated the relationship between the focus and implementation degree of internet based IT applications and the scope and orientation of process oriented integration in global supply chains.

Auramo et al (2005) provided empirical evidence of benefits from IT in supply chain management. They introduced five propositions on the use and benefits of IT. First, successful companies have developed focused e-business solutions for improving customer service. Second, improved efficiency allows company personnel to focus more on critical business activities. Third, the use of e-business solutions improves information quality. Fourth, e-business solutions support planning collaboration and improved agility of the supply network. Finally, to gain strategic benefits, the use of IT has to be coupled with process redesign.

Presutti (2003) emphasized on supply chain management is creating a greater focus on the supply management link in the supply chain. This focus will become even more intense as firms continue to adopt e-procurement strategies to leverage the competitive advantages of the Internet. Supply managers need to understand the impact of technology and gain competency in making a business case for e-procurement. The implications are profound for the industrial marketer.

Wu et al (2006) suggested that the investment in IT per se does not guarantee enhanced organizational performance. Drawing from the resource-based view, this study proposes that IT-enabled supply chain capabilities are firm-specific and hard-to-copy across

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organizations. These capabilities can serve as a catalyst in transforming IT-related resources into higher value for a firm. The findings provide a new perspective in evaluating IT investment in the supply chain process.

White et al (2005) suggested that high levels of coordination between organizations, necessary for improved supply chain performance, demand high levels of integration between partners' information systems. However, these high levels of integration reduce the ability to frequently and rapidly make changes to trading relationships, something that is a prerequisite of the agility paradigm. This paper seeks to explore how a number of emergent information systems offer the possibility of both deep integration and increased flexibility. This paper is exploratory in nature. A single case study of an organization seeking to improve supply chain agility is reported. Existing literature and the insights provided by the case study are combined to identify a number of themes for further study.

Ali and Kumar (2011) analyzed the role of information delivery through information and communication technology (ICT) in enhancing decision-making capabilities of Indian farmers. Users of e-Choupal show significantly better decision-making aptitudes, as compared to non-users, on various agricultural practices across the agricultural supply chain. Further, socio-demographic backgrounds of the users such as education levels, the social category they belong to, income levels and landholding size also play a significant role in impacting decision-making aptitudes. The impact is particularly prominent in production planning and post-harvest and marketing related decisions.

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Policy implications of these findings are discussed. The study emphasizes the importance of designing ICT enabled information systems to suit the socio-demographic profile of the user groups.

Johnson et al (2007) analyzed the drivers and outcomes of e-business technology use in the supply chain. Using a combination of case studies and survey data from a diverse sample of industries, the research examines how industry context, firm characteristics and firm-level strategic resources, such as purchasing teams, influence the exploitation of e-business technologies and the relationship between e-business technology use and firm performance. Based on a synthesis of related literatures from transaction cost economics and the relational view of the supply chain, a two-dimensional framework for e-business technology is proposed with transactional and relational dimensions. However, empirical analysis indicated that transactional technologies can be further subdivided into two factors: dyadic cooperation and price determination. Significant differences were found between the two dimensions in terms of their overall levels of adoption, with dyadic coordination being the most widely adopted. In addition, the development of strategic resources expanded, in particular internal and customer teams, the use of e-business technologies expanded. Purchasing organizational structure and firm size also were positively related to the adoption of transactional e-business technologies. Finally, of particular importance to practitioners, e-business technologies targeted at reducing dyadic coordination costs lead to improved financial performance.

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Byrd and Davidson (2003) examined the impact of information technology (IT) on the supply chain through a survey of 225 large for-profit US firms. Specifically, it involved the determination of IT antecedents to IT impact on the supply chain and the effect that these relationships had on overall firm performance. The respondents were primarily chief information officers and other top IT executives. The factors in the study were validated using confirmatory factor analysis. A model featuring the IT antecedents, IT impact on the supply chain, and firm performance was evaluated using a structural equation analysis. The data used fit well with the hypothesized relationships in the model, as all links were significant. The findings here suggested that the antecedents, IT department technical quality, IT plan utilization, and top management of IT positively affected IT impact on the supply chain. The results also revealed a positive relationship between IT impact and firm performance.

Wu and Chang (2012) indicated that there are significant differences between external diffusion and the two earlier stages, adoption and internal diffusion, on the four BSC perspectives. Furthermore, all of the four perspectives are well realized at external diffusion stage. Implications for managers and scholars are discussed.

Bendavid and Boeck (2011) presented a Radio-Frequency Identification (RFID)-enabled traceability system for the management of consignment and high value products requiring item level traceability in a hospital environment. The solution can be considered (i) as an alternative to RFID-enabled cabinets used in the replenishment of consignment and high value supplies in certain operating rooms, cardiac catheterization

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laboratories and interventional radiology departments, or (ii) as a complementary solution facilitating the tracking of medical devices removed from RFID-enabled cabinets. In short, the end-to-end traceability of medical products in the healthcare supply chain can be significantly enhanced. In another research, Rahman (2003) discussed how Internet is being used in the management of various areas of supply chain.

Ranganathan et al (2011) focused on two main objectives – (i) to understand the key antecedents that affect the web enablement of SCM activities; (ii) to document the performance impacts of web-enabled SCM efforts. Based on a large-scale, questionnaire survey of North American organizations, we assessed the influence of six factors namely – supplier synergy, information intensity, managerial IT knowledge, interoperable IT infrastructure, perceived IT returns on investments (ROI) and formal governance mechanisms – on the extent of web-enabled SCM. The results of the study revealed a strong positive influence of supplier synergy, information intensity, managerial IT knowledge, inter-operability and formal governance mechanisms on the extent of web-enabled SCM. They also found a negative association between relative cost–benefit perceptions and the extent of web-enabled SCM. Further, we also found strong positive association between extent of web-enabled SCM and the benefits realized from SCM efforts. They discuss the implications of their results for research and practice.

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Dehning et al (2007) examined the financial benefits of information technology investments around newly adopted IT-based supply chain management (SCM) systems by 123 manufacturing firms over the period 1994–2000.They form hypotheses using the value chain to specify the expected financial impact of SCM systems. By examining the change in financial performance pre- and post-adoption controlling for industry median changes in performance, they find that SCM systems increase gross margin, inventory turnover, market share, return on sales, and reduce selling, general, and administrative expenses. They also provide a model showing how process improvements around supply chain initiatives combine to improve overall performance. Finally, they show that contextual effects such as firms in the high-tech industry and the scope of the supply chain implementation have dramatic effects on the overall financial performance resulting from supply chain implementations.

Devaraj et al (2007) hypothesized that while there may be no direct benefit of e-Business technologies on performance, these technologies might support customer integration and supplier integration in the supply chain, which in turn might impact operating performance. To examine their hypotheses, they collected data from respondents who focused their responses to a single major product the process that manufactures it, a significant customer, and an important supplier. Their analyses showed that there was no direct benefit of e-Business technologies on performance; however these technologies supported customer integration and supplier integration. Further, supplier integration was found to positively impact cost, quality, flexibility, and delivery performance; however there was no relationship between customer integration

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and performance. Consequently, there is a relationship between e-Business technologies and supplier integration that leads to better performance. Further, there is an interactive effect between customer integration and supplier integration that supports the notion that firms that have both forms of integration, supported by e-Business technologies, significantly outperform the others.

Zhou and Benton (2007) showed that (1) effective information sharing significantly enhances effective supply chain practice; (2) supply chain dynamism has significant positive influence on effective information sharing as well as effective supply chain practice. Supply chain dynamism has more influence on information sharing than supply chain practice; (3) and effective supply chain practice becomes more important when the level of information sharing increases. The findings show that both effective information sharing and effective supply chain practice are critical in achieving good supply chain performance.

Klein (2007) examined supply chain management relationships between service providers and clients, focusing on the performance impacts of (1) the level of customization implemented by clients using vendor provided e-Business solutions and (2) the subsequent real time access achieved with respect to operational information maintained by vendors. The study also focuses on the impacts of the provider's information exchange behavior and both parties' level of trust. Using dyadic data collected from a logistics services provider and 91 clients, findings show that the level of customization and real time information access has a direct positive impact on

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performance outcomes realized by both. Additionally, results demonstrate that provider's level of trust in the client positively influences their information exchange behavior, and in turn, information exchange behavior positively impacts client customizations.

Kroes and Ghosh (2010) evaluated the degree of congruence (fit or alignment) between a firm's outsourcing drivers and its competitive priorities and assess the impact of congruence on both supply chain performance and business performance, using empirical data collected from manufacturing business units operating in the United States. They find outsourcing congruence across all five competitive priorities to be positively and significantly related to supply chain performance. They also find the level of supply chain performance in a firm to be positively and significantly associated with the firm's business performance.

Cao and Zhang (2011) indicated that supply chain collaboration improves collaborative advantage and indeed has a bottom-line influence on firm performance, and collaborative advantage is an intermediate variable that enables supply chain partners to achieve synergies and create superior performance. A further analysis of the moderation effect of firm size reveals that collaborative advantage completely mediates the relationship between supply chain collaboration and firm performance for small firms while it partially mediates the relationship for medium and large firms.

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Parmigiani et al (2011) spotlighted the dimensions of control and accountability that collectively determine stakeholder exposure, and show how this new construct affects the linkages between supply chain capabilities, configuration, and performance. In particular, this analysis reveals that the nature of stakeholder exposure determines how social/environmental technical and relational capabilities impact social and environmental outcomes. They conclude with implications for research and practice, discussing how current supply chain theories must be extended to incorporate external stakeholders, to clarify strategies and identify potential pitfalls, and to better predict performance outcomes.

Rexhausen et al (2012) examined the relative impact of relevant practices associated with demand and distribution management. They also collected data from 116 multi-national companies based in Europe and analyzed it using structural equation modeling techniques. The results of the study suggest that (i) high demand management performance has a substantial positive impact on the overall supply chain performance, (ii) this effect is stronger than that of distribution management performance, and (iii) there is no evidence that demand management might be an enabler for effective distribution management.

Amrani et al (2012) investigated by simulation the sensitivity of the supply chain's performance to the variations of two main supply commitments negotiated by contract: flexibility rate and frozen horizon. Each partner belonging to the SC of the OEM performs its own production planning process. A generic analytical model was proposed

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and applied to simulate the decisional behavior of each partner in planning its production activities. Contractual constraints (resulting from supply contracts) are formalized and incorporated into the model to allow the study of their impact. Experiments are carried out through a mobile phone SC case study confronted with market fluctuation. The performance of a partner and a SC is assessed via different indicators, mainly the cost and the reliability. The computational results address some managerial findings that are helpful in defining an interesting supply contract along the SC to achieve global performance.

Cho et al (2012) developed a framework of service supply chain performance measurement. Based on the strategic, tactical and operational level performance in a service supply chain, measures and metrics are discussed. The emphasis is on performance measures dealing with service supply chain processes such as demand management, customer relationship management, supplier relationship management, capacity and resource management, service performance, information and technology management and service supply chain finance. And to prioritize service supply chain performance measurement indicators to improve service supply chain performance, a methodology based on the extent fuzzy analytic hierarchy process is stressed. The developed framework of service supply chain performance measurement is applied to the hotel supply chain. The results of this study are useful both to practitioners in the service supply chain and to researchers carrying out further studies in the field.

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Akkermans et al (2003) conducted 23 Dutch supply chain executives of European multi-nationals. Findings from this exploratory study were threefold. First, our executives have identified the following key SCM issues for the coming years: (1) further integration of activities between suppliers and customers across the entire supply chain; (2) on-going changes in supply chain needs and required flexibility from IT; (3) more mass customization of products and services leading to increasing assortments while decreasing cycle times and inventories; (4) the locus of the drivers seat of the entire supply chain and (5) supply chains consisting of several independent enterprises. The second main finding is that the panel experts saw only a modest role for ERP in improving future supply chain effectiveness and a clear risk of ERP actually limiting progress in SCM. ERP was seen as offering a positive contribution to only four of the top 12 future supply chain issues: (1) more customization of products and services; (2) more standardized processes and information; (3) the need for worldwide IT systems; and (4) greater transparency of the marketplace. Implications for subsequent research and management practice are discussed. The following key limitations of current ERP systems in providing effective SCM support emerge as the third finding from this exploratory study: (1) their insufficient extended enterprise functionality in crossing organizational boundaries; (2) their inflexibility to ever-changing supply chain needs, (3) their lack of functionality beyond managing transactions, and (4) their closed and non-modular system architecture. These limitations stem from the fact that the first generation of ERP products has been designed to integrate the various operations of an individual firm. In modern SCM, however, the unit of analysis has become a network of organizations, rendering these ERP products inadequate in the new economy.

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Gunasekaran and Ngai (2004) attempted to find ways to improve their flexibility and responsiveness and in turn competitiveness by changing their operations strategy, methods and technologies that include the implementation of SCM paradigm and information technology (IT). However, a thorough and critical review of literature is yet to be carried out with the objective of bringing out pertinent factors and useful insights into the role and implications of IT in SCM. In this paper, the literature available on IT in SCM have been classified using suitable criteria and then critically reviewed to develop a framework for studying the applications of IT in SCM. Based on this review and analysis, recommendations have been made regarding the application of IT in SCM and some future research directions are indicated.

Lee et al (2011) examined coordination problems and corresponding incentive mechanisms between a manufacturer and a retailer for jointly investing in a new technology that has the potential to improve the efficiency and security of the supply chain. They show that depending on the relative strength of the efficiency and security concerns, supply chain stakeholders in a decentralized supply chain face two different coordination problems in investing in the new technology: (1) when security concerns are not strong enough to dominate efficiency concerns, stakeholders may not have a sufficient incentive to invest; therefore, at least one stakeholder under invests. Their analysis shows that internal incentive mechanisms, such as investment cost sharing between stakeholders, are not likely to resolve this underinvestment; instead, external financial incentive mechanisms, such as tax incentives, need to be considered. (2) When

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security concerns are strong enough to dominate efficiency concerns, stakeholders may not invest at all because of the uncertainty of other stakeholders' behavior, rather than the lack of an incentive to invest in the technology. Their analysis shows that external interventions, such as imposing a penalty for a breach of security, can be used as a way of reducing such behavioral uncertainty.

Li et al (2009) investigated the relationship among three factors: IT implementation, supply chain integration (SCI), and SCP. It presents a conceptual structure model in which IT implementation can affect SCP either directly or indirectly, via SCI. Datacollectedfrom182Chinesecompaniesare analyzed using structural equation modeling. The results suggest that IT implementation has no direct effect on SCP, but instead that it enhances SCP through its positive effect on SCI. These findings highlight the importance for companies to promote SCI and implement IT as an enabler.

Breen and Crawford (2005) examined the role of e-commerce in hospital pharmacy in the procurement of pharmaceuticals and determine how this has improved the internal pharmaceutical supply chain. Whilst e-commerce is in its infancy in this area it is still considered to be an important facet of supply chain management. E-trading within National Health Service (NHS) pharmacies is conducted via electronic data interchange (EDI) offering proven benefits and ensuring the efficient and effective transmission of data between remote parties. They supported that there are benefits to be gained from introducing EDI into a purchasing department as the next logical step towards a total e-commerce solution (internet based) and instigating quality improvements. They also

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proposed that the implementation and use of e-commerce in hospital pharmacies can be aligned with progress made in small to medium seized enterprises.

Afrin (2010) examined the performance of supply chain management pertinent to third party listed pharmaceutical companies applying some parameters such as order taking, delivery and possession of raw materials and finished products, information of suppliers and so on.

Thus it appears from the preceding discussions that IT use in supply chain have not been addressed in Bangladesh. It would, therefore, not be unjustified to state that present study is the first of its kind in Bangladesh and can be used for guidelines for the similar studies in years ahead.

2.2 Stages of Supply Chain Management Development

Historically, synchronizing the supply chain has always occupied a central position in the management of the enterprise, linking business marketing and sales strategies with manufacturing, inventory, and service execution. As far back as the beginning of the twentieth century, economists considered the activities associated with effectively managing business channels to be the crucial mechanism by which goods and services were exchanged through the economic system. However, despite its importance, this concept, first termed *logistics,* was slow to develop. Most business executives considered the channel management function to be of only tactical importance and,

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because of the scope and lack of integration among supply network nodes, virtually impossible to manage as an integrated function. In fact, it was not until the late 1960s, when cost pressures and the availability of computerized information tools enabled forward-looking companies to begin to dramatically revamp the nature and function of the supply chain that the strategic opportunities afforded by logistics began to emerge. The SCM concept could be said to consist of five distinct management stages.

The first can be described as the era of internal logistics departmentalism. In the second stage, logistics began the migration from organizational decentralization to centralization of core functions driven by new attitudes associated with cost optimization and customer service. Stage three witnessed the dramatic expansion of logistics beyond a narrow concern with internal warehousing and transportation to embrace new concepts calling for the linkage of internal operations with analogous functions performed by channel trading partners. As the concept of channel relationships grew, the old logistics concept gave way, in stage-four, to full supply chain management. Today, with the application of Internet technology to the SCM concept, we can describe SCM as entering into stage five, e-SCM. These stages are portrayed in **Table 2.1** which is on the next page (63).

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Table 2.1 SCM Management Stages

SCM Management Stages

SCM Stage	Management Focus	Organizational Design
	Stage 1 to 1960s	
Warehousing and Transportation	Operations performance Support for sales/marketing Warehousing Inventory control Transportation efficiencies	Decentralized logistics functions Weak internal linkages between logistics functions Little logistics management authority
	Stage 2 to 1980	
Total Cost Management	Logistics centralization Total cost management Optimizing operations Customer service Logistics as a competitive advantage	Centralized logistics functions Growing power of logistics management authority Application of computer
	Stage 3 to 1990	
Integrated Logistics Management	Logistics planning Supply chain strategies Integration with enterprise functions Integration with channel operations functions	Expansion of logistics functions Supply chain planning Support for TQM Expansion of logistics management functions
	Stage 4 to 2000	
Supply Chain Management	Strategic view of supply chain Use of extranet technologies Growth of coevolutionary channel alliances Collaboration to leverage channel competencies	Trading partner networking Virtual organization Market coevolution Benchmarking and reengineering Supply chain TQM metrics
	Stage 5 2000+	
e-Supply Chain Management	Application of the Internet to the SCM concept Low-cost instantaneous sharing of all databases e-Information SCM synchronization	Networked, multi-enterprise supply chain .coms, e-tailers, and market exchanges Organizational agility and scaleability

Ross, David F. (2003), *Introduction to e-Supply Chain Management: Engaging Technology to Build Market Winning Business Partnerships*, St. Lucie Press, Washington D.C.

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After analyze the stages of given table 2.1 and related literature, I explain here a short discussion of each stage. The discussion are as follows:

First Stage — Logistics Decentralization

Historically, the first stage of SCM occurred in the period extending from the late century to the early 1960s. During this era logistics was not perceived as a source of significant competitive advantage. Viewed essentially as an intermediary function concerned with inventory management and delivery, it was felt that logistics could not make much of a contribution to profitability and, therefore, was not worthy of much capital investment. It was accorded little management status, and assigned less qualified staff. For the most part, companies segmented logistics activities, dividing them among operations functions, such as sales, production, and accounting. Not only were activities that were naturally supportive, such as procurement management, inbound transportation, and inventory management, separated from one another, but narrow departmental performance measurements also pitted logistics functions against each other. The result was a rather disjointed, relatively uncoordinated, and costly management of logistics activities.

In an era when process and delivery cycle times were long, global competition practically non-existent, and the marketplace driven by mass production and mass distribution, logistics decentralization was a minor problem for most companies. By the early 1960s, however, changes in the business climate were forcing executives to rethink their logistics strategies. To begin with, expanding product lines, demand for

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shorter cycle times, and growing competition had begun to expose the dramatic wastes and inefficiencies of logistics decentralization. Second, executives were finding themselves handcuffed by the lack of a unified logistics planning and execution strategy. Logistics responsibilities were scattered throughout the organization, and no single manager was responsible for integrating channel management activities with the rest of the business. Finally, logistics decentralization had made it impossible to pursue effective cost trade-off strategies. Logistics performance was often caught in a performance measurement paradox. For example, transportation might seek to reduce costs by requiring a higher payload-to-cost ratio, even if the decision resulted in higher inventories.

By the mid-1960s it was clear that the existing structure and purpose of logistics and channel management functions were in need of serious revision. As late as 1969, Donald Bowersox, the dean of modern logistics management, lamented that the management science of logistics was still in its infancy. There was no standardization of terms or a commonly accepted vocabulary. No one was quite sure what form a revamped logistics function should look like. Should it be attached to the firm's marketing function? Should it be attached to manufacturing? Should it be a department on its own? What would be the impact on logistics of the growth of computerized technology?

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Second Stage — Total Cost Management

The second stage in the evolution of SCM can be said to revolve around two critical focal points. The first can be described as the concerted effort made by companies to centralize logistics functions into a single management system. By merging what previously had been a series of fragmented functions into a single department, it would be possible to decrease individual costs associated with transportation, inventory, and physical distribution, while simultaneously increasing the productivity of the logistics system as a whole. Second, it was hoped that centralization would facilitate the application of the *total cost concept* to logistics. The objective of this strategy is to strive to minimize the total cost of logistics, rather than focus on reducing the costs of one or two specific logistics functions, such as transportation or warehousing. A much larger assumption was that, because logistics costs and customer service were reciprocal, it would be easy to calculate the cost trade-offs necessary to balance total logistics costs with marketing and sales objectives.

The movement toward logistics centralization was driven by three converging factors. To begin with, as the economic and energy crises of the mid-1970s dramatically drove up inventory carrying costs, the marketplace began to demand smaller order quantities and more frequent deliveries from their supply partners. Second, explosions in product lines during the period required everyone in the supply channel to deliver products on time, avert obsolescence, and prevent channel inventory imbalances. Finally, new concepts of marketing, pricing, and promotion facilitated by the computer necessitated a

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thorough change in the cumbersome, fragmented methods of traditional channel management.

In addition to the operational demands driving reinvention of the logistics, a number of new ideas regarding the strategic place of logistics in the enterprise were emerging simultaneously. The first was the growing realization that, instead of a disconnected series of functions, logistics should rather be considered as a single integrated supply system. Complementary to this new idea of logistics was the application of new computerized technologies and management methods. During this period, computers became much more sophisticated, less costly, and more accessible. Also, new management methods centering on *just-in-time* (JIT), zero inventories, and quality management permitted companies to be more flexible and responsive, further eroding the old logistics model. Finally, logistics centralization was further accentuated by the realization that effective execution of logistics functions was critical to expanding customer service. As the era of mass production and mass distribution faded, companies found themselves looking to logistics capabilities to assist in gaining and sustaining competitive advantage through the coordination of channel resources.

Third Stage — Integrated Functions

During the 1980s, enterprise executives became increasingly aware that focusing solely on the total cost of logistics represented a passive approach to channel management. This awareness was driven by the radical changes occurring in what was rapidly becoming a global marketplace. If the decade could be compressed into two

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quintessential catchwords, they would be *competition* and *quality management.* Competition came in the form of tremendous pressure from global companies, often deploying radically new management philosophies and organizational structures that realized unheard-of levels of productivity, quality, and profitability. The threat also came from a new view of the place of quality and how it could be implemented to capture marketplace advantage. Management concepts, driven by JIT and *total quality management* (TQM) philosophies, were providing competitors with tools to compress time out of development cycles, engineer more flexible and lean processes, tap into the creative powers of the workforce, and generate entirely new forms of competitive advantage.

Businesses responded to these challenges by focusing, first of all, on revamping their organizations, either through corporate restructuring or by searching for methods to achieve cost reductions, work-force retraining, the application of technology to improve productivities, more careful use of fixed and variable assets, strategic outsourcing, and identification of customers, products, and markets providing the greatest potential for competitive advantage. Second, companies began to understand that logistics and other channel management functions could be leveraged as a dynamic force capable of winning customers beyond the execution of traditional marketing objectives.

Competitive values, such as speed of delivery, value-added services, development time to market, materials acquisition, and product availability, could be realized when the

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entire organization worked together, both internally and in close collaboration with supply chain trading partners.

One of the most significant results of the challenges of the 1980s was the recognition that logistics itself constituted a significant competitive weapon. Up to this period, most executives had viewed logistics as playing a tactical role, with little impact on corporate strategic planning. By the mid-1980s, however, companies began to understand that, by enabling organizations to pursue both cost/operational and service/value advantages through continuous process improvement and closer integration with channel partners, logistics could provide enormous strategic value.

By enabling trading partners not only to integrate their logistics functions but also to converge supporting efforts occurring in marketing, product development, inventory and manufacturing capacity planning, and quality management, companies could tap into reservoirs of virtual resources and competencies unattainable by even the largest of corporations acting independently. The realization of this opportunity is the subject matter of stage-four SCM.

Fourth Stage — Supply Chain Management

During the mid-1990s, companies began to expand the concepts of integrated logistics and supply channel management to embrace the new realities of the marketplace. The acceleration of globalization, the increasing power of the customer demanding ever higher levels of service and supplier agility, organizational reengineering, third party

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businesses to look beyond the integrated logistics paradigm in the search for new strategic models. The pressure of responding to these new challenges compelled organizations to implement what only can be called a dramatic paradigm shift from stage-three logistics to SCM. The fundamental feature of the integrated logistics model was the merger of channel management functions with those of trading partners targeted at improving customer service and total cost reduction across whole channels. In contrast, at the core of phase four organizations is a distinct recognition that competitive advantage can only be built by optimizing and synchronizing the productive competencies of each channel trading partner to realize entirely new levels of customer value. Using the *supply chain operations reference* (SCOR) model as a benchmark, the differences between stage-three logistics and stage-four SCM can be clearly illustrated.

Plan

In stage-three logistics, most business functions were still inward looking. Firms focused their energies on internal company scenario planning, business modeling, and corporate resource allocation management. ERP systems and sequential process management tools assisted managers to execute channel-level inventory flows, transportation, and customer fulfillment. In contrast, stage-four SCM companies began to perceive themselves and the supply networks to which they belonged as .value chains. Knowing the total cost to all network partners and optimizing the customer-winning velocity of collective supply channel competencies became the central focus. Companies began to deploy channel optimization software and communications enabling tools like EDI to network their ERP systems, in order to provide visibility to requirements needs across the entire network.

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Source

Companies with stage-three sourcing functions utilize the integrated logistics concept to merge their procurement needs with the capabilities of their channel suppliers. The goal is to reduce costs and lead times, share critical planning data, assure quality and delivery reliability, and develop win-win partnerships. In contrast, stage-four SCM sourcing functions perceive their suppliers as extensions of a single supply chain system. Besides achieving the benefits of integrated logistics, a critical goal of SCM-driven companies is to utilize channel data to execute volume purchasing to benefit all network trading partners. When possible, computerized extranet technologies are used to assemble channel collaborative relationships pointing toward consortia buying. Transportation and warehousing costs are reduced by the joint utilization of outsourcing opportunities, thereby reducing the overall assets invested in channel inventories.

Make

Stage-three organizations resist sharing product design and process technologies. Normally, collaboration in this area is undertaken in response to quality management certification or when it is found to be more economical to outsource manufacturing. There is minimal networking between trading partners when it comes to *computer aided design* (CAD) and ERP manufacturing databases. Stage-four companies, on the other hand, seek to make collaborative design planning and scheduling with their supply chains a fundamental issue. When possible, they seek to closely integrate their ERP systems to eliminate time and cost up and down the supply channel. SCM firms also

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understand that speedy product design-to-market occurs when they seek to leverage the competencies and resources of channel partners to generate virtual manufacturing environments that are capable of being as agile and scaleable as necessary to take advantage of every marketplace opportunity.

Deliver

Customer management in stage-three companies is squarely focused on making internal sales functions more efficient. A heavy priority is placed on basic available-to-promise functionality, finished goods management, and determining the proper timing of distribution channel differentiation. While there is some limited sharing of specific information on market segments and customers, databases are considered proprietary, and pricing data is rarely shared. In contrast, stage-four SCM firms are focused on reducing logistics costs and channel redundancies by converging channel partner warehouse space, transportation equipment, and delivery capabilities. Customer management looks toward automation tools to facilitate field sales, capability to promise tools, *customer relationship management* (CRM) software, mass customization, and availability of general supply chain repositories of joint trading partner market and customer data.

Stage-four SCM organizations possess the power to move beyond a narrow focus on channel logistics optimization to one where channel partners strive to identify the best core competencies and collaborative relationships among their trading partners in the search for new capabilities to realize continuous breakthroughs in product design,

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manufacturing, delivery, customer service, cost management, and value-added services before the competition. Through the application of SCM tools that seek to network whole supply channels, enterprises have the capability to view themselves and their channel partners as extended virtual organizations, possessed of radically new methods of creating marketplace value.

Fifth Stage — e-Supply Chain Management

Today, the application of Internet technology has propelled the Supply Chain Management (SCM) concept to a new dimension. Originating as a management method to optimize internal costs and productivities, SCM has evolved, through the application of e-business technologies, into a powerful strategic function capable of engendering radically new customer value propositions through the architecting of *external,* Internet-enabled collaborative channel partnerships. Actualizing e-SCM is a three-step process. Companies begin first with the integration of supply channel functions within the enterprise. An example would be integrating sales and logistics so that the customer, rather than departmental measurements, would receive top attention. The next step would be to integrate across trading partners channel operations functions, such as transportation, channel inventories, and forecasting. Finally, the highest level would be achieved by utilizing the power of the Internet to synchronize the channel functions of the entire supply network into a single, scalable virtual enterprise, capable of optimizing core competencies and resources from anywhere at any time in the supply chain to meet market opportunities.

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2.2.1 Application of e-business tools

To apply the e-business tools properly in Supply Chain Management systems the following things are considered:

Product and Process Design

As product life cycles continue to decline and development costs soar, firms have been quick to utilize Internet enablers to link customers to the design process, promote collaborative, cross-company design teams, and integrate physical and intellectual assets and competencies in an effort to increase speed to market and time to prompt. In the past, efforts utilizing traditional product data management systems and exchange of design data had been expensive, cumbersome, and inefficient. Internet technologies, on the other hand, now provide interoperable, low cost, real-time linkages between trading partners. For example, Adaptec, a semiconductor manufacturer, is connected through its Web-based network to its manufacturing and assembly partners in Taiwan, Hong Kong, and Japan. During product development, chip designers send designs and diagrams through the network to their partner counterparts for review, simulation, and real-world testing. Test outcomes are immediately communicated to Adaptec for redesign or approval. Since the entire process can be performed in real time, product design and market introduction have been dramatically cut.

e-Marketplaces and Exchanges

Sales and procurement have traditionally been concerned with proprietary channels characterized by long-term relationships, negotiation over lengthy contracts, long lead

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times, and fixed margins. Today, the Internet is completely reshaping this environment. Companies can now buy and sell across a wide variety of Internet enabled marketplaces ranging from independent and private exchanges to auction sites. As an example, Ingersoll-Rand has launched a business-to-business (B2B) service provider unit designed to help companies with annual sales of under $900 million who purchase similar types of products as Ingersoll-Rand. The goal is to get participators from the bottom tier of the supply base to outsource their purchasing effort to the site. In addition, the site plans to give smaller suppliers a chance to participate in collaboration, program development, problem solving, and design issues.

Collaborative Planning

Historically, enterprises were averse to sharing critical planning information concerning forecasts, sales demand, supply requirements, and new product introduction. Such information was considered proprietary and strictly reserved for internal strategic planning functions. Today, as many organizations increasingly outsource non core functions to network partners, the ability to transfer planning information online and real-time to what is rapidly becoming a virtual supply chain has become a necessity. The challenge has become how to transfer product and planning information across the business network to achieve the two-way collaboration necessary for joint decision-making. Fujitsu Computer Products of America, Inc. **(FCPA),** San Jose, CA, responded to the need for greater planning collaboration with their trading partners data by implementing state-of-the-art supply chain planning software. The system provides FCPA employees with the ability to access and manage information about product

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forecasting, availability, and deployment throughout various stages in the supply chain process. The result is that FCPA can track inventory levels and sources of supply, evaluate options and make decisions quickly, and refresh the supply chain database as needed.

Fulfillment Management

The collapse of the dot-com era in 2000 revealed one of the great weaknesses of e-business. Customers may have access to product information and can place orders at the speed of light, but actual fulfillment is still a complex affair that occurs in the physical world of materials handling and transportation. Solving this crucial problem requires the highest level of supply chain collaboration and takes the form of substituting, as much as possible, information for physical flows of inventory. Some of the methods incorporate traditional tools, such as product postponement, while others utilize Web-based network functions, providing logistics partners with the capability to consolidate and ship inventories from anywhere in the supply network and generate the physical infrastructures to traverse the last mile to the customer. An example would be the strategic partnership between Ford Motor Company and UPS Logistics. Using real-time Web-based technologies with leading edge distribution network design and execution, the alliance is designed to reduce by up to 40% the time required to deliver vehicles from Ford plants to the customer.

As this section concludes, it is clear that channel management is no longer the loose combination of business functions characteristic of stages one and two logistics. The

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system provides pinpoint network operations capability through real-time reporting by Autogistics people at every node in the delivery channel. New Internet-enabling technologies and management models have not only obscured company functional boundaries, they have also blurred the boundaries that separate trading partners, transforming once isolated channel functions into unified, virtual supply chain systems.

Today's top companies are using Internet connectivity to reassemble and energize supply chain management processes that span trading partners to activate core competencies and accelerate cross-enterprise processes. They are also using Web technologies to enable new methods of providing customer value by opening new sales channels as they migrate from pure bricks and mortar to click-and-mortar business architectures (Ross, 2003).

2.3 Software and Internet tools for effective Supply Chain Management

In this section, the scope for software and Internet-based tools to assist with the effective implementation of SCM initiatives is discussed. The section provides an initial theoretical discussion of the ways in which software and Internet tools can impact upon SCM initiatives, as well as providing a summary overview of some of the major software and Internet-based tools available. This section also provides a decision-making framework to allow managers to understand whether software and Internet-based applications will be beneficial in implementing particular types of SCM initiatives. The discussion demonstrates that, while there are some tools that may assist

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SCM initiatives, many of the current tools available are not necessarily directly relevant. Furthermore, those that are relevant tend to assist primarily with process efficiency initiatives associated with the eradication of waste resulting from poor information flow.

2.3.1 Benefit Perspective of Software and Internet Tools for SCM Initiatives

The first question that a practitioner must ask when considering the relative utility of any software or Internet tool for SCM initiatives concerns the purpose of the SCM initiative itself. This is an important question because there has been tremendous hype in recent years (not least from potential application providers) about how the Internet and software applications will enable companies to 'optimize' the efficiency of their supply chains. At the outset, therefore, it is imperative that we understand theoretically and practically what any SCM initiative is seeking to achieve, and only then consider the ways in which any software and Internet based tools can assist with such initiatives. As we saw earlier, SCM initiatives can be focused on three very different (if sometimes inter-related) areas:

- Process efficiency to reduce costs in the delivery of existing goods and services.
- Innovations to change the functionality of the goods and services produced.
- Achievement of both these desired outcomes at the same time.

It is clear, therefore, that at the outset practitioners must be sure about the real purpose of any SCM initiative and fundamentally understand how any particular software or

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Internet-based tool will, or will not assist with the delivery of any specifically desired outcome (Cox, Andrew 2003).

It is important to understand, however, that these optimization benefits only occur if the key problem in the supply chain is one associated with a lack of timely and accurate information – and all the players in the chain are signed up to the same information management software systems. While there are clearly major problems of this nature in supply chains, one has also to recognize that many of the problems that SCM initiatives are trying to resolve (even within process efficiency focused approaches) may not relate to information flow at all.

It may be that, the major benefits of a SCM initiative arise as a result of bringing together all the players in the supply chain through supplier networks or supplier association meetings. In such meetings the supply chain players are Software and Internet tools for effective SCM to develop a common understanding of physical operational problems and not just those created by the flow of order-related information.

Indeed, one can argue that much of the best practice in SCM arises from the development of this common understanding amongst participants about the suboptimal physical processes that exist within companies and the ways in which they operate internally. The benefits of SCM initiatives may then arise due to the willingness of participants to work together to redesign processes and systems to allow optimization

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through a common understanding of problems. In such circumstances it is a sharing of problems rather than having timely and accurate information that will be the basis on which the SCM initiative succeeds, not the availability of the latest software or Internet-based systems and processes to link information flow.

There is also another problem that relates to the **lock-in problem** that faces any buyer when it selects and installs particular software or Internet–based applications. While recognizing the significance of accurate and timely information flow for supply chain optimization, it is also essential that practitioners understand that buying IT applications has unique problems in its own right. This is because, while there may be many suppliers of IT software applications pre-contractually, once a sourcing decision has been taken to use one supplier a buyer is often inadvertently committed to a situation of post-contractual lock-in to one application supplier. In other words, what may be a competitive market pre-contractually rapidly becomes one of single sourced supplier dominance post contractually. This can also create immense problems operationally if the buyer is not careful since the buyer is not just being locked into a long-term relationship with the IT infrastructure/application provider, but may also be potentially locked into a permanent relationship with operational suppliers of goods and services. The reason for this is that software and IT costs make heavy demands on the budgets of all companies, and it is highly likely that once dedicated investments in software and IT infrastructure systems have been made, the buyer may find it extremely difficult to exit from the operational supply relationships that have been created. This may not be a problem if the buyer is working with the best suppliers possible, but it could become a

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major issue if, over time, new and more innovative potential suppliers become available who cannot make the dedicated software and IT investments that a buyer may wish them to make, or if the switching costs for the buyer to move to them are also too high because of incompatible IT systems.

It may be the case that far-sighted suppliers (both of software application systems and of operational goods and services) understand this problem of post-contractual supplier dominance and are keen to encourage buyers to become locked-in to particular infrastructure systems and software tools, so that switching later will become difficult.

The buyer of software and Internet-based tools must, therefore, think carefully about exit from existing applications over the long term and not just focus on the immediate short-term benefits that can be achieved from the initial optimization of SCM process efficiencies. If they do not, then they may find later that they are in a sub-optimal supply chain relationship. The problem of power must be considered carefully here and must always be factored into any specific supply chain software and Internet-based sourcing decision.

Nevertheless there definitely appear to be some circumstances in process efficiency SCM initiatives when software and Internet-based tools will provide significant benefits. The benefits from types of these applications are perhaps less apparent when one considers product/service innovation SCM initiatives (Cox, Andrew 2003).

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2.3.2 The Major E-Sourcing Software Applications

In Supply Chain Management systems can be used various e-sourcing software. Here these software applications are given below:

2.3.2.1 ERP Software

ERP (Enterprise Resource Planning) software is the internal technological hub of the organization. It is used to support existing business strategies and provides the company with the flexibility required to improve customer responsiveness (the demand-side) and to better manage production needs, inventory and the procurement of inputs (the supply-side). It is also the ultimate tool for allocating scarce resources. Using ERP, a company can create a new information foundation (that is organized, consistent, codified and standardized) by replacing the existing diverse legacy systems.

ERP software tools took the concepts of MRP (Materials Requirement Planning) and attempted to integrate other departments and functions that were outside the manufacturing-planning arena but were still related. Essentially, ERP systems are the software infrastructure that facilitates the flow of information between all functions in a company (e.g., manufacturing, finance, HR, sales and marketing, logistics and procurement).

ERP systems can be visualized as huge database applications for storing transaction data driven by software that connects the components of the company. When data becomes available at one point in the business, it courses its way through the software,

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which automatically calculates the effect of the transaction on other areas such as manufacturing, inventory, logistics, and procurement, invoicing and booking the sale to the financial ledger.

ERP deals with a highly complex problem – organizing and executing the millions of transactions that are required to efficiently operate a modern business. ERP software companies see sourcing as a data processing and database management problem, not as a mathematical modeling and supply chain optimization problem. However, while these systems are not oriented towards problem solving, ERP vendors have purchased vendors in the other markets to provide modeling/solving capabilities.

ERP software companies are very well known. The industry is led by **SAP AG** and **Oracle** – two of the world's largest software companies – and also includes Baan, PeopleSoft and JD Edwards. This market plays host to about 60 other suppliers. Despite the power of the leading players, the intensity of competition is forcing ERP software companies to rethink their products' role within the organization. They are seeking ways to broaden functionality by incorporating front-end technology, to create trading communities through portals and to forge collaborative associations with Internet-based technology and other suppliers.

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Table 2.2. Shang & Seddon (2000) ERP business benefits framework
Benefit dimensions and Benefit categories
1. Operational
1.1 Cost reduction
1.2 Cycle time reduction
1.3 Productivity improvement
1.4 Data quality improvement
1.5 Customer services improvement
2. Managerial
2.1 Better resource management
2.2 Better decision-making
2.3 Better performance control
3. Strategic
3.1 Supports current and future business growth plan
3.2 Supports business alliances
3.3 Supports business innovation
3.4 Supports cost leadership
3.5 Supports product differentiation
3.6 Supports external linkages
3.7 Enables worldwide expansion
3.8 Enables e-business
4. IT infrastructure
4.1 Increased business flexibility
4.2 IT cost reduction
4.3 Increased IT infrastructure capability
5. Organizational
5.1 Supports business organizational changes
5.2 Facilitates business learning and broadens employee skills
5.3 Empowerment
5.4 Changed culture with a common vision
5.5 Changed employee behavior with a shifted focus
5.6 Better employee morale and satisfaction

Source: Shang, S. & Seddon, P.B. (2000), " A comprehensive framework for classifying the benefits of ERP systems." In: *Proceedings of the 6th Americas Conference on Information Systems*, Chung, H. (ed.), Association for Information Systems, Long Beach, CA, USA, pp. 1005–1014.

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2.3.2.2 ERP Software: SAP and Oracle

The SAP is known as SAP AG. SAP AG (Systems Applications and Products in Data Processing)

SAP AG is the leading global provider of client /server business application solutions. Its flagship is its R/3 client /server system, which was released in 1992 (Williams and Hart, 1997). SAP AG is a German multinational software corporation that makes enterprise software to manage business operations and customer relations. Headquartered in Walldorf, Baden-Württemberg, with regional offices around the world, SAP is the market leader in enterprise application software. The company's best-known software products are its enterprise resource planning application (SAP ERP), its enterprise data warehouse solution - SAP Business Warehouse (SAP BW), SAP Business Objects software, and most recently, Sybase mobile products and in-memory computing appliance SAP HANA (Wikipedia, 2012; SAP 2012).

- **Components of the SAP Solution**

SAP has committed itself to the goal of integrating and improving the flow of information within the network of strategic and operational management tasks (figure 2.1) which is on next page (86).

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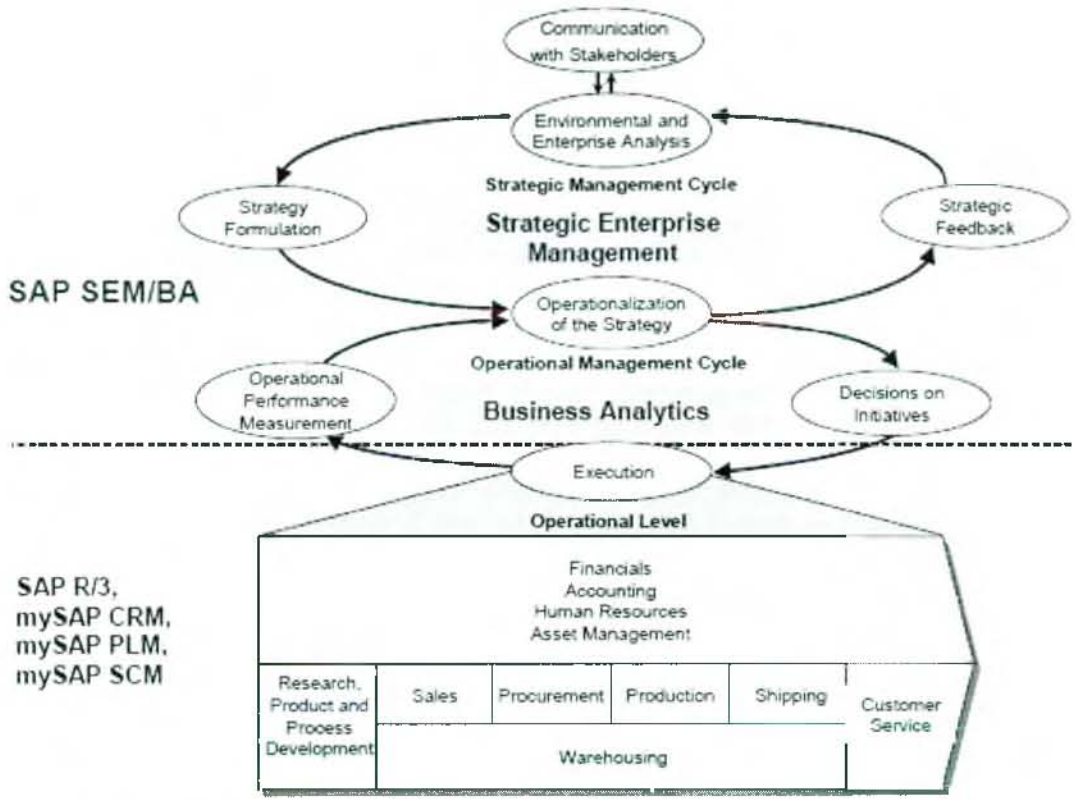

Figure 2.1 Business Classification of SAP Products
Source: Meier, M., Sinzig, W., Mertens, P. (2005), *Enterprise Management with SAP SEM/Business Analytics*, Springer, Nurnberg.

The analytical application which SAP calls SAP SEM/BA provides a full range of functionality for corporate governance. SAP Strategic Enterprise Management (SAP SEM) supplies the functions needed for strategic decision making. SAP Business Analytics (SAP BA) controls the business processes in corporate groups and their business units. The SAP SEM and SAP BA software form a unit (SAP SEM/BA).

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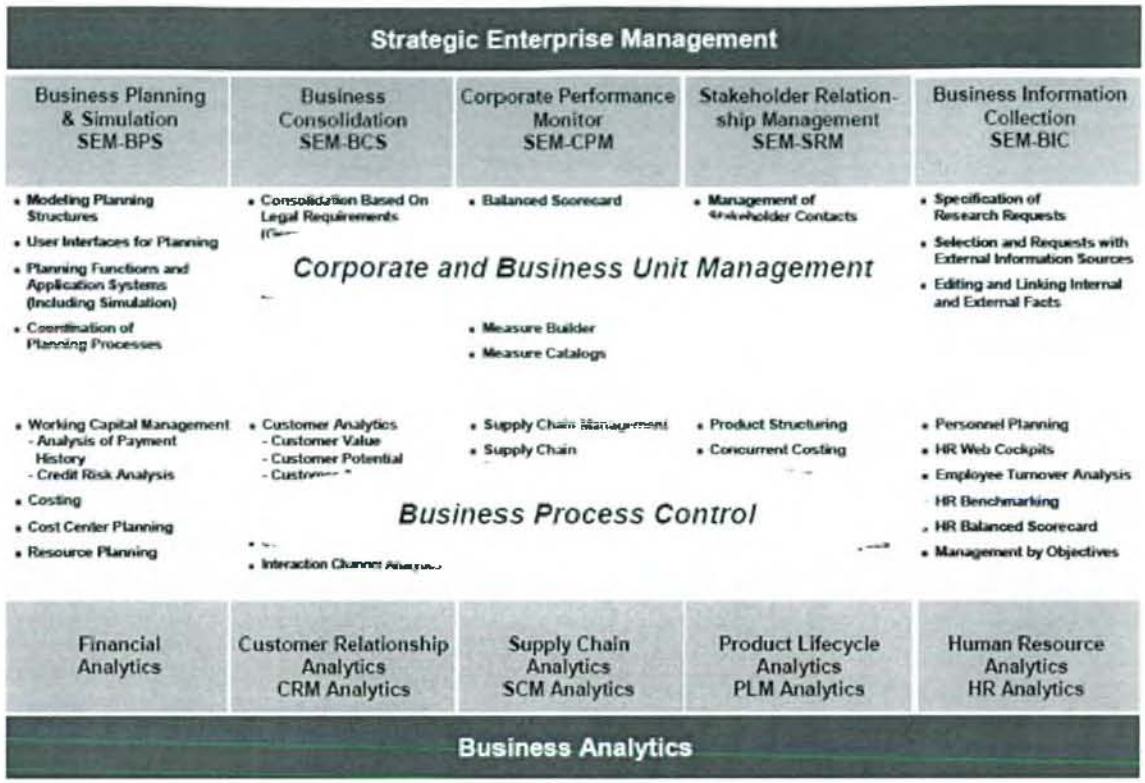

Figure 2.2 Components and Functions of SAP SEM/BA
Source: Meier, M., Sinzig, W., Mertens, P. (2005), *Enterprise Management with SAP SEM/Business Analytics*, Springer, Nurnberg.

Additional elements of the package are the SAP Business Information Warehouse (SAP BW), SAP Content Management®, the mySAP Enterprise Portal®, and SAP Business Framework Architecture®. The operational level includes systems such as SAP R/3, mySAP® Customer Relationship Management® (mySAP CRM®), mySAP Supply Chain Management (mySAP SCM®), and mySAP Product Lifecycle Management (mySAP PLM®). Figure 2.3 presents an overview of the system components that will be described in greater detail below.

In addition to the software functionality, the systems also provide domain-specific information models that SAP refers to as *Business Content*. Examples of Business

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Content in SAP SEM/BA are measure catalogs, calculation schemas for measures in value-based management, and Strategy Templates.

Application software handles business tasks, distinguishing it from the system software (operating systems for PCs and networks) and system-related software (database systems, middleware, and so on). Many software providers and consultants now use the abbreviated form *applications*, although this may not be ideal in some contexts. Since the terms *application* and *application system* have special meanings at SAP. *Application* can refer to SAP SEM/BA as a whole, to a single component such as SEM-BPS or SCM Analytics, or to a specific task within a component (such as personnel planning). For SAP, an *application system* is always a physically installed application.

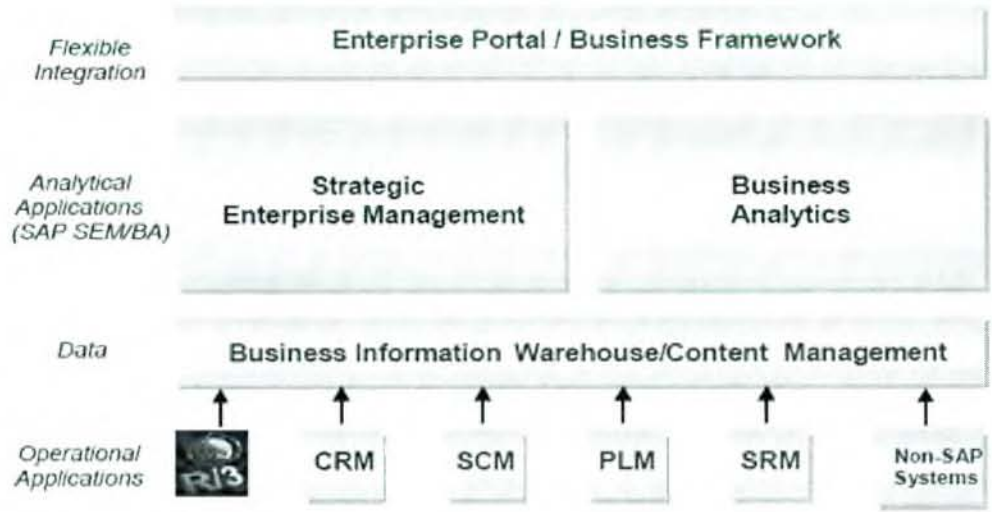

Figure 2.3 Systems Components

Source: Meier, M., Sinzig, W., Mertens, P. (2005), *Enterprise Management with SAP SEM/Business Analytics*, Springer, Nurnberg.

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2.3.2.3 Corporate and Business Unit Management with Strategic Enterprise Management

SAP SEM is used to determine, define, communicate, and implement strategies either for an entire group of companies, an individual company in a group, or an organizational unit within a company (such as a business area or profit center). The system facilitates the collection and evaluation of information from internal and external sources required for environmental and business analysis. It also provides functions for the subsequent identification, evaluation, and selection of alternative strategies. The selected strategy must be formulated, quantified, and described in relation to the existing strategies of the company. This is followed by operationalisation, which converts the general requirements into concrete plans step-by-step down to the level of measures.

SAP SEM thus functions as a tool for coordinating the managers and employees involved in the planning and decision-making process. It also furthers communication with stakeholders. To be able to test whether the requirements were implemented and the anticipated effects realized, actual values for the measured variables must be collected, aggregated, and consolidated, and then presented in a form appropriate for the user (Performance Measurement and strategic feedback).

2.3.2.4 Process Control with Business Analytics

Business Analytics extends SAP SEM to include operational management tasks (that is, decisions intended to improve business processes). The goal is to combine process-

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specific data (including non-financial data) with aspects of accounting. The focus is on situational, problem-oriented ad hoc analyses, which alert managers that a decision is needed, and that support the evaluation of alternative courses of action regarding their potential contribution to company strategy. Business Analytics thus forges a link between the management level and the operational level.

The term *analysis* should be understood here in its broadest sense. It includes modeling, simulating, planning, and evaluating defined subject areas. Such analysis is not limited to the firm itself, but can include cooperative scenarios with other firms (*Enterprise and Extraprise Controlling*). The main target groups are therefore middle and lower management as well as employees with staff functions, such as management accountants and internal consultants.

2.3.2.5 Operational Applications, Analytical Applications, SAP BW, and SAP Content Management

All the issues of the sub-section are discussed below:

- **SAP Business Information Warehouse**

Data integration – meaning the global availability and consistency of metadata and business data – is achieved by employing SAP BW in conjunction with SAP Content Management. The quantitative data for SAP SEM/BA resides in SAP BW.

The Administrator Workbench is the central administration tool of SAP BW for modeling, retrieving, and storing data. This tool monitors and controls the overall

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process – from the extraction of data from source systems to data storage. It also enables data loading processes to be scheduled, triggered, and monitored. SAP BW can integrate data from completely different sources, such as from one or more SAP R/3 Systems or other ERP software. This integration is realized through Business Application Programming Interfaces (BAPIs). External contents such as benchmarking data are used as well.

The SAP BW server consists of a staging engine which handles the data transfer from the source systems, plus the Metadata Manager, the Data Manager, and the memory areas (master data, metadata repository, Persistent Staging Area (PSA), Operational Data Store (ODS), and InfoCubes) for management of metadata and business data.
The master data repository holds the master data, while the metadata repository contains metadata that describe all data structures within SAP BW. The PSA is essentially an "inbox" in SAP BW where data is cleaned up and transformed by transfer rules before reaching the ODS. An ODS object contains cleaned-up transaction data (Meier et al , 2005).

SAP Business All-in-One for Life Sciences, specialized for pharmaceutical companies, is a comprehensive enterprise resource planning (ERP) solution based on proven industry best practices. Designed for rapid implementation at a predefined price, it delivers a fast ROI to help you increase sales and decrease costs.
The software solution supports the business processes that pharmaceutical companies depend on, including:

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Design and development – Support core innovation processes to deliver life-saving products rapidly and assure safe, superior therapeutic outcomes.

Demand and supply balancing – Enable life sciences companies with fluctuating demand and high product complexity to sense and respond faster and smarter to global demand and supply dynamics.

Quality management and compliance – Adhere to a growing number of regulations.

Strengthen decision making – Monitor execution and business events, implement process changes, and execute quickly across the business network.

Financials and controlling – Improve administrative and accounting efficiency, satisfy legal and fiscal requirements, and analyze profitability.

- **Business Benefits**

The basic business benefit of this section is given below:

- Improve efficiency with a solution that has the functionality to support your business processes.
- Lower total cost of ownership with a scalable and flexible solution that lets you implement enterprise-wide changes and deploy them globally.
- Confidently grow your business with the help of proven ERP software from SAP.
- Improve time to value by leveraging tools that help you run every facet of your business quickly and smoothly (Wikipedia, 2012).

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2.3.2.6 Oracle

Over the past 20 years, no area of business operations has changed more than supply chain. Streamlining internal operations is no longer enough to effectively compete. Today, in order to be successful, companies must transform their supply chains into value chains. And Oracle offers a unique information-driven value chain management approach to developing solutions that help companies achieve value chain transformation.

The most complete suite of supply chain applications, Oracle supply chain management is comprised of: value chain planning, value chain execution, product lifecycle management, advanced procurement, asset lifecycle management, order orchestration and fulfillment, and manufacturing. Oracle customers can adopt the entire suite or individual applications. This allows organizations to create a self-funding path to value chain transformation as the financial success of initial implementations feeds future initiatives.

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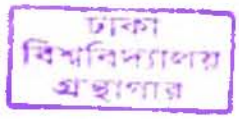
Many companies, across all industries, have discovered that Oracle supply chain management is right for their business. Oracle also transformed its own operations using Oracle applications when it completed an overhaul of Sun's business practices over a twelve month period. Start your own transformation story today (Oracle, 2012).



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➢ Benefits of Oracle

Oracle delivers key functionality built specifically for pharmaceutical, biotechnology, and medical device enterprises, so we can maximize innovation and discovery, marketplace agility, and ROI. The benefits of oracle are given below:

- Combined clinical data management and electronic data capture solution with the most comprehensive native electronic records and signatures solution.
- Solutions for aggregating clinical and non-clinical data for analysis, reporting, and submission
- Adverse event and product complaint management capabilities
- Process manufacturing solutions that fully enable lean initiatives in a regulatory compliant environment
- Built-in GMP business process support, and comprehensive capabilities to track, trace, and authenticate drug chain of custody
- Embedded analytics that combine on-line and off-line capabilities
- The world's leading CRM, with industry-specific life sciences functionality, available via the cloud and on-premise.

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➢ Oracle in the Pharmaceuticals and Biotechnology Industry

In order to develop Oracle system in the Pharmaceuticals Industry SCM, then we can get the accurate information and managers can take the appropriate decision. Oracle also provide following benefits:

- Improve operational efficiency and clinical trial outcomes with capabilities to manage hundreds of simultaneous trials in a regulatory compliant manner.
- Improve the quality of clinical data
- Streamline clinical analysis, reporting, and submission, and maintain a single source for adverse event data submission and reporting.
- Automate enforcement of compliance requirements, and assure products comply with industry quality and safety standards.
- Track, trace, and authenticate products
- Improve physician segmentation and targeting for personalized, effective sales interactions.
- Enhance the quality, consistency, and speed of medical communication (Oracle, 2012).

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2.3.3 The Major Internet Sourcing Applications

The use of the Internet in business-to-business supply chain applications has grown rapidly in recent years. From basic use in the area of transportation and warehousing, the Internet is now being used to manage key supply chain activities including raw materials inventory management, sophisticated warehousing, finished goods inventory management, production scheduling, purchasing, procurement and customer service. New tools in the areas of e-Procurement, e-Requisitioning, e-Auctioning, e-Markets, e-Fulfillment, e-Design and Manufacturing, e-supply chain collaboration and synchronization, e-real-time event monitoring, e-optimal pricing and e-logistics co-ordination expand the operational and strategic options available to firms in the area of sourcing in general and SCM specifically.

Even with the caveats introduced in our earlier discussion, the benefits of the use of e-applications in the field of sourcing and SCM can be multi-dimensional. In addition to improving the quality of information flows and speeding up communication between buyers and their suppliers at all stages of the supply chain, their use may also lead to lower transaction costs, lower purchase prices, increased levels of service, enhanced asset productivity, reduced logistics costs and increased operational flexibility in terms of delivery and response time. Until the advent of the Internet, the ability of firms to achieve these goals was limited, since the communication and knowledge links in the existing supply chains did not bring together all the key databases. Also, there was, and in some cases still is, justifiable reluctance on the part of firms in the supply chain to

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share data with each other. This hesitancy is due to a variety of factors, including the perceived threat of giving away competitive advantage to other firms, the sharing of sensitive information such as inventory levels and production schedules with other channel members and the potential of losing customers to other competitors.

To understand how the Internet provides additional sourcing and SCM *tools*, we discuss potential applications in six major areas:

- EDI
- Procurement;
- Inventory management;
- Transportation planning;
- Customer services;
- Production scheduling.

2.3.3.1 EDI

Electronic data interchange (EDI) is the structured transmission of data between organizations by electronic means, which is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention. It is more than mere e-mail; for instance, organizations might replace bills of lading and even cheques with appropriate EDI messages.

EDI provides a technical basis for commercial "conversations" between two entities, either internal or external. Note the perception that "EDI" constitutes the entire

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electronic data interchange paradigm, including the transmission, message flow, document format, and software used to interpret the documents. EDI standards describe the rigorous format of electronic documents. EDI is very useful in supply chains (Wikipedia , 2012).

Table 2.3: The benefits of adopting EDI

Benefit	Description
Faster communication	Data available for processing by receipt within minutes of creation by sender
Cost savings	No re-keying of data or printing and checking of reports
Accuracy	No transcription errors or misinterpretation of faxes
Reliability	Less documents delayed or lost in post
Business process redesign capability	Many processes driven by paper flow-EDI provides the opportunity to re-examine these and eliminate non-value steps
Faster delivery times	Reduction of keying and checking at supplier end can reduce lead times by up to one day
Delivery priority	EDI orders picked up at specific points in day and therefore are processed before others

Source: Convatec Ltd/ Bristol Myers Squibbs Pharmaceuticals Ltd (1999), *EDI Information Booklet*, Convatec Ltd, Chester, pp.1-12.

2.3.3.2 Procurement on the Internet

The use of the Internet for purchasing has developed rapidly over the last ten years. It has fundamentally streamlined the function and is now used for a variety of key purchasing activities including communication with suppliers, checking and comparing supplier price quotes and making purchases from suppliers' catalogues. General

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Electric, for example, has reduced its purchasing staff by more than 50 per cent and permits on-line purchasing from supplier catalogues by each department. The paperwork flows have been reduced, and order-cycle times – the time from when the order is purchased to the time it is delivered to the company – has decreased by 40 per cent.

Arguably the most popular use of the Internet within the procurement department is in e-applications that facilitate order placement, approval and order status. Indeed, e-Requisitioning has dramatically reduced the costs of order processing, which before the Internet accounted for approximately 18–20 per cent of the total cost of managing a supplier relationship. A major component of this cost saving is the reduction of paperwork involved in traditional order processing systems. Another advantage of the Internet in order processing is the speed and accuracy at which orders can be processed. The reduction in order-cycle time has been reduced by as much as 50 per cent. Errors can now be detected more easily (e.g., through out-of-stock notifications) and corrected more quickly (e.g., through the efficient handling of returned goods).

The Internet has also proven itself to be an important tool for communicating and negotiating with suppliers. Face-to-face negotiations are not used as frequently because the negotiations can be effectively conducted through the Internet. E-Procurement, e-Contracting and e-Auction applications have all been found to be beneficial in aspects of the buyer–supplier bargaining process. Another important factor in supplier relations is the ability of a buyer to rate and compare the performance of its suppliers, based on

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the key elements agreed to in their negotiated contracts. Inherent within many e-Procurement applications, the benefits of these evaluating systems improve the overall quality of supplier performance; lower purchasing costs, and improves the productivity of supplier operations. This information enables companies to form the appropriate strategic supplier relationships based on solid informational bases developed from Internet monitoring systems.

Despite the benefits that may arise from the use of Internet-based applications there is considerable confusion surrounding the different offerings from the various B2B, e-Business and e-Procurement application providers. Notwithstanding the confusion amongst practitioners, there appear to be five major categories of applications within the procurement and supply chain field:

- e-Procurement software (including e-Auctions, e-Catalogues and other 'content' creation, management and aggregation);
- e-Marketplaces and Internet exchanges (including additional services);
- e-Marketplace-making technology;
- e-Marketplace aggregators or 'intelligent agents';
- integration software (to integrate front-end e-Procurement or e-Sales systems with back office ERP or other legacy systems).

Much of the confusion amongst practitioners about the strengths and weaknesses of these applications stems from the fact that few of the companies offering solutions categorize themselves so neatly. For example, e-Marketplace makers frequently sell

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themselves as providers of 'hosted' e-Procurement software. Another source of confusion is that some application providers may have started operations in one segment of the market and have now moved into another – with some becoming more precisely focused, and others becoming less so.

The primary task for managers is to understand in detail what the strengths and weaknesses are of these particular applications (which tend to deal primarily with the dyadic buyer–supplier exchange relationship rather than with the total supply chain that may need to be managed) and how (given this) any of them can assist with the development of a particular type of SCM initiative.

2.3.3.3 Inventory Management and the Internet

One of the most costly aspects within supply chains is the management of inventory. These costs can potentially be reduced by the effective use of the Internet to inform relevant parties when problems with stock availability may arise. Through the use of e-fulfillment applications, firms are able to inform their suppliers that raw material inventory levels are low, or inform their customers that finished product inventory levels are low.

The Internet has also enabled companies to institute EDI programs with their customers more quickly. Prior to the development of the Internet, EDI took considerable time to implement in a supply chain. In addition, each player had to invest heavily in IT, software and training before EDI systems could be made operational. Since the

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introduction of the Internet, EDI systems (and their JIT counterparts) can be developed and put into operation more quickly.

The Internet potentially provides mangers with the opportunity to improve the quality and speed of information available for inventory management so that inventory levels are kept low, overall holding costs are reduced, while still providing high levels of customer service.

2.3.3.4 Transportation and the Internet

Another popular use of the Internet is in the management of transport logistics. Transportation typically is the second highest cost component in many supply chains, accounting for approximately 25 per cent of overall operating costs. The monitoring of pickups at regional distribution centres by carriers is one of the most popular Internet applications in this area. This is particularly important since tracking shipments to regional depots provides the firm with data on the reliability performance of the carriers being used. It also provides managers with the information they need to inform carriers of shipment delays as they occur and allows them to take immediate corrective action. The examples below provide an indication of some of the benefits that companies have received from the use of Internet-based transport logistics applications:

- General Electric, in its appliance division, uses the Internet to schedule shipments out of centrally located warehouses in metropolitan areas. The goal is to allow the company to deliver its products on time and more cost effectively.

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The numbers of deliveries per hour has increased significantly while transportation costs per order have dropped dramatically.

- The Ford Motor Company uses the Internet to track small quantities of spare parts shipped to customers on a daily basis.
- PPG Industries, Inc. utilizes the Internet to monitor the weekly route performance of carriers from its main production plants. The company also uses the Internet to track long-haul deliveries across the country.
- Air Products and Chemicals Inc. uses the Internet in its global sourcing process. The Internet informs the firm of which delivery terminal and which plant is the best for servicing the customer.
- Weyerhauser uses the Internet to monitor vessel-shipping while taking into consideration the stop-off costs for the sites.

2.3.3.5 Customer service and the Internet

An important function that the Internet can offer a firm is the creation and maintenance of excellent relationships with its customers. The Internet has provided customers with another way to contact the firm regarding service issues. Companies may use the Internet to receive customer complaints, emergency notifications and provide customers with 24-hour access to a company's service department, enabling customers to notify companies immediately of any service issues or problems that may arise. The overall effect can be reduced response times and rapid resolution of customer service problems.

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The Internet can also improve the two-way flow of communication between firms and their customers. Companies are using the Internet not only for service issues but also for selling their products and services as well. This two-way communication capability can have a profound effect on cementing customer–firm relationships.

Experience with Internet service systems shows that those customers whose service issues are dealt with quickly, and to their satisfaction, are more likely to purchase the firm's products again. The Internet can build strong product and service loyalty if used appropriately in the customer service area.

2.3.3.6 Production scheduling and the Internet

Production scheduling has traditionally been one of the most difficult problems in SCM initiatives. The reasons for this include:

- the high level of inaccuracy of sales forecasts;
- the lack of raw material information from suppliers;
- the general paucity of information regarding fluctuations in supplier-stock levels and customer demand.

The Internet can help firms to minimize these difficulties in their production scheduling by improving the information flow and communication between suppliers and buyers at all stages of the supply chain. Indeed, firms may use the Internet to co-ordinate their JIT programmes and co-ordinate their production schedules with their suppliers. While the issue of customer demand analysis using the Internet is not discussed directly here, the

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application of the Internet to order processing (by linking EPOS data with production scheduling) provides firms with real-time information on the sales of their products and services. This can result in more accurate sales forecasting, which in turn can significantly improve production and inventory scheduling (Cox et al 2003).

2.4 Supply Chain Management in the Pharmaceuticals Industry

After analyzing the related literature and field wok of Pharmaceuticals Industry in Bangladesh the supply chain systems given below:

A simple representation of a pharmaceutical forward supply chain is shown below in Figure 2.4.

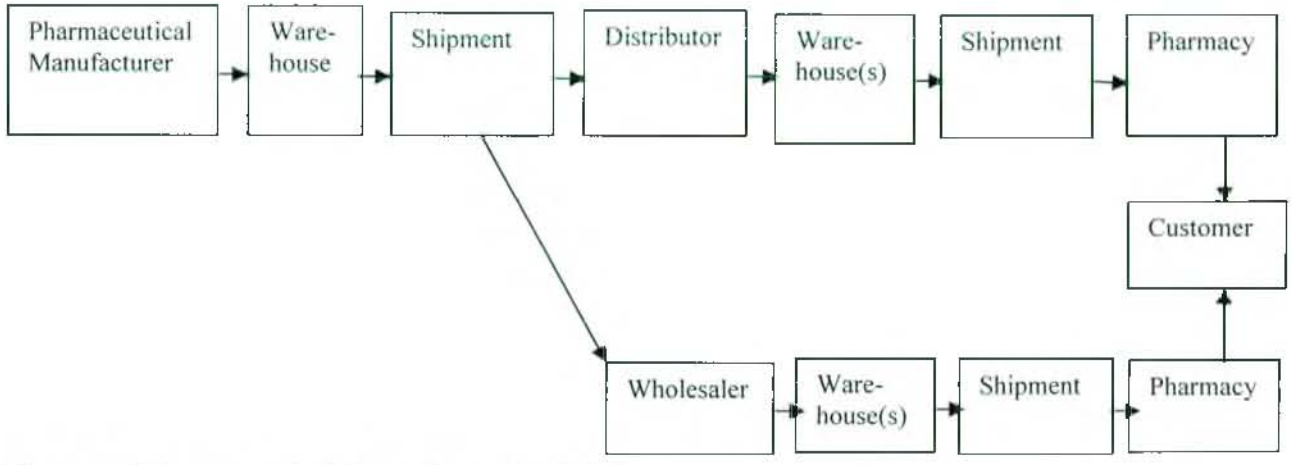

Figure 2.4 Pharmaceutical forward supply chain

Source: Kumar, S., Dieveney, E., Dieveney, A. (2009), "Reverse Logistic Process Control Measures for the Pharmaceuticals Industry Supply Chain", *International Journal of Productivity and Performance Management*, 58(2), pp.188-204

According to Figure 2.4, the pharmaceuticals forward supply chain, I can explain the things in following way:

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There are multiple entities involved, probably more than are shown in this simple representation. The entities not shaded give a visual of how little of the supply chain the manufacturer has direct control over, as far as product and information flow. The majority of the chain, and the portions closest to the customer, remain in the hands of others. It is an incredibly difficult task to ensure all recalled product gets back in a timely manner. There are also multiple players that must work together and be involved in this recall process, and each player utilizes different carriers, information systems, and other processes. As mentioned in the cause and effect diagram (Figure 2.4) there may be entities within the supply chain that are unknown to the manufacturer, due to the lack of control and information flow. As a result of loss of control, there is also potential for the possible introduction of counterfeit drugs. Consider, if the manufacturer partnered with the downstream players in the supply chain and utilized Radio Frequency Identification (RFID) tracking methods. The goal is to have a well defined process that is consistent through the supply chain in which all entities utilize. This reduces the redundancy and streamlines product and information flow to all players. In this manner the manufacturer also maintains better control from their facility to the end retailer. The process map might then look something like **Figure 2.5** (Page: 108).

The entities not shaded show that now there is much more control downstream from the manufacturer which will greatly increase the speed, efficiency, and the effectiveness of the recall process. The other key to this system is that the players utilize a common database for the RFID information as mentioned in the poka-yoke for not fully

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understanding the supply chain. In this manner, the manufacturer (as well as the 3PL for returns and the entire supply chain) know the exact quantity and location of each product. The RFID information can also capture additional information such as expiration dates (the top cause for pharmaceutical returns) so that this will streamline the return of drugs that are expired, or approaching expiration, which is a significant amount of the returned pharmaceuticals. The possibility exists that with RFID real time data can be obtained, which might give rise to the possibility of eliminating some previously needed warehousing space. This real time information also helps to mitigate the issue of expiring pharmaceuticals as it reduces the amount of time the manufacturer must forecast the demand. Using real time data gives the manufacturer, distributors, and others within the supply chain a true demand of what product is needed when and where. This will also greatly reduce the "bullwhip" effect within the supply chain, thereby reducing additional costs outside of those discussed here. Bullwhip effect, described as demand variability is higher at upstream stages (for example, pharmaceutical manufacturer) than downstream stages (for example, pharmacy) in a pharmaceutical supply chain. Also, with the manufacturer partnering with their downstream supply chain entities they should consider utilizing a common transportation carrier for shipments. They might even find a cost savings due to the multiple entities working together creating a larger total spend with this common carrier potentially resulting in volume price breaks. This will streamline the information flow, reduce the potential for transactional and/or handling errors, as well as improve communication through the supply chain as the carrier will be more involved in the entire process and be a vehicle for the product and the information.

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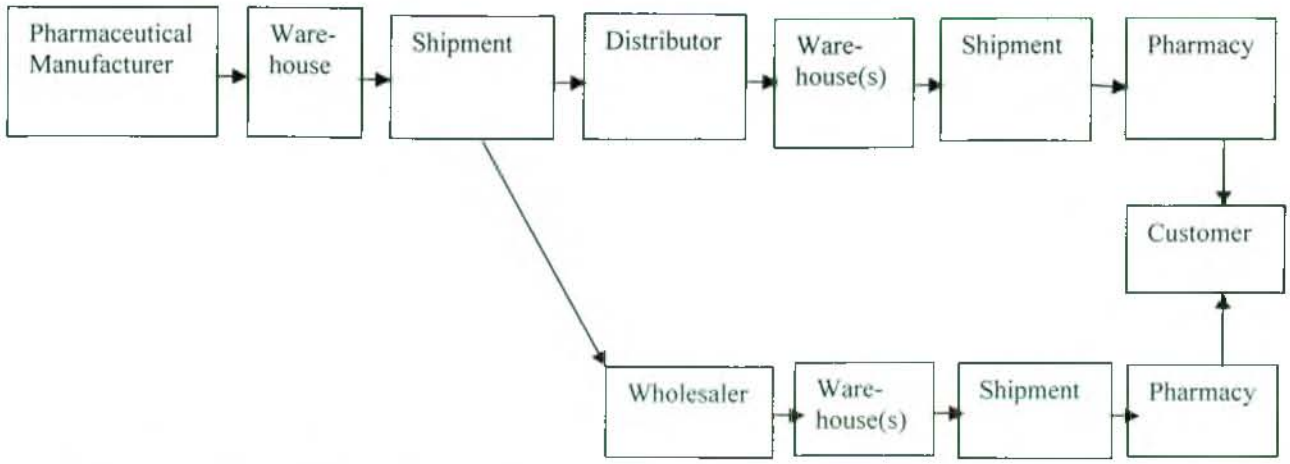

Figure 2.5 Pharmaceutical supply chain with RFID tacking capability

Source: Kumar, S., Dieveney, E., Dieveney, A. (2009), "Reverse Logistic Process Control Measures for the Pharmaceuticals Industry Supply Chain", *International Journal of Productivity and Performance Management*, 58(2), pp.188-204

Figure 2.6 (Page: 110) gives a potentially streamlined flow utilizing both of these possibilities.

For tracking to be most effective in the use of RFID, all players in the supply chain must work collaboratively and utilize the same system and processes for handling the RFID. This ensures real time information flow which streamlines the ability for the reverse supply chain logistics. Cost is a major consideration here, as implementing RFID is not inexpensive. By implementing this system, our hope is to streamline and improve the ability of the manufacturer to get the recalled, expired, and/or damaged drugs back quickly, before a purchase is made by the consumer. In doing so, we are also improving and securing the forward supply logistics and impeding the flow of counterfeit drugs to entering the chain. This will greatly reduce the amount of profit lost due to the fake drugs. As estimated in the introduction $12 billion is lost annually in the

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pharmaceutical business due to counterfeit drugs. This will help offset the cost of implementing the RFID system. There will also be significant savings in logistics costs in the new system, compared to the old, for both the forward and reverse directions. This outlines significant implementation plans aimed at improving the pharmaceutical returns, or reverse supply logistics, process. The last step is control. Controls must be put into place to ensure that the plans implemented are maintained. With the entire supply chain utilizing the same RFID process and systems, the process is being "double-checked" to ensure it is continually and effectively working. We are not relying on any individual contributor to the supply chain to use RFID. The group or groups that were implemented with clear roles and responsibilities around supply chain relationship management and reverse logistics can also measure returns over time to ensure continual improvements. They can also gather data on the length of time for a product return to move through the supply chain when it is initially called back due to expiration, recall, or other. By constantly control charting, the manufacturer can monitor the reverse supply logistics process and quickly notify those necessary when there is an issue. Another potential improvement method to help control might be to utilize manufacturing postponement strategies. Using real time data on demand of the various drugs from the RFID implementation helps the manufacturer only produce the required amount at the required time. By waiting to turn the raw materials into the released pharmaceutical, until needed, will greatly reduce the amount of drugs created that need to be monitored, shipped, tracked, and potentially recalled (Kumar et al, 2009).

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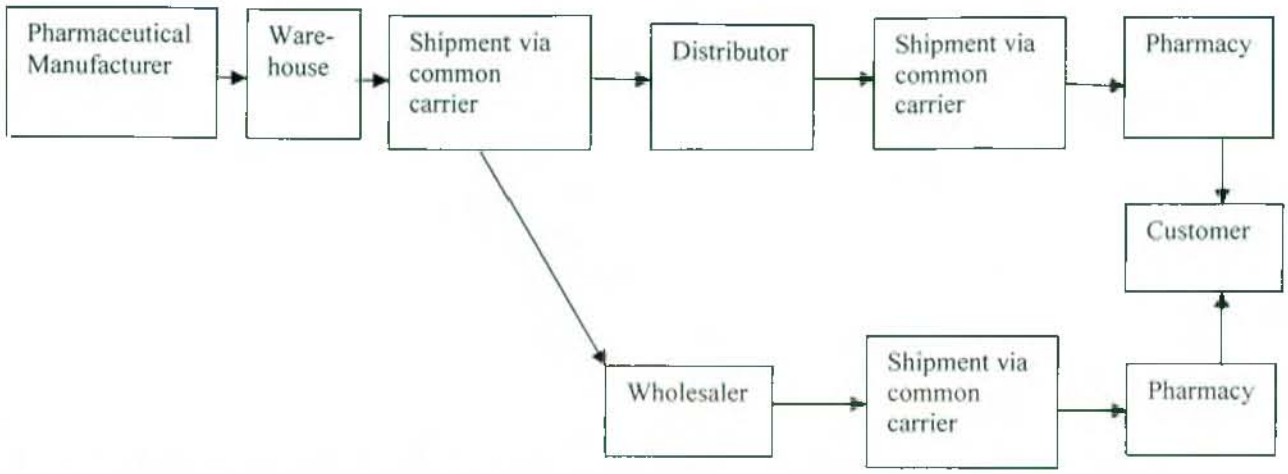

Figure 2.6 Pharmaceutical supply chain utilizing common transportation carrier and RFID.

Source: Kumar, S., Dieveney, E., Dieveney, A. (2009), "Reverse Logistic Process Control Measures for the Pharmaceuticals Industry Supply Chain", *International Journal of Productivity and Performance Management*, 58(2), pp.188-204

2.5 Summary

This chapter provides an initial discussion of various related literature, development process of supply chain management, the ways in which software and internet tools can impact upon SCM initiatives, as well as providing a summary overview of some of the major software and internet-based tools available. The major e-sourcing software applications for instance ERP software like SAP and Oracle, the benefits of ERP, application of SAP and Oracle in pharmaceutical sectors, EDI, benefits of EDI, internet use in operations, are conversed. This chapter also included Supply Chain Management (SCM) in the Pharmaceuticals Industry. To this closing stage, the impending chapter will assess conceptual framework and research methodology.

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CHAPTER THREE: CONCEPTUAL FRAMEWORK AND RESEARCH METHODOLOGY

3.0 Introduction

After analyzing literature, in this chapter I introduced the conceptual framework of my study including the research framework, research model etc. Here includes the role of information technology in the supply chain management systems and expected result. In this chapter the research argument and research question is developed. This chapter shows the explanation of methodology of the study, which included - the background of methodology; initial research method; triangulation: description & present study; field work; interviews; construct measures; data analysis and descriptive statistics.

3.1 The Research Framework on Role of Information Technology (IT) in Supply Chain Management (SCM)

Traditionally, SCM issues have been investigated by operations management researchers with a focus on functional problems, such as facilities location and transportation (Geoffrion and Powers 1995), inventory management (Cohen and Lee 1998; Mabert and Venkatraman 1998), materials management, purchasing, and distribution (Scott and Westbrook 1991; Turner 1993). Similarly, IT impacts in the context of SCM have been mostly investigated with a focus on specific technologies and innovations, such as EDI (Srinivasan and Kekre 1994), cellular manufacturing

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(Black 1991), and vendor-managed inventory (Ellinger et al. 1999). Recent recommendations encourage researchers to focus investigations on the inter-organizational capabilities that integrate a firm with its network of suppliers and customers to create value for firms (Ho et al. 2002; Narsimhan and Jayram 1998).

Extending on the resource-based view of the firm (Barney 1991), higher-order organizational capabilities are suggested as a source of firm performance in the strategic management literature (Grant 1996; Teece et al, 1997) and. more recently, in the IS literature (Barua et al. 2004; Mithas et al. 2011; Sambamurthy et al. 2003). According to this perspective, a firm must develop capabilities to acquire, integrate, reconfigure, and release resources that are embedded in their social, structural, and cultural context. Developing these capabilities is a long-term process that requires firms to make a series of linked strategic decisions and moves related to IT resources so as to blend them with organizational processes and knowledge resources (Barua et al, 2004).

Viewed from the perspective of organizational capabilities and resource-based theory, commonly available IT resources cannot by themselves create sustained performance gains for a firm (Floyd and Wooldridge 1990; Powell and Dent- Micallef 1997; Zahra et al. 2002). Accordingly, conceptual distinctions have been made between IT components broadly available in the marketplace, integrated IT platforms that require significant time and expertise for development (Weill et al. 2001), and IT-enabled processes that deeply embed capabilities of IT platforms into organizational processes (Bharadwaj 2000).

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A well-integrated IT platform is much more than individual physical components. It requires standards for the integration of data, applications, and processes to be negotiated and implemented in order for real-time connectivity between distributed applications to be achieved (Ross 2003; Weill and Broadbent 1998). From our perspective, an integrated IT infrastructure enables consistent and real-time transfer of information between SCM-related applications and functions that are distributed across partners.

Such integrated IT infrastructures for SCM can be blended with inter-organizational processes to develop higher-order capabilities for demand sensing, operations and workflow coordination, and global optimization of resources. These capabilities require firms to unbundle the three complementary flows of materials (Stevens 1989), information (Lee et al. 2008), and finances (Mabert and Venkatraman 1998), and integrate each of them with supply chain partners. Accordingly, we consider information, physical, and financial flows in our framing of a focal firm's supply chain integration capability.

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Based on my discussion, I present the framework for my study in **Figure 3.1.** IT infrastructure integration for SCM represents a lower-order capability that can be leveraged to develop a higher-order process capability (i.e., supply chain process integration), which is a source of significant and sustained performance gains for a firm. Given that I am suggesting a hierarchy of capabilities for firm performance, a direct effect between IT infrastructure integration for SCM and firm performance is not specified.

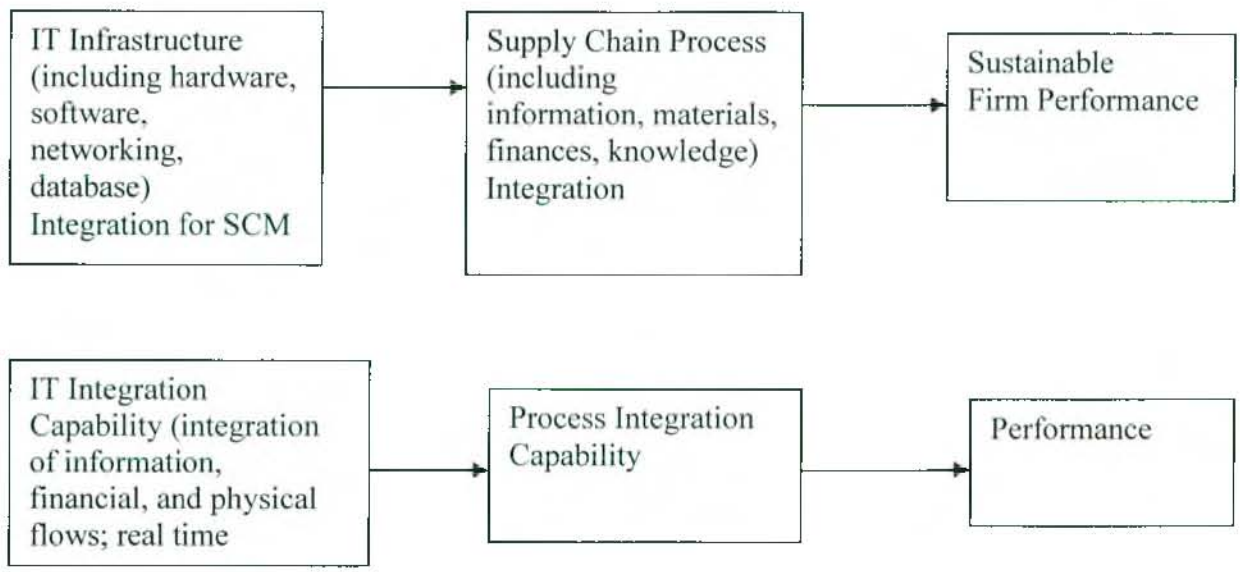

Figure 3.1: Research Framework

Source: The Author

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3.1.1 The Research Model:

According to the research framework, a model required in the study. Figure 3.2 schematically represents the research model and Table 3.1 summarizes the definitions of latent constructs and sub-constructs which is on next page (116).

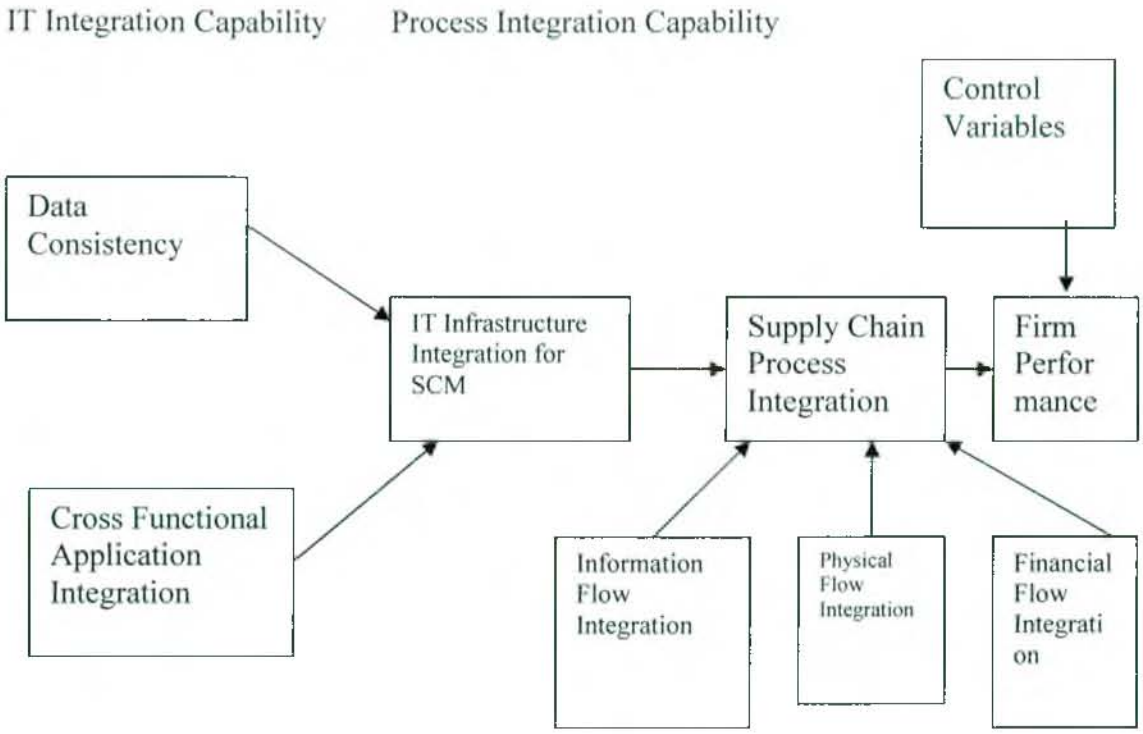

Figure 3.2: Research Model

Source: Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly, 30*(2), 225–246.

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Table 3.1: Construct Definitions

Construct	Definition
IT Infrastructure Integration for SCM: *The degree to which a focal firm has established information systems for the consistent and high-velocity transfer of supply chain-related information within and across its boundaries.*	
Data Consistency	The degree to which common data definitions and consistency in stored data have been established across a focal firm's supply chain.
Cross-Functional SCM Application Systems Integration	The degree of real-time communication of a focal firm's function-specific supply chain management applications with each other and related ERP and CRM applications
Supply Chain Process Integration Capability: *The degree to which a focal firm has integrated its physical, financial, and information flows with its supply chain partners*	
Physical Flow Integration	The degree to which a focal firm uses global optimization with its supply chain partners to manage the stocking and flow of materials and finished goods.
Information Flow Integration	The extent of operational, tactical, and strategic information sharing that occurs between a focal firm and its supply chain partners.
Financial Flow Integration	The degree to which financial flows between a focal firm and its supply chain partners is driven by workflow events.
Firm Performance: *The degree to which a focal firm has superior performance relative to its competition*	
Operations Excellence	The degree to which a focal firm is better than its competitors in its responsiveness and generation of productivity improvements.
Customer Relationship	The degree to which the focal firm's relationship with customers and information about their preferences is better than its competitors.
Revenue Growth	The degree to which the focal firm's increase in revenue from current and new products and markets is more than its competitors.

Source: Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly, 30*(2), 225–246.

All above (Table 3.1) definitions are accepted in this study, because these are helpful to explain the research argument properly.

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3.1.1.1 Firm Performance

We are concerned with a firm's aggregate performance relative to its competition. Operations excellence, revenue growth, and customer relationships, recognized as important dimensions of firm performance (Slywotzky et al. 2000), are three aspects of performance that we consider. Operations excellence is defined as a focal firm's responsiveness to customers and improvements in productivity relative to its competition. It has been noted that firms must balance operations costs and service level performance in terms of lead times to meet customer needs (Fisher 1997; Simchi-Levi et ai. 2000). In addition, firms need to achieve market focused performance (Malhotra et al. 2005) that encompasses customer relationships (Groves and Valsamakis 1998) and revenue growth (Kalwani and Naravandas 1995; Moorman 1995). Customer relationships focus on the bond and loyalty between a focal firm and its customers, and the focal firm's intimate knowledge about customer-related preferences. Growth in revenues includes sales from existing products and from new products and markets (Zahra and George 2002).

There is some evidence that supply chain integration impacts the three dimensions of performance considered here. For instance, it has been suggested that integration of supply chains can enhance a firm's time-based competitiveness by compressing cycle times (Hult et al. 2007). Integrated supply chains provide operational visibility, coordination of plans, and streamlined flow of goods that compress the time interval between a customer's request for a product or service and its delivery (Hult et al. 2007; Tyndall et al 1998). This capability is also suggested to positively impact top- and

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bottom line financial performance (Lee et al. 2011; Simchi-Levi et al 2000), improve customer relationships, and promote market growth (Goldhar and Lei 1991; Tyndall et al. 1998). We examine whether aggregate performance of a firm, as assessed by operations excellence, revenue growth, and customer relationships, is influenced by supply chain process integration.

3.1.1.2 Supply Chain Process Integration Capability and its Impacts on Firm Performance

The literature identifies important flows across the supply chain to include materials (Stevens 1990), information (Lee et al. 2011), and finances (Mabert and Venkatraman 1998). Accordingly, supply chain process integration is defined as the degree to which a focal firm has integrated the flow of information, materials, and finances with its supply chain partners. Although knowledge flows are discussed in the literature (Carlile 2002), they are sometimes overlapped in their definition to include information flows, and we do not consider them as a distinct flow in our investigation. Accordingly, supply chain process integration is conceptualized as a formative construct with three sub-constructs: information flow integration, physical flow integration, and financial flow integration. All these are discussed below:

Information Flow Integration

Information flow integration is defined as the extent to which operational, tactical, and strategic information are shared between a focal firm and its supply chain partners. Specifically, we consider the sharing of demand-related information, inventory and

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sales positions, production and delivery schedules, and performance metrics as indicators of information flow integration. Seidmann and Sundarajan (1997) note that operational information sharing can leverage the economies of scale and expertise across organizations. Inventory holding information, when shared, can reduce total inventory in the supply chain (Lee et al. 2008). Similarly, production and delivery schedules can be shared to enhance operational efficiencies through improved coordination of allocated resources, activities, and roles across the supply chain (Lee et al. 2000). Tactical information sharing can encompass performance metrics associated with execution of tasks and their outcomes.

Finally, strategic information sharing occurs when the information possessed by a firm generates little value by itself, but creates strategic value when shared (Seidmann and Sundarajan 1997). For instance, sharing of sales information by buyers with sellers creates value through improved demand planning, forecasting, and replenishment. It has been shown that lack of sharing of actual sales information substantially distorts the demand signal as it travels upstream across the supply chain. The phenomenon of upstream amplification of error in the demand signal is called the *bullwhip effect* (Lee et al. 2011) and causes problems such as excessive or inadequate inventory, poor production and capacity planning, cash flow utilization, and customer service.

Information sharing allows retailers, manufacturers, and suppliers to improve forecasts, synchronize production and delivery, coordinate inventory-related decisions, and develop a shared understanding of performance bottlenecks (Lee and Whang 2000; Simchi-Levi et al. 2000). By substituting information for inventory holdings (Milgrom

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and Roberts 1990), information flow integration can improve operational performance by reducing inventory costs, enhancing capital and cash flow utilization, and improving cycle times. By improving the precision of demand estimation through collaborative forecasting, and facilitating supply and demand alignment, information sharing can strengthen bonds with customers and generate increased revenues from existing products and new products and markets (Anderson et al. 1994; Mohr and Nevin 1990).

Physical Flow Integration

Physical flow integration is defined as the degree to which a focal firm uses global optimization with its supply chain partners to manage the stocking and flow of materials and finished goods. Downstream flows consist of raw materials, subassemblies, and finished goods, while upstream flows consist of products that are returned or need to be repaired. Specific initiatives that have been suggested to improve global optimization of physical flows include just-in-time delivery (Lowson et al. 1999), automatic replenishment, vendor managed inventory programs (Daugherty et al. 1999; Ellinger et al. 1999), and contracting with logistics providers for inventory management services (Richardson 1999; Van Hoek 2001). In addition, distribution networks can be reconfigured to optimally stage inventory across the supply chain (Amtzen et al. 1995; Vidal and Goetschalckx 2000).

This research identify multi-echelon optimization of costs, just-in-time deliveries, joint management of inventory with suppliers and logistics partners, and distribution network configuration for optimal staging of inventory as indicators of physical flow integration.

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Physical flow integration can improve productivity by reducing costs of production, transportation, warehousing, and logistics (Goldhar and Lei 1991). It can enable firms to cut lot sizes, increase order frequency, cut buffer inventory (Kaeli 1990; Lee and Billington 1992), reduce purchasing costs, improve material handling, and invest in reliable suppliers (Schneidrjans 1993). Other operational performance benefits include fewer stock outs, more efficient stocking, less need for safety stock, and improved selling space productivity (Ellinger et al. 1999). By increasing responsiveness to customer demand through strategies such as postponement of differentiation (Feitzinger and Lee 1997) physical flow integration can improve customer relationships and customer service (Ellinger et al. 1999; Gustin et al. 1995). Finally, such integration is expected to improve long-term competitiveness and growth (Goldhar and Lei 1991).

Financial Flow Integration

Financial flow integration is defined as the degree to which exchange of financial resources between a focal firm and its supply chain partners is driven by workflow events. Financial processes were among the earliest business processes that were reengineered to reduce delays, improve productivity, and eliminate redundant tasks (Hammer 1990). Yet, organizations often do not have a consistent view of their financial flows with their upstream and downstream partners (McComiack and Johnson 2003). Important downstream flows to be managed include prices, invoices, and credit terms, and essential upstream flows to be coordinated include payments and account payables.

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Financial flow integration can enable better working capital and cash flow management through event-based triggering of payables and receivables; for instance, electronic payment can be triggered upon delivery of goods. Event-based financial workflows can reduce costs associated with billing, payment processing, and dispute handling, and can shorten the invoicing and receivables cycle time, accelerate payments, and improve the availability of financial information for decision-making (Greenfield et al. 2001). Reduced delays, accelerated payments, and collection of customer preferences with billing and invoicing transactions can result in improved customer relationships. Finally, financial flow integration can impact revenue growth by improving cash flow availability for production ramp-up when demand swings upward, or for exploration of new product lines.

3.1.1.3 IT Infrastructure Integration for SCM

We define IT infrastructure integration as the degree to which a focal firm has established IT capabilities for the consistent and high-velocity transfer of supply chain-related information within and across its boundaries. IT infrastructure integration is conceptualized as a formative construct with two sub constructs: data consistency and cross-functional SCM application systems integration. These are discussed below:

Data Consistency

Data consistency is defined as the degree to which common data definitions and consistency in stored data have been established across a focal firm's supply chain. There are significant data consistency problems in large distributed database or

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intermittently connected distributed systems, such as mobile computing environments (Pitoura and Bhargava 1999). Even greater problems occur in disparate and fragmented systems spread across organizational boundaries, such as supply chains. Data consistency in supply chains will be enabled by common data definitions for key entities, such as customer and product, as well as automated systems for accurate data capture. This consistency should enable process integration (Huber 1990; Malone et al. 1987), including the integration of information, financial, and physical flows.

Cross-Functional SCM Application Systems Integration

Cross-functional SCM application systems integration is defined as the degree of real-time communication of a focal firm's function-specific SCM applications with each other and related ERP and CRM applications. Such connectivity enables the management of cross-functional process dependencies in a supply chain (Rai, Bush, and Tiwana 2012; Rai, Ruppel, and Lewis 2002). Note that, application integration is concerned with a firm's *ability* to interface function specific supply chain applications with each other in real time, while the information flow integration construct described earlier is concerned with the content of operational, tactical, and strategic information *actually* shared among partners. We consider integration of applications for supply chain planning and execution, and their integration with ERP and CRM systems; together they characterize the applications infrastructure for end-to-end management of supply chains (Kalakota and Robinson 1999). Planning applications are designed to support planning for critical functions such as procurement, production, transportation, and warehousing. Execution applications are designed to support execution of order

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management, replenishment, production, and distribution Integrated planning applications provide a capability to generate cross-functional information about the supply chain and develop globally optimal plans (Kalakota and Robinson 1999). Similarly, integrated execution applications provide the capability to generate supply chain-wide visibility of processes and coordinate global execution. Finally, integrated supply chain, ERP, and CRM applications should facilitate the coordination of supplier- and customer-facing processes with internal firm processes.

3.1.1.4 Control Variables

Fisher (1997) makes a distinction between functional and innovative products. While functional products have long product lifecycles and low forecasting errors, innovative products have short product lifecycles and high forecasting errors. In addition, profit margins for innovative products are significantly higher than those for functional products. Since firm performance can be influenced by demand predictability at the end-consumer level based on the type of products in question, we specify consumer demand predictability as a control variable. In addition, since larger firms may be in a better position to achieve performance gains due to their ability to garner scale efficiencies (Hitt et al. 2002), we specify firm size as a control variable (Rai et al, 2006).

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3.1.2 Argument of the Thesis:

This research argues that Information technology can play a vital role in managing the different elements of Supply chain management (SCM) and as a result performance/benefit of supply chain will improve. This argument has received relatively little attention in the previous research on Supply chain management. Review of previous research indicates that many researches has been conducted on how to manage the different elements of supply chain management and also how to improve the performance of supply chain management; nevertheless, the role of Information technology in these area has received inadequate attention.

Globalization of world economy has made the supply chain more complicated from the managerial point of view and at the same time the development of information technology is much faster than the organization can cope with it. In this cases organization faces the problem to develop effective supply chain management. Here application of IT can play a vital role.

In a broader sense, establishing the relationship between Information technology and supply chain management will contribute in the field of supply chain management.

This theoretical development will not only help the academic world but also help the practicing manager to improve the performance/benefit of supply chain management.

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So, in this case I can draw my argument of this study in following way:

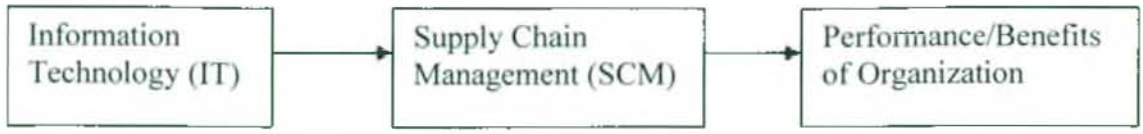

Figure: 3.3 IT in SCM
Source: The Author

Here, the basic functional role of information technology on supply chain management is given below:

The important role of IT in supply chain management is reducing the friction in transaction between supply chain partners through accurate and cost effective information flow. Then, information technology is most importantly viewed to have a role in supporting the collaboration and coordination of supply chains through information sharing. Third, IT can be used for decision support. In this instance the analytical power of computers is used to provide assistance to managerial decisions of an organization. Figure: 3.4 showing the functional role of IT in SCM.

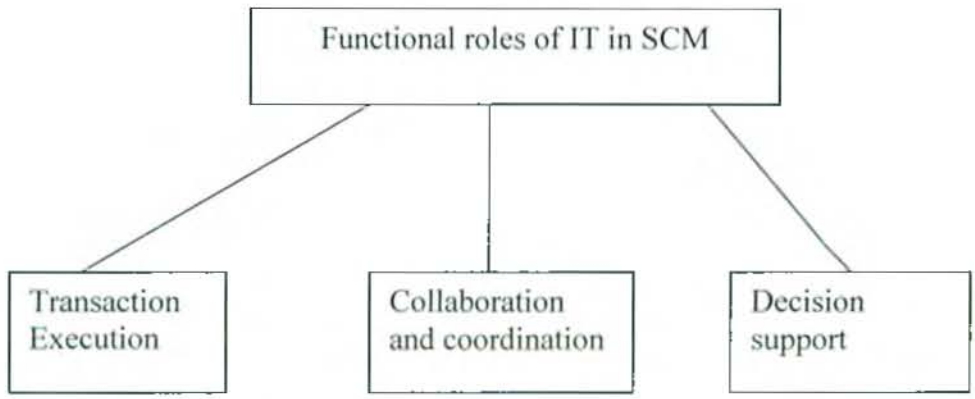

Figure: 3.4 Functional role of IT in SCM
Source: The Author

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3.1.3 Research Questions:

The main question of the study is:

- Considering the Pharmaceuticals Company context in Bangladesh, how Supply Chain Management with the integration of IT creates the benefit to the Pharmaceuticals Company and how these benefits are realized?

The other potential research question is:

- Where does Bangladesh stand in initiating IT based supply chain management in the pharmaceuticals sector?

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3.2 Research Methodology

3.2.1 Introduction:

This advanced level research project deserves a methodological sophistication. Considering the complexity of the research project a deviant methodology has been selected which is known as Triangulation Method. It has been defined by Denzin (1978:291) as "the combination of methodologies in the study of the same phenomenon". Denzin (1978:302) further labeled as "between (or across) method" type, and represents the most popular use of triangulation. It is largely a vehicle for cross validation when two or more distinct methods are found to be congruent and yield comparable data.

Triangulation can have other meanings and uses as well. There is the "within-method" kind (Denzin, 1978:301) which uses multiple techniques within a given method to collect and interpret data. For quantitative methods such as survey research, this can take the form of multiple scales or indices focused on the same construct. For qualitative methods such as participant observation, this can be reflected in "multiple comparison groups" (Glaser and Strauss, 1965:7) to develop more confidence in the emerging theory. In short, "within-method" triangulation essentially involves cross-checking for internal consistency or reliability while 'between-method" triangulation tests the degree of external validity. In this research, both within method and between methods of triangulation methodology will be used. Balance between these two

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methods will depend on the field work and necessary modifications will be made on the basis of the experience gained during the field work.

This section I explained the background of methodology; initial research method; triangulation: description & present study; field work (phase 1 & phase 2); interviews; construct measures; data analysis and descriptive statistics.

3.2.2 Initial Research Method:

This research is primarily on IT's role in SCM which are complex, dynamic and not well understood, the multi-method approach was adopted in the fieldwork and also for analyzing collected data. Moreover, Pharmaceutical Industry in Bangladesh is new and emerging sector. Many new attempts in the organizational processes are taking place to improve the performance of industry as a whole. Capturing industry scenario is generally based on quantitative data from multiple sources specially documented and published source, but there is always a criticism of this type of data because of bias about the data. In order to overcome this type of criticism, multi-method approach in data collection will reduce bias and at the same time will increase validity of the data. As Pettigrew (1973, 61:62) mention– "While no single method is completely reliable, measures can be taken to increase the validity of data. In the present case, the use of multiple observers and multiple sources of documentary data were built-in checks, which also prevented over-identification with the views of particular informants and widened the range of data collected."

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The very nature of the study indicates that field work should be at least two phases. First phase, broadening an understanding pharmaceuticals industry in Bangladesh by using quantitative data. Analysis of this data has helped to identify the list of companies where IT may have been used in SCM. Introducing the phases in the field work is well known methodological approach in the social science research (Pettigrew, 1973).

There were the key elements of the initial research model and it contains two stages. The incorporation of stage issues into the research model was to increase the reliability and validity of the findings as the one stage provides the opportunity to check the findings of the previous stage (Kirk and Miller, 1986). A review of previous research reveals that inadequate attentions were given on the issues of stages in designing the research model with notable exception of Wilkinson (1983) and Staughton and Williams (1994). The stages of initial model were: Familiarisation with the field, Data collection from the field, and the revisits of field. Lincoln and Guba (1985:235-236) highlighted the importance of determining successive phases of the inquiry. They suggest three phases for any study. The first phase is 'Orientation and Overview', the second phase is 'Focused exploration' and the third phase is 'Member check'. Walker (1985:20-23) also suggests three phases in designing the qualitative research model and these are: Preliminary, Principal, and Validation phase. Although the different phases have been used, the explanation provided by both methodologists is appear to be identical.

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Ackroyd & Hughes (1993:166) has emphasizes two aspects in collecting data: First, it is necessary for social researchers to take appropriate precautions as far as is possible to ensure that their data is reliable. Second, since there is not really any way of resolving problems entirely, it is also wise to regard survey data as indicative rather than definitive evidence. Regarding the first point, it is possible to check the responses of respondents by the use of different questions on the same topic, to ask open-ended questions as well as fixed answer questions, in short to probe the test the validity of the answer being given. It is also valuable to pilot a questionnaire and to consider the responses given reflectively.

3.2.3 Triangulation: Description and Present Study:

Rationale for math method is that different approaches to that same subject can add to understanding. More data can lead to a fuller application of complex topics.

The general idea being promoted with the triangulation metaphor is that the best way to develop knowledge of a subject is to study it from a number of points of view. As Denzin expresses it.

- No single method is free from flaws – no single method will adequately handle all the problems of causal analysis – and that no single method will yield all the data necessary for a theory's test. Consequently, the researcher must combine his methods in a process termed triangulation; that is empirical events must be examined from the vantage provided by as many method as possible.

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There are at least two ways in which the idea of triangulation can be understood. One is to see it as a strategy which is intended to reveal the one true picture of whatever it is research is about." The general strategy was to use multiple methods and data sources in an attempt to overcome the different threats to validity posed by different data-gathering instruments" (Pettigrew, 1973:75).

One of the focuses of this study is to establish the relationship between IT and SCM. In this section 'flaws and strength of each method need to be balanced. This situation Ackroyd & Hughes (1992:172) has describe in the way: "this rationale behind the call for more data, more situations and different methods, in order better to uncover what the 'true' picture is."

For many researchers, triangulation is restricted to the use of multiple data gathering techniques (usually three) to investigate the same phenomenon. Denzin (1978) insists that the multiple methods approach is the generic form of this approach. But triangulation additionally represents varieties of data, investigators, and theories as well as methods. Denzin (1978:295) outlines these four categories as follows:

- (1) Data triangulation has three subtypes: a) time, b) space, and c) person. Person analysis in turn, has three levels: a) aggregate, b) interactive, and c) collectivity. (2) Investigator triangulation consists of using multiple rather than single observers of the same object. (3) Theory triangulation consists of using multiple rather than single perspectives in relation to the same set of objects. (4)

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> Methodological triangulation can entail within-method triangulation and between-method triangulation.

Novice researchers are thus instructed in the use of research strategies composed of multiple methods in a single investigation. Denzin (1978:101) also suggests that triangulation includes multiple data collection procedures, multiple theoretical perspectives, and/or analysis techniques as well. The use of multiple research strategies and theories increases the depth of understanding an investigation can yield (Miles and Huberman, 1983).

In the social sciences, the use of triangulation can be traced back to Campbell and Fiske (1959) who developed the idea of "multiple operationism." They argued that more than one method should be used in the validation process to ensure that the variance reflected that of the trait and not of the method. Thus, the convergence or agreement between two methods "... enhances our belief that the results are valid and not a methodological artifact" (Bouchard, 1976:268).

This kind of triangulation is labeled by Denzin (1978:302) as "between (or across) method" type, and represents the most popular use of triangulation. It is largely a vehicle for cross validation when two or more distinct methods are found to be congruent and yield comparable data. For organizational researchers, this would involve the use of multiple methods to examine the same dimension of a research problem.

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Triangulation can have other meanings and uses as well. There is the "within-method" kind (Denzin, 1978:301) which uses multiple techniques within a given method to collect and interpret data. For quantitative methods such as survey research, this can take the form of multiple scales or indices focused on the same construct.

It should be underscored that the quantitative results were used largely to supplement the qualitative data, rather than the reverse which is far more common in organizational research. Jick (1979:606) argued that the survey become more meaningful when interpreted in light of critical qualitative information just as other statistics were most useful when compared with content analyses or interview results. Triangulation, in this respect, can lead to a prominent role of qualitative evidence (just as it also should assure a continuing role of quantitative data).

As the study is cross functional in nature and also an initial attempt, multiple methods would help to identify logical pattern of the phenomenon under study. Applying triangulation methodology would help the researcher to understand the complex reality in simple form. This further helps to describe and analyze the situation in a better form. As Glaser & Strauss (1965:8) observe the triangulation investigator is left to search for a logical pattern in mixed-method results. His or her claim to validity rests on a judgement or as Weiss (1968:349) calls it, "a capacity to organize materials within a plausible framework." One begins to view the researcher as builder and creator, piecing together many pieces of a complex puzzle into a coherent whole. It is in this respect that the first hand knowledge drawn from qualitative methods can become critical. While

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one can rely on certain scientific conventions (e.g., scaling, control groups, etc.) for maximizing the credibility of one's findings, the researcher using triangulation is likely to rely still more on a "feel" of the situation. This intuition and first hand knowledge drawn from the multiple vantage points is centrally reflected in the interpretation process. Glaser & Strauss (1965:8) observation about fieldworkers summarizes this point of how triangulated investigations seem to be crystallized: "The fieldworker knows that he knows, not only because he's been there in the field and because of his careful verifications of hypotheses, but because "in his bones" he feels the worth of his final analysis."

In summary, having rationalize the use of multi-method approach from research methodological perspective, this study has employed phase-wise method for data collection. This decision would help to achieve the goal of the present research. In this context, McCutcheon and Meredith (1993:251) comments can be cited: "the theoretical base in some of these areas [SCM] is not well developed (in fact, woefully weak) and field based approaches are the best ways to find out about the issues, describe the problems, discover solutions and generally ground our theory in the complex, messy world of real organizations".

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3.2.4 Field work:

Field work completed in two phases:

Phase-One: Orientation and Familiarization:

This phase concentrate on the national condition of pharmaceutical industry of Bangladesh. The main thrust of first stage was to familiarize with the pharmaceutical environment getting acceptance from the management to conduct research; developing trust; gaining unrestricted access to all documentary sources; collect maximum data to broaden the reason and process of implementing different aspects of business decisions. The experience and knowledge gathered during this stage will help not only to support or to modify the theoretical framework but also to validate the research model. Lincoln and Guba (1985:235) mention that "The object of this first phase [Orientation and Overview] is to obtain sufficient information to get some handle on what is important enough to follow up the detail".

Phase-Two: Data Collection from the field:

The second stage of the research model was 'Data Collection from the field'. This phase is largely dependent upon the analysis of previous phase is determining the interview structure, the sample size and the exact standing data. The primary mode of collecting data was interview and followed by open ended questions as it emerged. Phase was planned for three months to achieve the minimum number of interview from the selected companies. Lincoln and Guba (1985:235) mention that 'Sufficient time must be

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allowed between phase 1 and 2, for phase 1 data to be analyzed and for more structured protocols (Interview, Discussion) to be build accordingly'. Wilkinson (1983:102) said 'questions to be put to interviewees were generally determined prior to the interview'.

Moreover, the process of selecting the companies for interview was largely dependent upon the access to the companies. Having discussed the research problem with the top management of a number of good companies, accesses was not given saying "time constraint" for the executives. But the researcher understands that the sensitivity of SCM data was the prime factor. On the other hand, researcher has got time constraint to finish the study. As a result some of the good companies have not been selected for this study. The following are the companies selected for this study:

a) Bexmico Pharmaceuticals Ltd

b) Incepta Pharmaceuticals Ltd, and

c) ACI Pharmaceuticals Ltd

3.2.5 Interviews:

Although survey research is a relatively economical approach for theory testing, it does not provide depth of understanding regarding multifaceted issues. A case study methodology is needed to explore the complex what, why and how questions associated with organization capabilities and performance outcomes (Yin1981; Meredith, Raturi, Amoako-Gyampah and Kaplan 1989; McCutcheon and Meredith 1993). Therefore, following the initial stages of the survey data collection in each time period, a series of

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detailed interviews were conducted to complement and contextualize the survey findings (Pettigrew 1990).

In order to ensure that the majority of the content of our research area was covered, we used a semi-structured interview approach. Each interview was taped and transcribed for reliability purposes. Interviews ranged from 45 to 55 minutes. The largest firms in terms of revenue at each level of the Pharmaceuticals Supply Chain (PSC) were identified and contacted. As data collection began, a combination of opportunistic and snowball sampling (A snowball sample is one in which the researcher collects data on the few members of the target population he or she can locate, then asks those individuals to provide information needed to locate other members of that population whom they know) was followed. Interviews with respondents often led to contacts with respondents within the same company, stratum, or in another stratum of the PSC. The final sample consisted of 30 interviews with executives from 3 pharmaceuticals companies – Incepta , Bexmico and ACI. Data were collected in between May and July 2012. All measures were anchored on a 5 point Likert scale. Several experienced SCM researchers reviewed the instrument i.e interview schedule.

After embracing their feedback, the instrument was then pre-tested with multiple supply chain executives. The executives' comments and suggestions were carefully appraised and incorporated in the final version of the questionnaire.

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Once a company agreed to participate, a brief overview of the research objectives and a copy of the interview protocol were provided (Spradley 1979). A semi structured interview guide was used to assure comparability of findings while allowing for flexibility in perusing insight into unique practices and programs that became evident during the interview. During each interview, extensive notes were made for later reflection. These notes were then translated into structured case write-ups to avoid "data asphyxiation" (Pettigrew 1990). Importantly, each case was viewed as a "stand-alone entity" to help identify unique patterns and to validate generalized theory in cross-case comparisons (Eisenhardt and Graebner 2007).

3.2.6 Construct Measures:

One of the most important measures of scale adequacy is scale reliability, which is the percent of variance in an observed variable that is accounted for by the true score of the latent factor or underlying construct (DeVellis 1991). High-scale reliability means that all variables that measure a single factor share a high degree of common variance. Although there are different methods to measure scale reliability, the more commonly used statistic is Cronbach's coefficient α. Cronbach's α measures the degree of interitem correlation in each set of items and indicates the proportion of the variance in the scale scores that is attributable to the true score. α levels below 0.7 are considered unacceptable (DeVellis 1991).

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Therefore, the constructs are adequately normal, theoretically unique and posses good reliability as well as acceptable convergent and discriminant validity. We can be reasonably confident that the measured items reflect the theoretical constructs they are designed to measure. Further, use of rigorous tests to establish convergent and discriminant validity have shown the factors to be distinct and unique, we conclude that common methods bias does not unduly affect the interpretability of the findings (Podsakoff, Mackenzie, Lee and Podaskoff 2003).

3.2.7 Data Analysis:

In the present study, we analyze our data by employing descriptive statistics and Cronbach's alpha test . For the study, the entire analysis is done by personal computer (PC). A well known statistical package SPSS (Statistical Package for Social Sciences) 17 Version was used in order to analyze the data.

3.2.8 Descriptive Statistics:

A large data set is bulky, and its very mass poses a serious obstacle to any attempt to visually extract pertinent information. Much of the information contained in the data can be assessed by calculating certain summary numbers, known as *descriptive statistics*. For example, the arithmetic average or sample mean is a descriptive statistic that provides a measure of location-that is a 'central value' for a set of numbers. And

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the average of the squares of the distances of all of the numbers from the mean provides a measure of the spread, or variation, in the numbers.

The use of descriptive statistics in supply chain management is well recognized mean for the purpose of purified constructs as well as the individual measures that comprise the elements (Fawcett and his associates, 2011).

We shall rely most heavily on descriptive statistics that measure location, variation, and linear association (Johnson and Wichern, 2007).

3.3 Summary

In this chapter showed the research framework, which is focused on the role of information technology in supply chain management. Here I also developed the argument of my study. The chapter also described the methodology of the study. The choice of using multi methods in a combination of both quantitative and qualitative criteria was justified. The choice of personal interview strategy for data collection was stated. In the study, 30 executives from 3 pharmaceutical companies were successfully interviewed. The study coded and processed the data collected using a special data entry and analysis through SPSS package. The major statistical tools used included, among others, descriptive statistics and Cronbach's alpha test. Now, the forthcoming chapter will present the description and analysis of data.

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CHAPTER FOUR: DESCRIPTION AND ANALYSIS OF DATA

4.0 Introduction

In Bangladesh, Pharmaceutical sector is one of the most developed hi tech sector which is contributing in the country's economy. After the promulgation of Drug Control Ordinance - 1982, the development of this sector was accelerated. The professional knowledge, thoughts and innovative ideas of the pharmacists working in this sector are the key factors for this development. Due to recent development of this sector we are exporting medicines to global market including European market. This sector is also providing 95% of the total medicine requirement of the local market. Leading Pharmaceutical Companies are expanding their business with the aim to expand export market. Recently few new industries have been established with hi tech equipments and professionals which will enhance the strength of this sector (Bangladesh Pharmaceutical Society, 2012).

This study has evaluated the supply chain management of three pharmaceuticals companies in Bangladesh. These are as follows:

- Beximco Pharmaceuticals Ltd,
- Incepta Pharmaceuticals Ltd. and
- ACI Pharmaceuticals Ltd.

Here the description of the organization and analysis of data are given below:

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4.1 Beximco Pharmaceuticals Limited

Beximco Pharmaceuticals Ltd (BPL) is a leading manufacturer of pharmaceutical formulations and Active Pharmaceutical Ingredients (APIs) in Bangladesh. The company is the largest exporter of pharmaceuticals in the country and its state-of-the-art manufacturing facilities are certified by global regulatory bodies of Australia, European Union, Gulf nations, Brazil, among others. The company is consistently building upon its portfolio and currently producing more than 400 products in different dosage forms covering broader therapeutic categories which include antibiotics, antihypertensives, antidiabetics, antireretrovirals, anti asthma inhalers etc, among many others.

With decades of contract manufacturing experience with global MNCs, skilled manpower and proven formulation capabilities, the company has been building a visible and growing presence across the continents offering high quality generics at the most affordable cost.

Ensuring access to quality medicines is the powerful aspiration that motivates more than 2,500 employees of the organization, and each of them is guided by the same moral and social responsibilities the company values most (Beximco Pharmaceuticals Ltd , 2012a).

Manufacturing Capabilities

Situated near Dhaka, the capital city of Bangladesh, our manufacturing site extends over an area of 23 acres. The site houses manufacturing facilities for producing various drug

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formulae in different strengths and delivery systems such as capsules, tablets, intravenous fluids, metered dose inhalers, ophthalmic drops, injectables and nebulizer solutions. The site has its own utility infrastructure to ensure adequate generation and distribution of electricity with an installed capacity of 10 MW, in addition to water purifying and liquid nitrogen generation facilities. The bulk drug unit for producing paracetamol is also located within this site. The Company's penicillin API and formulation units are situated at Kaliakoir, a few kms from the main site.

The company has diversified into innovative delivery systems such as dry powder inhalers, total parenteral nutrition, prefilled syringes and lyophilized products (Beximco Pharmaceuticals Ltd 2012b).

Demand Forecasting and Market Information

Demand forecasting of Beximco Pharmaceuticals Ltd depends on both internal sources and external sources. Based on external information Strategic Brand Management (SBM) department of Beximco Pharmaceuticals Ltd forecasts their existing demand. SBM collects information from SMSRC, MSP, 4P Marketing Consultancy, and IMS. MSP involved with prescription survey. 4P Marketing Consultancy provides market information. SMSRC involved with prescription survey and provides quarterly data. IMS Bangladesh also provides quarterly and monthly data.

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Strategic Marketing Solutions and Research Centre (SMSRC) Private Limited

SMSRC conducted numerous Corporate Strategy Workshops (SW) as the Team Leader to finalize Corporate Strategic Action Plan starting from setting Corporate and Divisional Strategic Perspective and finally arriving at:

- Restructuring of Marketing Operations & setting up Divisionalization Processes
- Product Portfolio Structuring
- Merger and Acquisition Strategy Formulation
- New Product / Therapy Gap Identification and New Launch Strategy Planning
- Brand & Therapy Building Strategy
- Doctor Coverage & Field Force Planning
- Sales Representative Call Evaluation and Call Pattern Designing

National and Multinational organization he has served (few examples):

1 . Alembic	2. Alkem Laboratories
3. Aristo Pharmaceuticals	4. AstraZeneca (India)
5. Cipla	6. Dr. Reddy's Laboratories
7. E MERCK	8. Fourrts (India)
9. GlaxoSmithkline Pharmaceuticals	10. Intas Pharmaceuticals
11. Lupin Laboratories	12. MSD

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13. Novartis India
14. Piramal Healthcare
15. Ranbaxy Laboratories
16. Sun Pharmaceutical
17. Tablets (India)
18. Unichem Laboratories
19. Wockhardt
20. Zydus Cadila Healthcare

Management Development Programme:

During 2007 & 2009, as the Programme Director, Mr Sanjoy Mitra was the only professional from C MARC who coordinated and conducted number of Management Development Programmes (MDP) for various national and international pharmaceutical organisations from India and Bangladesh to train the Product Management & Field Management Teams of various pharmaceutical organizations (Strategic Marketing Solutions and Research Centre (SMSRC) Private Limited , 2012).

4.1.1 IMS

IMS is a leading provider of information, services and technology for the healthcare industry, covering markets in 100+ countries around the world.

A market leader for more than 55 years, they blend industry expertise and advanced technology to deliver the most accurate perspectives and in-depth analytics on healthcare dynamics. Actionable insights, powered by superior information assets, are tuned to our clients' precise requirements.

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They continuously innovate to keep pace with a global healthcare environment that is increasingly complex and interdependent.

In addition to the daily demands of supplying products to countless locations globally, wholesalers must proactively prepare for the impacts of emerging healthcare trends — the aging population, emerging markets, the growth of specialty therapeutics, greater regulatory involvement, patent expirations and parallel trade — all while ensuring safe storage and handling. In a business operating on a narrow margin, every decision affects the bottom line.

Today, distributors do much more than simply optimize their inventory levels. Activities in the areas of supply chain integrity, assurance of stock availability, planning for and catering to individual store needs and ensuring contract compliance are reviewed and adjusted real-time. In addition, distributors are extending their retail services to help their pharmacies remain relevant and patient-focused.

These new demands require knowledge that is real-time and consistent across the geographic field of operations. They provide a range of services that support the needs of our pharmaceutical distributors —national, regional and specialty — in areas such as:

- Performance measurement and management
- Program design, monitoring and measurement/ROI
- Advanced customer segmentation and targeting
- Utilization metrics
- Forecasting

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- Category management
- Generic utilization tracking
- Customer contract compliance
- Commercial effectiveness services such as sales force alignment and incentive compensation

➢ ***IMS Bangladesh***

In Bangladesh IMS also play a vital role. These are as follows:

Bangladesh Market Overview

In the past ten years, the Bangladesh pharmaceutical market has doubled in growth, reaching a total value of US$929 million in from the fourth quarter of 2009 to third quarter of 2010. Dynamic, vital, and blessed with a 6.21% GDP, the country was recently named to the Goldman Sachs "Next Eleven" list as well as the JP Morgan "Frontier Five." At IMS Health, we too believe that Bangladesh stands poised to join China, India, Brazil, and Russia as a country that represents significant potential to multinational companies.

At the moment, the Bangladesh market is dominated by local players. The top 10 companies in Bangladesh, all of which are local companies, contribute 68% to the total market, while the top 20, just four of which are multinational, contribute 84%. All told, nearly 200 manufacturers are responsible for the 8,000 branded generics now available

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to the local population. Competition is intense, but the branded generics nature of the market enables top companies to command premium prices and ensure a return on their investment.

The Bangladesh pharma market is heavily retail oriented, with the bulk of distribution undertaken by the companies themselves, leaving wholesalers to play a limited role. Patients must advocate for themselves within the system, as health insurance is virtually non-existent and patients are expected to pay the full price for medicines.

To help clients realize the potential present in the Bangladesh market, IMS provides a number of services ranging from Information and Analytics to Commercial Effective Services and Management Consulting. These include:

- **Information & Analytics**

Bangladesh Pharmaceutical Index (BDPI) – The BDPI estimates the primary sales in volume & value of the pharmaceutical market, by projecting the sell-in transactions made by companies to the panel retail outlets. It includes a regional breakdown and monthly and quarterly data.

- **Commercial Effectiveness Services**

Commercial Effectiveness Services in Asia-Pacific deliver evidence-based market insights to support critical sales and marketing decisions. The services have two vital elements: Commercial Intelligence and Commercial Analytics.

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Commercial intelligence offers performance analytics and performance tracking, brand insights, primary market research, learning solutions, incentive compensation and a range of business transformation services.

Commercial analytics provides integrated and channel optimization, cross geography, portfolio and channel promotion allocation, field force sizing and structure optimization; promotional program and ROI analyses, prescriber, patient and account profiling, segmentation and targeting and account management optimization.

- **Management Consulting (MC)**

MC provides IMS Health with a unique opportunity to serve our clients and people better. They are the advisor of choice to the executives of leading global life sciences organizations:

- ❖ The MC team focuses on issue-based, value-add engagements supporting clients.
- ❖ The MC team maintains 5 core areas of specialization: Brand & Commercial Strategy (B&CS), Strategy & Portfolio Analysis (S&PA), Pricing & Market Access (P&MA), Health Economics & Outcomes Research (HEOR), and Competitive Intelligence (CI). It leverages the foundation of IMS data assets.
- ❖ The MC team is committed to high-quality engagement, which supports both company and product issue resolution, ultimately facilitating clients' personal successes (IMS, 2012).

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4.1.2 Supply Chain Management of Beximco Pharmaceuticals Ltd

The supply chain system of Beximco Pharmaceuticals Ltd started from strategic Brand Management (SBM) then it goes in following stage:

Planning Department- Beximco Pharmaceuticals Ltd

After getting information from SBM department, the planning department will check inventory and raw materials. Every six months they will monitor it.

Procurement Department

After getting internal procurement order (IPO) from planning department, procurement department analyzes data regarding approve source and price. The concerned department collects raw materials from USA, Italy, Spain, Germany, Belgium, Ukraine, India,China and so on. After negotiating price, the concerned department will issue pro-forma invoice. In the case of new product basically raw materials, the concerned department will go through British Pharmacopoeia, US Pharmacopoeia and WHO (World Health Organization) website.

Quality Control (QC)

After getting sample from the concerned suppliers, QC department will test the sample.

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Quality Assurance (QA)

QA department will go through suppliers documents such as trade license and Bangladesh Bank approval and so on. After satisfying their requirement, QA approves their order.

Director General of Drug Administration (DGDA)

After getting price and quantity from procurement department, DGDA went through quantity, price and VAT related issues. They also approves block list.

Insurance

After getting approval from DGDA, the concerned company will seek insurance company for insuring imported raw materials.

Bank

After managing insurance policy, the company will apply for LC (Letter of Credit).

Freight Forwarding Agent

In this case, Beximco Pharmaceuticals Ltd appoints their own freight forwarding agents named IGS.

At Intergroup Shipping (IGS), Freight Forwarding is a well defined, planned and executed service function. Offering a very strong local market focus and a comprehensive global reach, it brings to each client the assurance and the satisfaction of dealing with a professional logistics management group.

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Responsible for this service at IGS is a close knit team of experts who are well informed and well versed with the intricacies of managing and delivering a complete range of logistics solutions across multiple surfaces.

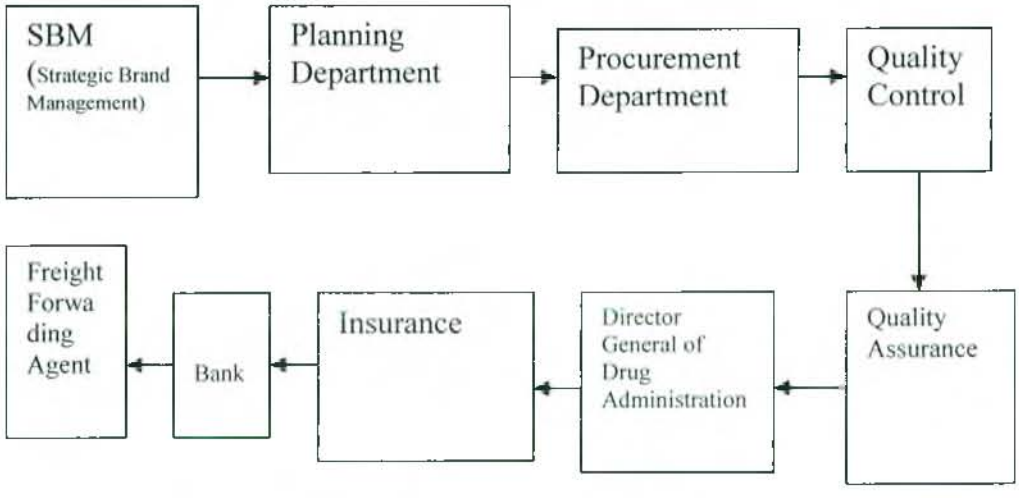
Today, the service has evolved to cover a variety of shipments, offering a wide choice of destinations and provides the perfect match between cost and time schedules.

International Marketing Department (IMD)

IMD analyzes foreign market potentialities. They also responsible for exporting finished product in international markets.

Figure 4.1 Supply Chain Management of Beximco Pharmaceuticals Ltd

Backward Integration (Raw materials) and Forward Integration (Consumers)



Source: Beximco Pharmaceuticals Ltd

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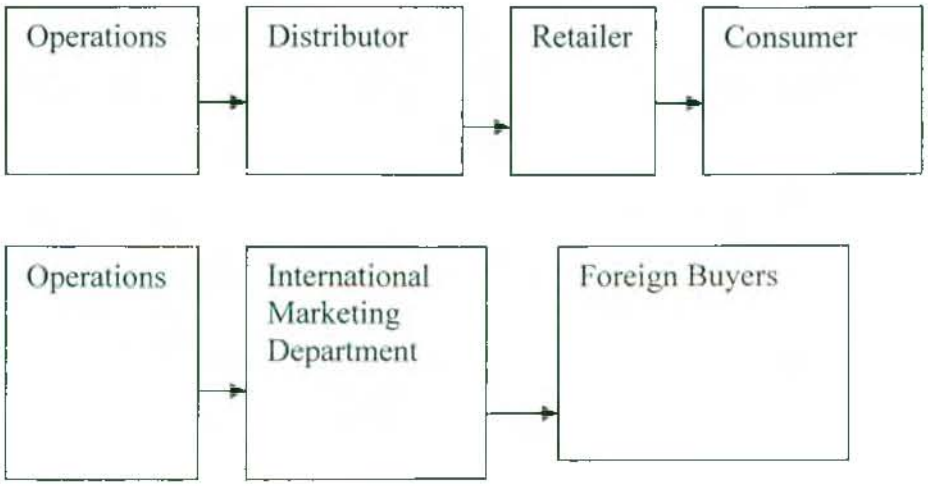

Source: Beximco Pharmaceuticals Ltd

4.1.3 Data Analysis of Beximco Pharmaceuticals Ltd (BPL)

Here, data are collected from various employees from Beximco Pharmaceuticals Ltd (BPL) with the help of prescribed Questionnaire (Appendix). The study coded and processed the data collected using a special data entry and analysis through SPSS package. The major statistical tools are included, among others, descriptive statistics and Cronbach's alpha test.

The data collection process and analysis is given below:

- **Demographic Profile of the Respondents:**

Table 4.1.1: Gender

Gender	Frequency	Percent
Male	10	100.0

Source: The Author

Table 4.1.1 shows that all respondents are male.

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Table 4.1.2: Work Experience

Work Experience	Frequency	Percent
1-4 Years	7	70.0
5-8 Years	3	30.0
Total	10	100.0

Source: The Author

Table 4.1.2 depicts that 70 percent respondents acquired 1-4 years job experience and 30 percent respondents acquired 5-8 years job experience.

Table 4.1.3: IT Experience

IT Experience	Frequency	Percent
1-4 Years	7	70.0
5-8 Years	3	30.0
Total	10	100.0

Source: The Author

Table 4.1.3 depicts that 70 percent respondents acquired 1-4 years IT experience and 30 percent respondents acquired 5-8 years IT experience.

Table 4.1.4: Position or Title

Position	Frequency	Percent
Senior Assistant Procurement Officer	4	40.0
Brand Executive	3	30.0
Brand Manager	3	30.0
Total	10	100.0

Source: The Author

Table 4.1.4 depicts that the survey respondents held a range of titles such as Senior Assistant Procurement Officer (40 percent), Brand Executive (30 percent) and Brand Manager (30 percent).

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Table 4.1.5: Scale Reliability of Observed Variables

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CI1	266.5000	41.8333	.4801	.7807
CI2	266.5000	41.8333	.4801	.7807
CI3	266.5000	41.8333	.4801	.7807
CI4	266.5000	41.8333	.4801	.7807
SI1	266.6000	52.2667	-1.0000	.8280
SI2	266.8000	38.4000	1.0000	.7607
SI3	266.2000	45.0667	.0000	.7922
SI4	266.9000	48.7667	-.5830	.8139
BSIT1	266.8000	38.4000	1.0000	.7607
BSIT2	266.9000	48.7667	-.5830	.8139
BSIT3	266.2000	45.0667	.0000	.7922
BSI1	268.9000	48.7667	-.5830	.8139
BSI2	268.9000	48.7667	-.5830	.8139
BSI3	268.2000	45.0667	.0000	.7922
SPM1	267.2000	45.0667	.0000	.7922
SPM2	266.5000	41.8333	.4801	.7807
SPM3	266.2000	45.0667	.0000	.7922
OPM1	266.8000	39.0667	.4195	.7824
OPM2	268.1000	35.4333	.8506	.7538
OPM3	267.2000	45.0667	.0000	.7922
LP1	268.2000	45.0667	.0000	.7922
LP2	269.2000	45.0667	.0000	.7922
LP3	268.2000	45.0667	.0000	.7922
LP4	267.2000	45.0667	.0000	.7922
EC1	266.8000	38.4000	1.0000	.7607
EC2	266.8000	38.4000	1.0000	.7607
EC3	266.5000	41.8333	.4801	.7807
EC4	267.2000	45.0667	.0000	.7922
EC5	269.2000	45.0667	.0000	.7922
EP1	269.2000	45.0667	.0000	.7922
EP2	268.5000	41.8333	.4801	.7807
EP3	268.2000	45.0667	.0000	.7922

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EP4	267.9000	48.7667	-.5830	.8139
EP5	268.2000	45.0667	.0000	.7922
ERP1	268.2000	45.0667	.0000	.7922
ERP2	268.2000	45.0667	.0000	.7922
EPR3	268.2000	45.0667	.0000	.7922
ERP4	268.2000	45.0667	.0000	.7922
ERP5	268.2000	45.0667	.0000	.7922
MC1	267.1000	35.4333	.8506	.7538
MC2	267.1000	35.4333	.8506	.7538
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
MC3	267.1000	35.4333	.8506	.7538
MC4	266.6000	52.2667	-1.0000	.8280
IT1	266.2000	45.0667	.0000	.7922
IT2	266.5000	41.8333	.4801	.7807
IT3	266.2000	45.0667	.0000	.7922
IT4	266.2000	45.0667	.0000	.7922
IT5	266.2000	45.0667	.0000	.7922
GEN1	266.9000	48.7667	-.5830	.8139
GEN2	267.5000	41.8333	.4801	.7807
GEN3	270.2000	45.0667	.0000	.7922
GEN4	267.8000	38.4000	1.0000	.7607
DIS1	267.2000	45.0667	.0000	.7922
DIS2	268.2000	45.0667	.0000	.7922
DIS3	268.2000	45.0667	.0000	.7922
DIS4	267.5000	41.8333	.4801	.7807
USE1	266.2000	45.0667	.0000	.7922
USE2	267.2000	45.0667	.0000	.7922
USE3	267.2000	45.0667	.0000	.7922
USE4	267.2000	45.0667	.0000	.7922
INQT1	266.2000	45.0667	.0000	.7922
INQT2	268.2000	45.0667	.0000	.7922
INQT3	268.2000	45.0667	.0000	.7922
INQT4	267.2000	45.0667	.0000	.7922
INQL1	268.2000	45.0667	.0000	.7922
INQL2	268.2000	45.0667	.0000	.7922
INQL3	268.2000	45.0667	.0000	.7922
INQL4	268.2000	45.0667	.0000	.7922
IA1	267.2000	45.0667	.0000	.7922
IA2	267.8000	38.4000	1.0000	.7607
IA3	267.2000	45.0667	.0000	.7922
IA4	267.2000	45.0667	.0000	.7922

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Reliability Coefficients
N of Cases = 10.0 N of Items = 72
Alpha = .7921

Source: The Author

The scale items used to measure each observed variables are specifically derived from past studies. One of the most important measures of scale adequacy is scale reliability, which is the percent of variance in an observed variable. Although thre are different methods to measure scale reliability, the more commonly used statistic is Cronbach's coefficient α.. Cronbach's α. measures the degree of interim correlation in each set of items and indicates the proportion of variance in the scale scores that is attributable to the true score. Cronbach's α. levels below 0.7 are considered unacceptable (Sanders, 2005). Here all the observed variables have a value of Cronbach's α. above 0.7 (Table 4.1.5).

Table 4.1.6: Descriptive Statistics of Observed Variables

Observed Variables	N	Minimum	Maximum	Mean	Std. Deviation
INQT1 customers' requirements?	10	5	5	5.00	.000
USE1 improve understanding of customers	10	5	5	5.00	.000
IT5 constantly monitor and evaluate available information technology options	10	5	5	5.00	.000
IT4 maintain a strong network relationships with information technology suppliers	10	5	5	5.00	.000
IT3 maintain knowledge and skills needed to put together the best information technology for your company	10	5	5	5.00	.000
IT1 actively search out and acquire state of the art information technology	10	5	5	5.00	.000

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Development of new business opportunities	10	5	5	5.00	.000
Alignment of applications used for communication	10	5	5	5.00	.000
We believe that cooperating with our suppliers is beneficial	10	5	5	5.00	.000
We strive to be highly responsive to our customers' needs	10	4	5	4.70	.483
IT2 effectively use state of the art information technology	10	4	5	4.70	.483
RFxrequest for quotation ,proposal and information	10	4	5	4.70	.483
Creation of new products, product enhancements	10	4	5	4.70	.483
Our customers seem happy with our responsiveness to their problems	10	4	5	4.70	.483
Our customers give us feedback on our quality and delivery performance	10	4	5	4.70	.483
We frequently are in close contact with our customers	10	4	5	4.70	.483
Mix flexibility	10	4	5	4.60	.516
We are comfortable sharing problems with our suppliers	10	4	5	4.60	.516
Order management and tracking	10	4	5	4.40	.516
Content and knowledge management	10	4	5	4.40	.516
Alignment of applications used in transaction processing	10	4	5	4.40	.516
In dealing with our suppliers, we are willing to change assumptions in order to find more effective solutions	10	4	5	4.40	.516
Cost efficiencies from higher sales volumes	10	3	5	4.40	.966
GEN1from key customers	10	4	5	4.30	.483
Alignment of applications used in operations	10	4	5	4.30	.483
We emphasize openness of communications in collaborating with our suppliers	10	4	5	4.30	.483

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Unit manufacturing cost	10	3	5	4.10	.876
Delivery speed	10	3	5	4.10	.876
Manufacturing lead time	10	3	5	4.10	.876
IA4 industry trends	10	4	4	4.00	.000
IA3 competition in our industry	10	4	4	4.00	.000
IA1 how to provide high quality services	10	4	4	4.00	.000
INQT4 industry trends?	10	4	4	4.00	.000
USE4 improve customer service	10	4	4	4.00	.000
USE3 improve decision-making	10	4	4	4.00	.000
USE2 identify opportunities for new business	10	4	4	4.00	.000
DIS1 to the right people inside the firm	10	4	4	4.00	.000
Access to catalogues	10	4	4	4.00	.000
Increased the level of work force flexibility following your business unit's competitive strategy(e.g. temporary workers, part time , job sharing , variable working hours, etc.)	10	4	4	4.00	.000
Increased profitability	10	4	4	4.00	.000
Learning about customers and markets for our products	10	4	4	4.00	.000
GEN2 from your suppliers	10	3	4	3.70	.483
DIS4 effectively prioritize information from external sources	10	3	4	3.70	.483
IA2 how to meet customers' needs	10	3	4	3.40	.516
GEN4 about industry trends	10	3	4	3.40	.516
epOrder management and tracking	10	3	4	3.30	.483
Improvements to current processes or creation of new processes	10	2	4	3.10	.876
INQL4 credible?	10	3	3	3.00	.000
INQL3 complete?	10	3	3	3.00	.000
INQL2 accurate?	10	3	3	3.00	.000
INQL1 timely?(untimely-timely)	10	3	3	3.00	.000
INQT3 competitors?	10	3	3	3.00	.000
INQT2 suppliers' schedules?	10	3	3	3.00	.000

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DIS3 in a timely manner	10	3	3	3.00	.000
DIS2 in user friendly formats	10	3	3	3.00	.000
Distribution management	10	3	3	3.00	.000
Sales management	10	3	3	3.00	.000
Production planning and control	10	3	3	3.00	.000
Material management	10	3	3	3.00	.000
Purchasing and supply management	10	3	3	3.00	.000
epAuctions	10	3	3	3.00	.000
epAccess to catalogues	10	3	3	3.00	.000
Implemented action programs to increase the level of delegation and knowledge of your workforce(e.g. empowerment, training, autonomous teams, etc.) during last three years	10	3	3	3.00	.000
Implemented the lean organizational model by e.g.reducing the number of levels and broadening the span of control during last three years	10	3	3	3.00	.000
Collaborative planning with buyer	10	3	3	3.00	.000
epContent and knowledge management	10	2	3	2.70	.483
Cross-functional teams with buyer	10	2	3	2.30	.483
Partnering with buyer	10	2	3	2.30	.483
epRFxrequest for quotation ,proposal and information	10	2	2	2.00	.000
Auctions	10	2	2	2.00	.000
Implemented continuous improvement programs through systematic initiatives(e.g.kaizen, improvement teams,etc.) during last three years	10	2	2	2.00	.000
GEN3 about your competitors	10	1	1	1.00	.000
Valid N (listwise)	10				

Source: The Author

Table 4.1.6 shows that the most of the mean value of IT infrastructure , few variables of mean value of information use, supplier integration , collecting market information ,

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and buyer-supplier IT alignment is 5. After 2006, they introduce IT in SCM. That's why they develop their IT infrastructure. They use tailor made software in SCM which is invented by BOL. Still they do not introduce sophisticated software like SAP or Oracle. Within few months, they will introduce SAP software in SCM. For that reason, ERP system of Beximco Pharmaceuticals Ltd (BPL) is not up to mark. When they will import raw materials, then they will consider ERP system in few extents.

4.2 Incepta Pharmaceuticals Limited

Incepta Pharmaceuticals Ltd. is a leading pharmaceutical company in Bangladesh established in the year 1999. The company has a very big manufacturing facility located at Savar, 35 kilometer away from the center of the capital city Dhaka. The company produces various types of dosage forms which include tablets, capsules, oral liquids, ampoules, dry powder vials, powder for suspension, nasal sprays, eye drops, creams, ointments, lotions, gels, prefilled syringes, liquid filled hard gelatin capsules, lyophilized injections, human vaccine etc. Since its inception, Incepta has been launching new and innovative products in order to fulfill unmet demand of the medical community. The focus has always been to bring new, more technologically advanced molecules and innovative dosage forms to this country.

The vision of Incepta Pharmaceuticals Ltd is to become a research based global pharmaceutical company in addition to being a highly efficient generic manufacturer. They would also like to discover and develop innovative, value-added products that

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improve the quality of life of people around the world and significantly contribute towards the growth of Bangladesh.

History

Incepta began its operation with a handful of highly skilled and dedicated professionals guided by an able leadership. Proper strategic planning, technical excellence, swift and timely decisions helped us achieve our objectives leading to much faster growth. Incepta was able to anticipate the need of the market and provide the right product at the right time. High focus on R&D investment from the very beginning made possible the introduction of quality products ahead of its competitors in most cases.

Incepta Pharmaceuticals Ltd. is now the 2nd largest company of the country and recognized as the fastest growing of the top five manufacturing company in the country. Established in the year 1999, the company has come a long way. Currently the Zirabo plant consists of several buildings with state of the art technology. Dedicated cephalosporin manufacturing building, a specialized manufacturing building for the production of lyophilized products, insulin and amino acids and newly built liquid and semisolid manufacturing building and large warehouse is also in operation.

Another multipurpose building for housing the Research & Development operation along with the canteen facility is also there. Currently all the products are coming from the plant at Zirabo.

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The company now produces almost all types of dosage forms covering nearly all therapeutic area.

Incepta now has one of the largest and competent sales force and large distribution network of its own, operated from 18 different locations throughout the country. A most dynamic skilled and dedicated marketing team comprising of pharmacists and doctors are at the core of the marketing operation. These highly skilled professionals play a crucial role in providing the necessary strategic guideline for the promotion of its product.

Distribution

Incepta has its own large distribution network having 18 depots all over the country. They make the products available in every single drug store of the country. The depots are located in Dhaka, Chittagong, Rajshahi, Khulna, Sylhet, Barisal, Comilla, Noakhali, Mymensingh, Magura, Bogra, Narayangonj, Rangpur, Dinajpur, Tangail, Jessor, Moulovibazar and Cox's Bazar (Incepta Pharmaceuticals Ltd,2012).

Quality Management System

The QMS of Incepta Pharmaceuticals Limited is established in a frame to describe its operations in different documents and practices which is based on the principles of PICS and WHO guidelines. The Quality Manual describes the Quality Policy of Incepta Pharmaceuticals Limited.

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The responsibilities for the technical aspects of Quality Assurance are defined in the Quality Manual. It encompasses all activities necessary to generate, maintain and verify the quality of drugs.

The Quality Assurance of Zirabo Plant consists of Quality Control, Quality Compliance and Quality Surveillance. The main tasks and duties of Quality Control have been described in the Quality Manual and relevant SOPs. The Head of Quality Assurance or his delegates are responsible for releasing drug substances, excipients, dosage forms and packaging materials.

Quality Compliance is responsible for IPC, GMP co-ordination and training. Performances of routine GMP checks are done as per need. Monitors to respect GMP regulation in the manufacturing by instant checks of Batch Record completion, visual checks of cleaning of working place, line clearance, performance checks of balance & other equipment.

Quality Surveillance is responsible for the implementation of the Quality Management System in different areas in collaboration with different departments. Quality Surveillance play active role in conducting external and internal audits with their follow-ups.

Research & Development is responsible for formulation development and method development, implementing technical transfer to Production and Quality Control, and also covers process validation, cleaning validation, method validation and follow up stability.

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The Quality Manual describes how testing instructions are established and used. The testing instructions include the specifications and testing methods. The testing instructions are binding for release testing and for follow-up stability testing.

A routine inspection is being done in the name of "Self Inspection" mainly concerned with safety, sanitation and infra-structural facilities leading to GMP including documentation.

Supply of raw materials are mainly obtained from approved suppliers. We select and evaluate the supplier as per procedures. This procedure is also applicable in case of supply of Primary and Secondary Packaging Materials.

Change Control Procedure

The Quality Unit along with other appropriate functions are responsible for coordinating activity in their respective areas to ensure that there is an assessment of all proposed changes and that approved changes are communicated to all affected parties. They are also responsible for Change Control Procedures, documentation, evidence and continuous support and maintenance for implemented changes.

All air conditioning system servicing production and service area required for room air-conditioning and production processes are designed as per International Standard.

The "Site Validation Master Plan" describes the strategy on qualification and validation covering Equipment Qualification, Process Validation, Cleaning Validation, Method Validation, System Validation, Personnel Validation etc

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Training is a routine function. The training needs depend on the function of the employee. Departmental Manager and Supervisors define the training needs.

A medical policy (health) exists for the employees.

Corporate Social Responsibility (CSR)

Incepta achieved its tremendous commercial success through its honesty and sincerity in business policies. The company aims to become the Nation's most admired company through its honest and intelligent approach. Company management strives to support community where they live and also the nation as far as possible in times of need.

Incepta believes it can thrive only if the nation remains healthy. Incepta gives emphasis to its practice of Corporate Social Responsibility (CSR) and evidence of this commitment is found in its dealing with clients, suppliers, employees, Government's and the society at large.

Company CSR activity includes its finances because the company pays tax and VAT to the Government and also settles bank and suppliers liabilities in a timely fashion and disburses benefits to employees on time. Incepta considers its employees to be valuable assets and protects their rights and provides a full range of staff facilities including life insurance and disbursement of 5% of the company profit to them. Incepta maximizes safety in workplace for its employees and child labor is strictly prohibited.

As its commitment to society the company donates medicine to the Government Relief Fund during natural disaster. Incepta also provides financial assistance for expensive

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treatment including heart and cancer and disburses its corporate Zakat for relief of distressed people every year.

Incepta also produces life-saving "import-substitute medicines" at affordable price for the people of Bangladesh as an expression of true love and compassion for the people. Incepta strongly believes that commitment towards people and the society as a whole positively contributes towards its business objective (Incepta Pharmaceuticals Ltd, 2012).

4.2.1 Supply Chain Management of Incepta Pharmaceuticals Ltd.

Supply chain Management (SCM) of Incepta Pharmaceuticals Ltd started from demand forecasting and its all process is given below: (Figure 4.2, page: 169)

Demand Forecasting

Earlier Incepta Pharmaceuticals Ltd collected market information from 4P-Marketing Consultancy and MSP. Now they collect information from IMS Bangladesh office.IMS Bangladesh provides quarterly data. Moreover, Incepta Pharmaceuticals Ltd established own survey team which is called Sales Service Research Department (SSRD). SSRD provides several information such as market share, prescription share, product trend, prescription habit, doctors choice, doctors treatment, drug group priority and so on.

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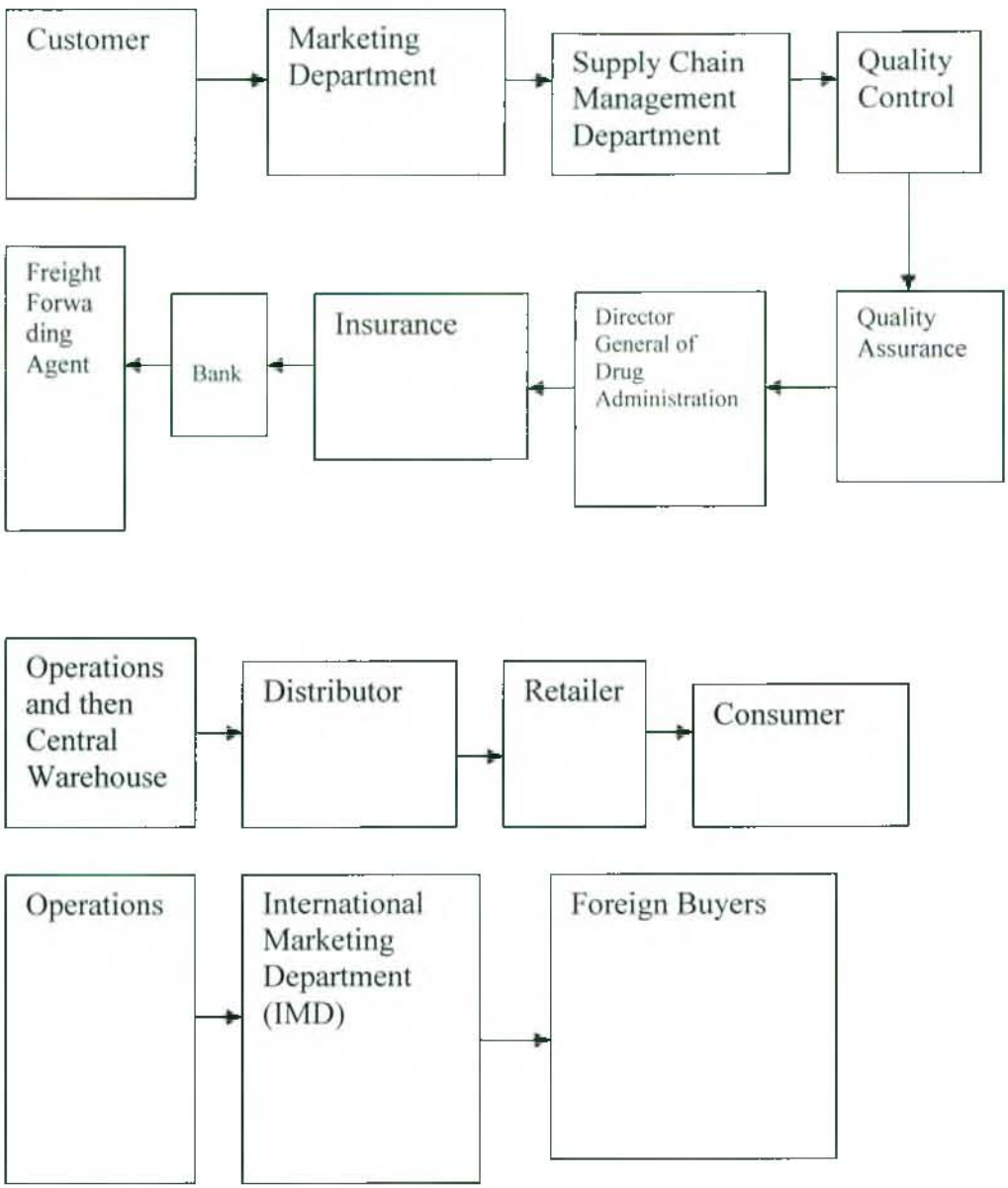
Backward and Forward Integration



Source: Incepta Pharmaceuticals Ltd

Figure 4.2 Supply Chain Management of Incepta Pharmaceuticals Ltd.

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4.2.2 Data Analysis of Incepta Pharmaceuticals Ltd

Here, data are collected from various employees from Incepta Pharmaceuticals Ltd with the help of prescribed Questionnaire (Appendix). The study coded and processed the data collected using a special data entry and analysis through SPSS package. The major statistical tools are included, among others, descriptive statistics and Cronbach's alpha test.

The data collection process and analysis is given below:

- **Demographic Profile of the Respondents**

Table 4.2.1: Gender

Gender	Frequency	Percent
Male	10	100.0

Source: The Author

Table 4.2.1 shows that all respondents are male.

Table 4.2.2: Work Experience

Work Experience	Frequency	Percent
1-4 Years	3	30.0
5-8 Years	3	30.0
25 Plus years	4	40.0
Total	10	100.0

Source: The Author

Table 4.2.2 depicts that 30 percent respondents acquired 1-4 years job experience , 30 percent respondents acquired 5-8 years job experience and 40 percent respondents acquired more than 25 years job experience .

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Table 4.2.3: IT Experience

IT Experience	Frequency	Percent
1-4 Years	7	70.0
5-8 Years	3	30.0
Total	10	100.0

Source: The Author

Table 4.2.3 depicts that 70 percent respondents acquired 1-4 years IT experience and 30 percent respondents acquired 5-8 years IT experience.

Table 4.2.4: Position/Rank

Position	Frequency	Percent
Brand Executive	3	30.0
Brand Manager	3	30.0
Senior Officer Supply Chain Management	4	40.0
Total	10	100.0

Source: The Author

Table 4.2.4 depicts that the survey respondents held a range of titles such as Senior Officer Supply Chain Management (40 percent),Brand Executive(30 percent) and Brand Manager (30 percent).

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Table 4.2.5: Scale Reliability of Observed Variables

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)				
Item-total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CI1	298.8000	279.0667	-.9435	.9309
CI2	298.4000	262.2667	-.6562	.9235
CI3	298.4000	262.2667	-.6562	.9235
CI4	298.8000	279.0667	-.9435	.9309
SI1	297.7000	252.2333	.0000	.9190
SI2	299.1000	268.7667	-.9922	.9259
SI3	298.1000	268.7667	-.9922	.9259
SI4	298.4000	262.2667	-.6562	.9235
BSIT1	298.3000	236.2333	.9911	.9137
BSIT2	298.0000	246.0000	.3960	.9175
BSIT3	297.7000	252.2333	.0000	.9190
BSI1	299.0000	242.6667	.6202	.9162
BSI2	299.0000	242.6667	.6202	.9162
BSI3	299.0000	242.6667	.6202	.9162
SPM1	298.7000	252.2333	.0000	.9190
SPM2	298.0000	242.6667	.6202	.9162
SPM3	297.7000	252.2333	.0000	.9190
OPM1	298.3000	233.5667	.6005	.9154
OPM2	297.7000	252.2333	.0000	.9190
OPM3	298.3000	236.2333	.9911	.9137
LP1	298.9000	220.7667	.9905	.9103
LP2	299.0000	242.6667	.6202	.9162
LP3	299.0000	242.6667	.6202	.9162
LP4	298.3000	236.2333	.9911	.9137
EC1	298.3000	236.2333	.9911	.9137
EC2	298.0000	242.6667	.6202	.9162
EC3	298.0000	242.6667	.6202	.9162
EC4	299.7000	252.2333	.0000	.9190
EC5	301.4000	262.2667	-.6562	.9235
EP1	298.3000	236.2333	.9911	.9137
EP2	298.6000	226.9333	.9300	.9118

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EP3	299.0000	242.6667	.6202	.9162
EP4	299.0000	242.6667	.6202	.9162
EP5	300.5000	285.8333	-.9927	.9340
ERP1	297.7000	252.2333	.0000	.9190
ERP2	297.7000	252.2333	.0000	.9190
EPR3	297.7000	252.2333	.0000	.9190
ERP4	297.7000	252.2333	.0000	.9190
ERP5	298.9000	220.7667	.9905	.9103
MC1	299.0000	242.6667	.6202	.9162
MC2	298.6000	226.9333	.9300	.9118
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
MC3	298.6000	226.9333	.9300	.9118
MC4	297.7000	252.2333	.0000	.9190
IT1	297.7000	252.2333	.0000	.9190
IT2	298.0000	246.0000	.3960	.9175
IT3	298.1000	268.7667	-.9922	.9259
IT4	297.7000	252.2333	.0000	.9190
IT5	297.7000	252.2333	.0000	.9190
GEN1	298.4000	262.2667	-.6562	.9235
GEN2	298.6000	230.2667	.7978	.9133
GEN3	300.9000	220.7667	.9905	.9103
GEN4	298.9000	220.7667	.9905	.9103
DIS1	298.3000	236.2333	.9911	.9137
DIS2	299.3000	236.2333	.9911	.9137
DIS3	298.9000	220.7667	.9905	.9103
DIS4	299.4000	258.9333	-.4460	.9224
USE1	298.1000	268.7667	-.9922	.9259
USE2	298.7000	252.2333	.0000	.9190
USE3	298.3000	236.2333	.9911	.9137
USE4	298.3000	236.2333	.9911	.9137
INQT1	297.7000	252.2333	.0000	.9190
INQT2	298.3000	236.2333	.9911	.9137
INQT3	298.7000	252.2333	.0000	.9190
INQT4	298.3000	236.2333	.9911	.9137
INQL1	298.6000	226.9333	.9300	.9118
INQL2	298.0000	246.0000	.3960	.9175
INQL3	298.0000	246.0000	.3960	.9175
INQL4	298.0000	246.0000	.3960	.9175
IA1	298.3000	236.2333	.9911	.9137
IA2	298.9000	220.7667	.9905	.9103
IA3	298.3000	236.2333	.9911	.9137

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IA4	298.3000	236.2333	.9911	.9137
Reliability Coefficients				
N of Cases = 10.0			N of Items = 72	
Alpha = .9188				

Source: The Author

The scale items used to measure each observed variables are specifically derived from past studies. One of the most important measures of scale adequacy is scale reliability, which is the percent of variance in an observed variable. Although there are different methods to measure scale reliability, the more commonly used statistic is Cronbach's coefficient α.. Cronbach's α. measures the degree of interim correlation in each set of items and indicates the proportion of variance in the scale scores that is attributable to the true score. Cronbach's α. levels below 0.7 are considered unacceptable(Sanders, 2005).Here all the observed variables have a value of Cronbach's α. above 0.9 (Table 4. 2.5).

Table 4. 2.6: Descriptive Statistics of Observed Variables

	N	Minimum	Maximum	Mean	Std. Deviation
INQT1 customers' requirements?	10	5	5	5.00	.000
IT5 constantly monitor and evaluate available information technology options	10	5	5	5.00	.000
IT4 maintain a strong network relationships with information technology suppliers	10	5	5	5.00	.000
IT1 actively search out and acquire state of the art information technology	10	5	5	5.00	.000
Mix flexibility	10	5	5	5.00	.000
Sales management	10	5	5	5.00	.000

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Production planning and control	10	5	5	5.00	.000
Material management	10	5	5	5.00	.000
Purchasing and supply management	10	5	5	5.00	.000
Improvements to current processes or creation of new processes	10	5	5	5.00	.000
Development of new business opportunities	10	5	5	5.00	.000
Alignment of applications used for communication	10	5	5	5.00	.000
We are comfortable sharing problems with our suppliers	10	5	5	5.00	.000
INQL4 credible?	10	4	5	4.70	.483
INQL3 complete?	10	4	5	4.70	.483
INQL2 accurate?	10	4	5	4.70	.483
IT2 effectively use state of the art information technology	10	4	5	4.70	.483
RFxrequest for quotation ,proposal and information	10	4	5	4.70	.483
Order management and tracking	10	4	5	4.70	.483
Creation of new products, product enhancements	10	4	5	4.70	.483
Alignment of applications used in operations	10	4	5	4.70	.483
USE1 improve understanding of customers	10	4	5	4.60	.516
IT3 maintain knowledge and skills needed to put together the best information technology for your company	10	4	5	4.60	.516
We believe that cooperating with our suppliers is beneficial	10	4	5	4.60	.516
IA4 industry trends	10	4	5	4.40	.516
IA3 competition in our industry	10	4	5	4.40	.516
IA1 how to provide high quality services	10	4	5	4.40	.516
INQT4 industry trends?	10	4	5	4.40	.516
INQT2 suppliers' schedules?	10	4	5	4.40	.516
USE4 improve customer service	10	4	5	4.40	.516

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USE3 improve decision-making	10	4	5	4.40	.516
DIS1 to the right people inside the firm	10	4	5	4.40	.516
epRFxrequest for quotation ,proposal and information	10	4	5	4.40	.516
Content and knowledge management	10	4	5	4.40	.516
Increased the level of work force flexibility following your business unit's competitive strategy(e.g. temporary workers, part time , job sharing , variable working hours, etc.)	10	4	5	4.40	.516
Increased profitability	10	4	5	4.40	.516
Alignment of applications used in transaction processing	10	4	5	4.40	.516
Cost efficiencies from higher sales volumes	10	3	5	4.40	.966
GEN1from key customers	10	4	5	4.30	.483
We emphasize openness of communications in collaborating with our suppliers	10	4	5	4.30	.483
We strive to be highly responsive to our customers' needs	10	4	5	4.30	.483
Our customers give us feedback on our quality and delivery performance	10	4	5	4.30	.483
INQL1 timely?(untimely-timely)	10	3	5	4.10	.876
GEN2 from your suppliers	10	3	5	4.10	.876
Unit manufacturing cost	10	3	5	4.10	.876
Delivery speed	10	3	5	4.10	.876
epContent and knowledge management	10	3	5	4.10	.876
INQT3 competitors?	10	4	4	4.00	.000
USE2 identify opportunities for new business	10	4	4	4.00	.000
Learning about customers and markets for our products	10	4	4	4.00	.000
Our customers seem happy with our responsiveness to their problems	10	3	5	3.90	.876
We frequently are in close contact with our customers	10	3	5	3.90	.876

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IA2 how to meet customers' needs	10	3	5	3.80	1.033
DIS3 in a timely manner	10	3	5	3.80	1.033
GEN4 about industry trends	10	3	5	3.80	1.033
Distribution management	10	3	5	3.80	1.033
Implemented the lean organizational model by e.g.reducing the number of levels and broadening the span of control during last three years	10	3	5	3.80	1.033
Manufacturing lead time	10	3	4	3.70	.483
epOrder management and tracking	10	3	4	3.70	.483
epAccess to catalogues	10	3	4	3.70	.483
Implemented action programs to increase the level of delegation and knowledge of your workforce(e.g. empowerment, training, autonomous teams, etc.) during last three years	10	3	4	3.70	.483
Implemented continuous improvement programs through systematic initiatives(e.g.kaizen, improvement teams,etc.) during last three years	10	3	4	3.70	.483
Collaborative planning with buyer	10	3	4	3.70	.483
Cross-functional teams with buyer	10	3	4	3.70	.483
Partnering with buyer	10	3	4	3.70	.483
In dealing with our suppliers, we are willing to change assumptions in order to find more effective solutions	10	3	4	3.60	.516
DIS2 in user friendly formats	10	3	4	3.40	.516
DIS4 effectively prioritize information from external sources	10	3	4	3.30	.483
Access to catalogues	10	3	3	3.00	.000
epAuctions	10	1	3	2.20	1.033
GEN3 about your competitors	10	1	3	1.80	1.033
Auctions	10	1	2	1.30	.483
Valid N (listwise)	10				

Source: The Author

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Table 4.2.6 shows that the mean value of IT infrastructure, information use, supplier integration, collecting market information, and buyer-supplier IT alignment is 5.After 2010, they introduce SAP software in SCM. That's why they develop their IT infrastructure. For that reason, ERP system of Incepta Pharmaceuticals Ltd is well organized and well developed. On the other hand mean value of auction is very low. Because they produce life saving products. If quality deteriorating, then they destroy those products.

4.3 ACI Pharmaceuticals Limited

In 1973, the UK based multinational pharmaceutical company, ICI plc, established a subsidiary in Dhaka, known as ICI Bangladesh Manufacturers Limited. In 1992, ICI plc divested its share to local management, and the company was renamed Advanced Chemical Industries (ACI) Limited.

ACI formulates and markets a comprehensive range of more than 387 products covering all major therapeutic areas, which come in tablet, capsule, powder, liquid, cream, ointment, gel ,ophthalmic and injection forms. ACI also markets world-renowned branded pharmaceutical products like Arimidex, Casodex, Zoladex, Atarax etc. from world-class multinational companies like ASTRAZENECA, UK and UCB, BELGIUM in Bangladesh.

ACI is actively engaged in introducing newer molecules and Novel Drug Delivery Systems (NDDS) to meet the needs of the future.

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ACI introduced the concept of quality management system by being the first company in Bangladesh to achieve ISO 9001 certification in 1995 and follows the policy of continuous improvement in all its operations.

Aligned with the concept that a pharmaceutical must ensure effective management of environment, ACI complies with standard environment management policy, thus adorned with EMS 14001 in 2000.

ACI maintains a congenial and supportive relationship with the healthcare community of Bangladesh, with the belief that business excellence can only be achieved through pursuit of quality by understanding, accepting, meeting and exceeding customer expectations.

The management of ACI, a competent team of professionals, thus operates with a progressive attitude to provide effective solutions to satisfy the customers' needs, through its products and services of uncompromising quality.

Location and area

The pharmaceutical manufacturing plant is located at Narayanganj, by the bank of river Shitolokkhya. It encompasses a land area of 11.5 acres with 85,000 square feet covered area. 235 skilled persons are involved in the plant to produce world class quality products.

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Facilities

The plant is well designed and well equipped with all latest facilities and state-of-the-art technologies. The responsible team of plant workers, supervisors, officers and managers strictly follow cGMP recommended by WHO and In-process Quality control methodology for production and meets all national regulatory requirements.

Product Development

This creative team of professionals is engaged in developing new formulations and dosage forms with competitive advantages and strong product differentiation.

Production

This highly skilled team is dedicated in producing products with consistent quality under clearly defined Standard Operating Procedures (SOP) in compliance with the procedures and instructions of ISO 9001 quality system.

Quality Assurance

This dedicated team plays the vigilant role of controlling, ensuring and maintaining the consistent quality of products for which ACI is so well recognized.

Domestic market

Being a developing country, the pharmaceutical market and at the same time, the pharmaceutical industry of Bangladesh is growing. In this growing market, ACI has been able to maintain its growth through its innovative marketing strategies.

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In Bangladesh, ACI introduced the concept of quality management system by being the first company to achieve ISO 9001 certification that reflects its commitment to quality in every aspect of business.

ACI covers the health care community of whole Bangladesh based in both urban and rural markets, through its 18 strategically located depots.

International Operations

After assuring its credentials in the pharmaceutical industry of the country, ACI Limited began spreading its wings toward greater interaction, integration and interdependence among people and organization across borders with trust on becoming a global player in the international market. ACI Limited started exporting medicine in 1999. The quality of ACI products, strengthened by its ISO 9001 certification, has brought immediate success in Sri Lanka, Myanmar, Vietnam and Yemen.

Distribution Network

The company maintains strategically located sales centers in nineteen different locations across the country. It has developed an advanced distribution system through its skilled and trained manpower and a large fleet over eighty vehicles. The distribution system is fully equipped for handling continuing volume of diverse range of products from the various businesses.

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The company's distribution centers are highly streamlined, computerized and automated. We are capable of maintaining a cold chain for some specialized range of products such as vaccines and insulin. The combination of this advanced function and multidimensional capabilities made it possible to handle hundreds of products efficiently.

MIS Department

MIS department of ACI ensures the overall IT related supports for the company. This department manages a smooth operation of software's, hardware trouble shooting and business databases related to sales and inventory. The MIS department consists of knowledgeable and skilled programmers and software developers. MIS provides customized report and data analysis to the management to facilitate effective decision making (ACI Pharmaceuticals Ltd, 2012). ACI basically use Sales and Depot Management System (SDMS) software for SCM. The SDMS software introduced by MIS department of ACI Ltd.

4.3.1 Data Analysis of ACI Pharmaceuticals Ltd

Here, data are collected from various employees from ACI Pharmaceuticals Ltd with the help of prescribed Questionnaire (Appendix). The study coded and processed the data collected using a special data entry and analysis through SPSS package. The major statistical tools are included, among others, descriptive statistics and Cronbach's alpha test.

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The data collection process and analysis is given below:

- **Demographic Profile of the Respondents**

Table 4.3.1: Gender

Gender	Frequency	Percent
Male	10	100.0

Source: The Author

Table 4.3.1 shows that all respondents are male.

Table 4.3.2: Work Experience

Work Experience	Frequency	Percent
1-4 Years	5	50.0
5-8 Years	4	40.0
More than 8 Years	1	10.0
Total	10	100.0

Source: The Author

Table 4.3. 2 depicts that 50 percent respondents acquired 1-4 years job experience , 40 percent respondents acquired 5-8 years job experience and 10 percent respondents acquired more than 8 years job experience.

Table 4.3.3: IT Experience

IT Experience	Frequency	Percent
1-4 Years	5	50.0
5-8 Years	5	50.0
Total	10	100.0

Source: The Author

Table 4.3.3 depicts that 50 percent respondents acquired 1-4 years IT experience and 50 percent respondents acquired 5-8 years IT experience.

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Table 4.3.4: Position or Title

Position	Frequency	Percent
DGM Supply Chain	1	10.0
Assistant Manager	2	20.0
Supply Chain Executive	2	20.0
Supervisor	1	10.0
Coordinator Officer	1	10.0
Commercial Executive	1	10.0
Assistant Commercial Officer	1	10.0
Commercial Assistant	1	10.0
Total	10	100.0

Source: The Author

Table 4.3.4 depicts that the survey respondents held a range of titles such as DGM Supply Chain (10 percent), Assistant Manager (20 percent), Supply Chain Executive (20 percent), Supervisor (10 percent), Coordinator Officer (10 percent), Commercial Executive (10 percent), Assistant Commercial Officer (10 percent) and Commercial Assistant (10 percent).

Table 4.3.5: Scale Reliability of Observed Variables

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
CI1	187.7000	934.0111	.3234	.9503

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CI2	187.7000	927.3444	.3946	.9501
CI3	187.4000	940.7111	.0999	.9515
CI4	187.9000	942.9889	.0795	.9513
SI1	187.0000	944.4444	.0281	.9523
SI2	187.0000	895.1111	.6696	.9489
SI3	187.4000	893.1556	.8535	.9481
SI4	187.6000	901.8222	.7805	.9486
BSIT1	187.4000	893.1556	.8535	.9481
BSIT2	187.3000	908.6778	.7003	.9490
BSIT3	187.0000	914.0000	.4976	.9497
BSI1	187.7000	938.4556	.2189	.9507
BSI2	187.7000	938.4556	.2189	.9507
BSI3	187.5000	923.3889	.5752	.9496
SPM1	187.1000	929.2111	.3705	.9502
SPM2	187.4000	893.1556	.8535	.9481
SPM3	186.7000	899.7889	.5122	.9499
OPM1	187.1000	894.3222	.7030	.9487
OPM2	187.3000	908.6778	.7003	.9490
OPM3	187.2000	909.5111	.6306	.9492
LP1	187.5000	923.3889	.5752	.9496
LP2	187.7000	938.4556	.2189	.9507
LP3	187.6000	938.7111	.1455	.9512
LP4	187.6000	923.6000	.4025	.9501
EC1	187.6000	937.6000	.1921	.9508
EC2	187.4000	943.1556	.0622	.9516
EC3	187.0000	904.2222	.5485	.9495
EC4	187.3000	916.9000	.5495	.9495
EC5	187.8000	962.4000	-.3470	.9522
EP1	188.4000	935.1556	.4378	.9501
EP2	188.0000	947.3333	.0041	.9515
EP3	187.7000	953.3444	-.1101	.9519
EP4	187.4000	938.0444	.1904	.9508
EP5	188.0000	927.7778	.5848	.9497
ERP1	188.1000	924.3222	.8295	.9494
ERP2	188.4000	925.6000	.3780	.9502
EPR3	187.7000	934.0111	.3234	.9503
ERP4	187.6000	923.1556	.5741	.9496
ERP5	187.1000	948.3222	.0000	.9508
MC1	187.4000	893.1556	.8535	.9481
MC2	187.4000	893.1556	.8535	.9481

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted

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MC3	187.4000	893.1556	.8535	.9481
MC4	187.5000	908.0556	.7783	.9488
IT1	186.7000	896.2333	.5527	.9497
IT2	187.7000	934.0111	.3234	.9503
IT3	187.1000	897.2111	.6632	.9489
IT4	187.1000	897.2111	.6632	.9489
IT5	187.1000	897.2111	.6632	.9489
GEN1	187.3000	916.9000	.5495	.9495
GEN2	186.4000	949.1556	-.0358	.9511
GEN3	189.1000	948.3222	.0000	.9508
GEN4	186.7000	938.6778	.2964	.9504
DIS1	187.7000	934.0111	.3234	.9503
DIS2	187.6000	923.1556	.5741	.9496
DIS3	187.5000	942.9444	.1138	.9510
DIS4	187.3000	922.9000	.4402	.9500
USE1	187.7000	934.0111	.3234	.9503
USE2	187.3000	916.9000	.5495	.9495
USE3	187.7000	934.0111	.3234	.9503
USE4	187.5000	908.0556	.7783	.9488
INQT1	187.4000	893.1556	.8535	.9481
INQT2	187.5000	938.7222	.2127	.9507
INQT3	187.6000	923.1556	.5741	.9496
INQT4	187.2000	923.9556	.3867	.9502
INQL1	187.5000	936.9444	.2544	.9505
INQL2	187.5000	938.7222	.2127	.9507
INQL3	187.5000	936.9444	.2544	.9505
INQL4	187.6000	923.1556	.5741	.9496
IA1	187.3000	916.9000	.5495	.9495
IA2	187.4000	921.8222	.5165	.9497
IA3	187.3000	916.9000	.5495	.9495
IA4	187.1000	917.2111	.4699	.9499

Reliability Coefficients

N of Cases = 10.0 N of Items = 72

Alpha = .9506

Source: The Author

The scale items used to measure each observed variables are specifically derived from past studies. One of the most important measures of scale adequacy is scale reliability,

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which is the percent of variance in an observed variable. Although there are different methods to measure scale reliability, the more commonly used statistic is Cronbach's coefficient α.. Cronbach's α. measures the degree of interim correlation in each set of items and indicates the proportion of variance in the scale scores that is attributable to the true score. Cronbach's α. levels below 0.7 are considered unacceptable(Sanders, 2005).Here all the observed variables have a value of Cronbach's α. above 0.9 (Table 4.3.5).

Table 4.3.6: Descriptive Statistics of Observed Variables

Observed Variables	N	Minimum	Maximum	Mean	Std. Deviation
GEN2 from your suppliers	10	3	4	3.70	.483
GEN4 about industry trends	10	3	4	3.40	.516
Development of new business opportunities	10	1	5	3.40	1.506
IT1 actively search out and acquire state of the art information technology	10	1	5	3.40	1.506
RFx request for quotation ,proposal and information	10	1	5	3.10	1.287
Alignment of applications used for communication	10	2	5	3.10	1.101
In dealing with our suppliers, we are willing to change assumptions in order to find more effective solutions	10	1	5	3.10	1.287
We are comfortable sharing problems with our suppliers	10	1	5	3.10	1.287
IA4 industry trends	10	1	4	3.00	1.054
IT5 constantly monitor and evaluate available information technology options	10	1	5	3.00	1.247
IT4 maintain a strong network relationships with information technology suppliers	10	1	5	3.00	1.247

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IT3 maintain knowledge and skills needed to put together the best information technology for your company	10	1	5	3.00	1.247
Distribution management	10	3	3	3.00	.000
Cost efficiencies from higher sales volumes	10	1	5	3.00	1.247
Learning about customers and markets for our products	10	2	4	3.00	.816
INQT4 industry trends?	10	1	4	2.90	.994
Increased profitability	10	1	4	2.90	.994
IA3 competition in our industry	10	1	4	2.80	.919
IA1 how to provide high quality services	10	1	4	2.80	.919
USE2 identify opportunities for new business	10	1	4	2.80	.919
DIS4 effectively prioritize information from external sources	10	1	4	2.80	.919
GEN1from key customers	10	1	4	2.80	.919
Access to catalogues	10	1	4	2.80	.919
Improvements to current processes or creation of new processes	10	1	4	2.80	.919
Alignment of applications used in operations	10	1	4	2.80	.919
IA2 how to meet customers' needs	10	1	4	2.70	.823
INQT1 customers' requirements?	10	1	5	2.70	1.059
Unit manufacturing cost	10	1	5	2.70	1.059
Delivery speed	10	1	5	2.70	1.059
Manufacturing lead time	10	1	5	2.70	1.059
epOrder management and tracking	10	1	4	2.70	.823
Order management and tracking	10	1	4	2.70	1.059
Creation of new products, product enhancements	10	1	5	2.70	1.059
Alignment of applications used in transaction processing	10	1	5	2.70	1.059
We believe that cooperating with our suppliers is beneficial	10	1	5	2.70	1.059

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We strive to be highly responsive to our customers' needs	10	1	4	2.70	1.059
INQL2 accurate?	10	1	3	2.60	.699
INQT2 suppliers' schedules?	10	1	3	2.60	.699
INQL3 complete?	10	1	3	2.60	.699
INQL1 timely?(untimely-timely)	10	1	3	2.60	.699
USE4 improve customer service	10	1	4	2.60	.843
DIS3 in a timely manner	10	1	3	2.60	.699
Mix flexibility	10	1	4	2.60	.843
Implemented the lean organizational model by e.g.reducing the number of levels and broadening the span of control during last three years	10	1	3	2.60	.699
Collaborative planning with buyer	10	1	3	2.60	.699
INQL4 credible?	10	1	3	2.50	.707
INQT3 competitors?	10	1	3	2.50	.707
DIS2 in user friendly formats	10	1	3	2.50	.707
Sales management	10	1	3	2.50	.707
Content and knowledge management	10	1	4	2.50	.850
Increased the level of work force flexibility following your business unit's competitive strategy(e.g. temporary workers, part time , job sharing , variable working hours, etc.)	10	1	4	2.50	.972
Implemented action programs to increase the level of delegation and knowledge of your workforce(e.g. empowerment, training, autonomous teams, etc.) during last three years	10	1	4	2.50	.972
We emphasize openness of communications in collaborating with our suppliers	10	1	4	2.50	.972
USE3 improve decision-making	10	1	3	2.40	.699
USE1 improve understanding of customers	10	1	3	2.40	.699
DIS1 to the right people inside the firm	10	1	3	2.40	.699
IT2 effectively use state of the art	10	1	3	2.40	.699

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information technology					
Production planning and control	10	1	3	2.40	.699
epAccess to catalogues	10	1	3	2.40	.843
Implemented continuous improvement programs through systematic initiatives(e.g.kaizen, improvement teams,etc.) during last three years	10	1	3	2.40	.699
Cross-functional teams with buyer	10	1	3	2.40	.699
Partnering with buyer	10	1	3	2.40	.699
Our customers give us feedback on our quality and delivery performance	10	1	4	2.40	.843
We frequently are in close contact with our customers	10	1	3	2.40	.699
Auctions	10	1	3	2.30	.675
Our customers seem happy with our responsiveness to their problems	10	1	4	2.20	.919
epAuctions	10	1	3	2.10	.568
epContent and knowledge management	10	1	3	2.10	.876
Purchasing and supply management	10	1	3	2.00	.471
epRFxrequest for quotation ,proposal and information	10	1	2	1.70	.483
Material management	10	1	3	1.70	.949
GEN3 about your competitors	10	1	1	1.00	.000
Valid N (listwise)	10				

Source: The Author

Table 4.3.6 shows that the mean value of information generation, strategic performance and buyer-supplier IT alignment is more than 3. IT infrastructure of ACI Pharmaceutical Ltd is not up to mark. Even they didn't introduce and apply any ERP software in SCM.

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4.4 Summary

This chapter has description of three pharmaceuticals companies supply chain management and analysis of data of three pharmaceuticals companies –Beximco Pharmaceuticals Ltd, Incepta Pharmaceuticals Ltd and ACI Pharmaceuticals Ltd. The evidence, obtained from the field visits, was presented in details. Based on this evidence and observations, made during the field survey, the effectiveness of IT use in supply chain management was assessed. Analyses divulged that Incepta Pharmaceuticals Ltd has the most effective organization in implementing IT in supply chain management. Incepta uses SAP software in supply chain management. The second successful pharmaceutical company seems to be Beximco. Beximco employs customized software in supply chain management. On the other hand, ACI Pharmaceuticals Ltd uses only Sales and Depot Management software in supply chain management and unable to employ IT and ERP software in SCM. To this end, the next chapter will explain the findings of the study.

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CHAPTER FIVE: FINDINGS OF THE STUDY

5.0 Introduction

This chapter mainly describes the finding of the study. The findings can be supported by the work of Cao, M. and Zhang, Q. (2011). They identified a set of seven interconnecting dimensions that make up effective supply chain collaboration: information sharing, goal congruence, decision synchronization, incentive alignment, resource sharing, collaborative communication, and joint knowledge creation. Benefits of supply chain collaboration will be realized when all parties in the supply chain from suppliers to customers cooperate. Jointly creating the common pace of information sharing, replenishment, and supply synchronization in a supply chain can reduce excess inventory, avoid costly bullwhip effect, enhance business synergy and quality, provide offering flexibility, and increase joint innovation.

The analysis of data properly showed in chapter four. In the study, I analyze my data by employing descriptive statistics and Cronbach's alpha test. For the study, the entire analysis is done by personal computer (PC). A well known statistical package SPSS (Statistical Package for Social Sciences) 17 Version was used in order to analyze the data. After analyzing data successfully, the finding described in this chapter. Three Pharmaceuticals company in Bangladesh are as follows:

- Beximco Pharmaceuticals Ltd,
- Incepta Pharmaceuticals Ltd. and
- ACI Pharmaceuticals Ltd.

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Findings are explained below:

5.1 Beximco Pharmaceuticals Limited

Beximco Pharmaceutical Company has been building a visible and growing presence across the continents offering high quality generics at the most affordable cost. Before the year 2006 Bexmico uses traditional supply chain systems and some cases they followed depot management software.

5.1.1 IT Application in Supply Chain Management (SCM) of Beximco Pharmaceuticals Ltd:

After 2006, they introduced information technology (IT) in supply chain management (SCM). That's why they develop their IT infrastructure which is includes various hardware, related software, database systems and networking. They use tailor made software in SCM which is invented by BOL (Bangladesh Online). This software can support to take decision properly in every stage of SCM in Beximco pharmaceuticals ltd.

Still Beximco Pharmaceuticals ltd does not introduce sophisticated software like SAP or Oracle. Within few months, they will introduce SAP software in SCM. For that reason, ERP system of Beximco Pharmaceuticals Ltd (BPL) is not up to mark. When they will import raw materials, then they will consider ERP system in few extents which is provided by third party.

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According to field work and analysis of data properly, after application of information technology in supply chain management of Beximco ltd, the company benefited a lot. This is presented in figure 5.1.1

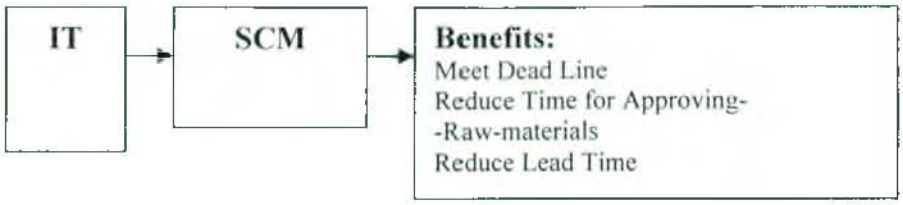

Figure: 5.1.1 Role of IT in SCM of Beximco Pharmaceuticals ltd.
Source: The Author

Discussion of these benefits is given below:

- ***Meet Dead Line***

After using information technology in the supply chain, Beximco pharma ltd can do its all SCM related work in due date. Here also need latest time for the completion of a negotiation, services, and product development. We know the failure to meet a deadline has negative consequences, such as loss of business, lack of credibility, and penalty charges. After 2006, Beximco can meet the deadline properly by using IT.

By using BOL software and IT infrastructure, here require least time to go is a dynamic scheduling algorithm and used in real-time operating systems. It places processes in a priority queue. Whenever a scheduling event occurs (task finishes, new task released, etc.) the queue will be searched for the process closest to its deadline.

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- ***Reduce Time for Approving Raw-materials***

Before 2006, when the IT infrastructure was not developed in Beximco, in that time approval was not automatic. For this reason, it took long time for approving raw materials and the work in process. After install the information technology in supply chain process, they reduced time of approval. For this reason Beximco pharmaceuticals ltd increases its performance like save time/money, accountability is available, control is easy and enhance efficiency.

We know, a materials or substance used in the primary production or manufacturing of a goods. Before being used in the manufacturing process raw materials often are altered to be used in different processes. Raw materials are often referred to as commodities, which are bought and sold on commodities exchanges around the world. Beximco Pharma collect its raw materials, process this materials properly, and here BOL software helped them. By using BOL all processing time of raw materials reduced.

- ***Reduce Lead Time***

Lead time is broken into several components: preprocessing, processing and post processing. Preprocessing involves determining resource requirements and initiating the steps required to fill an order. Processing involves the actual manufacturing or creation of the order. Post processing involves delivery of products to the market. Beximco Pharmaceuticals limited looks at each component and compare it against benchmarks to

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determine where slowdowns are occurring. Here information technology helped them to reduce lead time.

Though Beximco Pharmaceuticals ltd does not introduce sophisticated software like SAP or Oracle, but they use tailor made software in SCM which is invented by BOL (Bangladesh Online). After using this software, Beximco pharmaceuticals ltd. benefited a lot, and its performance increased. If they will introduce SAP software in SCM, then they will get more benefit.

5.2 Incepta Pharmaceuticals Limited

Incepta began its operation with a handful of highly skilled and dedicated professionals guided by an able leadership. Proper strategic planning, technical excellence, swift and timely decisions helped them to achieve their objectives leading to much faster growth. Incepta was able to anticipate the need of the market and provide the right product at the right time. High focus on R&D investment from the very beginning made possible the introduction of quality products ahead of its competitors in most cases. Before the year 2004 the Incepta Pharmaceuticals used traditional system of supply chain management.

5.2.1 IT Application in Supply Chain Management (SCM) of Incepta Pharmaceuticals Ltd:

In 2004, Incepta Pharmaceuticals Ltd introduced information technology (IT) in supply chain management (SCM). At that time, they introduced **in house** develop software.

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From 2004 to 2009 they used that type of software. In that time other IT infrastructure developed properly. But their **in house** software was time consuming because of not sophisticated software.

In 2010, Incepta Pharmaceuticals Ltd introduced SAP software. With the help of Indian experts they trained up their staffs operating SAP software. It took at least 6-9 months.

SAP Software

SAP AG is the German enterprise software company providing business solutions for almost four decades. SAP stands for "Systems, Applications, and Products (in data processing)." This name is based on the original German name "Systeme, Anwendungen und Produkte (in der Datenverarbeitung)."

SAP Software provides IT-solutions for the ERP (Enterprise Resource Planning) needs of an enterprise, and named so after the company which produces it.

It involves a host of business packages including ECC (ERP Central Component), New Dimensional products (BW, CRM, APO, EP, E-Recruiting, etc.), Business One, Business Objects, etc.

SAP ERP in Incepta Ltd

SAP software is the world's leading ERP software package. The main reason behind its success is high level of integration among different business functions of an organization. Here Incepta ltd gets the high level integration after using SAP ERP.

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ERP software packages improve business processes and use and availability of information across the Incepta Company for better decision-making. They integrate the functions like finance, purchasing, order management to achieve these goals and others.

The authorized executive in the Purchase department of Incepta views this purchase requisition and raises purchase order. The supplier supplies the material to the company. Quality checks, invoice, etc are entered into the system by authorized users responsible for those functions. Finally the payment is made to the supplier. Entries are made to respective accounts automatically.

This series of activities is an end-to-end process called "Procure to Pay" (P2P) and SAP MM (Materials Management) module addresses this business process. It is one example of end-to-end processes in a business enterprise. Other examples are Order to Manufacture, hire to retire, etc.

The following figure 5.2.1 shows some of the business functions SAP ERP software impacts which is on next page (199).

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Figure 5.2.1: SAP ERP Application in Incepta Pharmaceuticals ltd.

Source: The Author

The persons responsible in the respective departments carry out their business transactions and store business data. This data (information) is available across organizational boundaries to all SAP users (SAP Career and Learning Resources, 2012).

According to field work and analysis of data properly, after application of information technology in supply chain management of Incepta ltd, the company benefited a lot. This is presented in figure 5.2.2

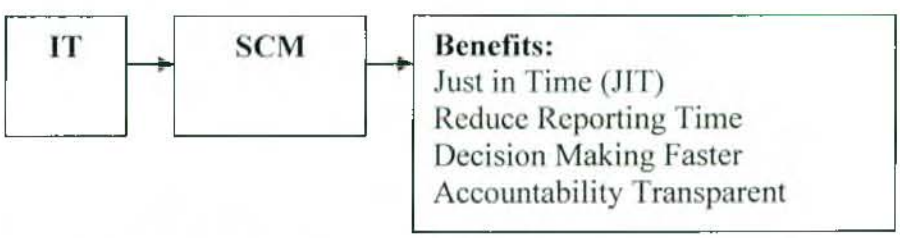

Figure 5.2.2: Role of IT in SCM of Incepta Pharmaceuticals ltd.

Source: The Author

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Discussion of these benefits is given below:

- **Just in Time (JIT)**

Using SAP software and IT infrastructure with trained employee the inventory strategy of Incepta pharmaceuticals ltd employ to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thereby reducing inventory costs. This inventory supply system represents a shift away from the older "just in case" strategy where producers carried large inventories in case higher demand had to be met. Here, Incpta are able to accurately forecast its demand also.

- ***Reduce Reporting Time***

SAP is an integrated process. The SAP ERP shortened time frame of Incepta pharma is due to applying information technology and the reporting software. Using this software, Incepta will be able to assess the data in hours instead of days. The software gives the company the ability to create a provisional report for items that need repair or an upgrade, allowing the client to see the specific needs of the product before it is final. So, the ERP software reduced reporting time.

- ***Decision Making Faster***

Generally, big corporations are filled with people in bureaucracy who want to cover things – cover the bases, say they did everything a little bit. It is impossible also in a manual process to take faster decision. After introducing strong IT infrastructure,

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trained employee in technology and introduce sophisticated software SAP ERP, Incepta limited is now a fastest-thinking firm. It also follow a simple set of guiding principles – shared by everyone in the organization – for proposing a new course of action would help them make correct decisions faster

- ***Accountability Transparent***

Accountability and transparency is the main elements of good *governance.* Transparency is a powerful forces that, when consistently applied, can help fight corruption, improve governance and promote accountability. The concept of *accountability* refers to the legal and reporting framework, organisational structure, strategy, and procedures. The SAP software of Incepta pharmaceuticals limited shows all relevance information for users. For this reason, accountability is transparent in this organization.

After installation of SAP software in 2010, Incepta Pharmaceuticals Ltd benefited a lot. With the help of Indian experts they trained up their staffs for operating SAP software properly. For this reason Incepta is a faster growing pharmaceutical industry in Bangladesh.

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5.3 ACI Pharmaceuticals Limited

In Bangladesh, ACI introduced the concept of quality management system by being the first company to achieve ISO 9001 certification that reflects its commitment to quality in every aspect of business.

5.3.1 IT Application in Supply Chain Management (SCM) of ACI Pharmaceuticals Ltd:

ACI ltd have Management Information Systems (MIS) department which ensures the overall information technology related supports for the company. This department manages a smooth operation of software's, hardware trouble shooting and business databases related to sales and inventory. The MIS department consists of knowledgeable and skilled programmers and software developers. MIS provides customized report and data analysis to the management to facilitate effective decision making (ACI Pharmaceuticals Ltd, 2012). ACI basically use Sales and Depot Management System (SDMS) software for supply chain Management (SCM). The SDMS software introduced by MIS department of ACI Ltd. The uses of IT in ACI ltd in given table 5.3.1 which is on the next page (203).

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Table 5.3.1 Application of IT in SCM applicable for ACI Pharmaceutical Ltd

Apply	Not in Use
Material Requirement Planning (MRP)	Enterprise Resources Planning (ERP)
Manufacturing Resources Planning (MRPII)	Advance Planning System (APS)
Warehouse Management System (WMS)	Just in Time (JIT)
Supply Chain Management	Theory of Constraints (TOC)
Supplier Relationship Management (SRM)	Radio Frequency Identification (RFID)
E-Commerce	Electronic Data Interchange (EDI)
E-Business	
Decision Support or Expert System	

Source: ACI Pharmaceutical Ltd

According to field work and analysis of data properly, ACI limited unable to apply appropriate information technology in supply chain management. Here they use sales and depot management (SDMS) in supply chain systems, and lot of problem they faces. This is presented in figure 5.3.1 which is on the next page (204).

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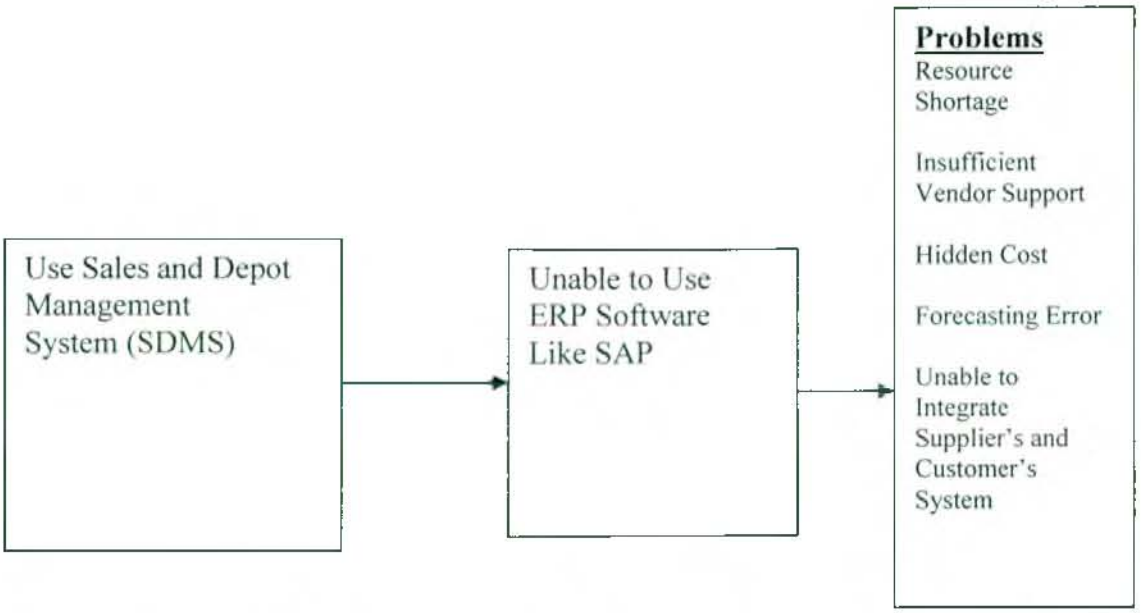

Figure 5.3.1: Use of SDMS System of ACI Pharmaceuticals Ltd and Facing Problems

Source: The Author

Here, we have seen that ACL pharmaceuticals limited is not applying the appropriate Information Technology in their supply chain systems, and they faces lot of problems. These are as follows:

- ***Resource Shortage***

Without having IT infrastructure and software, it is difficult to identify and measure the appropriate resources. ACI limited faces this problem in most of the time because they have not introduced the Advance Planning System (APS).

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- ***Insufficient Vendor Support***

To develop efficient vendor support, the organization must require Electronic Data Interchange (EDI) systems to communicate with all vendors. ACI pharmaceuticals limited face this problem because of not having EDI systems.

- ***Hidden Cost***

Hidden cost means - Expense not normally included in the purchase price of an equipment, materials or machine, such as for maintenance, supplies, training, and upgrades. Enterprise Resources Planning (ERP) is an integrated system and can identify the hidden cost. But ACI limited unable here.

- ***Forecasting Error***

Forecasting error also leads efficiency loss position of an organization. If the organization have IT infrastructure and quality software, then the firm can forecast properly. SAP software can do it. But ACI Company has not this.

- ***Unable to Integrate Supplier's and Customer's System***

ACI limited unable to integrate supplier's and customer's system, because they are not using any integration type of software.

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Here we have seen that ACI Pharmaceuticals Ltd uses only Sales and Depot Management software in supply chain management. They have not strong IT infrastructure and unable to employ any type of ERP software. For this reason, they face huge problem and their performance reduced.

5.4 Summary

This chapter has evaluated the findings of IT based supply chain management of three pharmaceuticals companies –Beximco Pharmaceuticals Ltd, Incepta Pharmaceuticals Ltd and ACI Pharmaceuticals Ltd. On the basis of data this evidence and observations, made during the field survey, the effectiveness of IT use in supply chain management was assessed. Findings divulged that Incepta Pharmaceuticals Ltd has the most effective organization in implementing IT in supply chain management. Incepta uses strong IT infrastructure, SAP software in supply chain management, trained employee and benefited in several ways such as minimize inventory cost, reduce reporting time, decision making faster and accountability are transparent. The second successful pharmaceutical company seems to be Beximco. Beximco also developed strong IT infrastructure, employs customized software in the supply chain management and benefited in few extent such as meet dead line, reducing time for approving raw-materials and reducing lead time. On the other hand, ACI Pharmaceuticals Ltd uses Sales and Depot Management software in supply chain management and unable to employ strong IT infrastructure and any type of sophisticated software like ERP software. ACI is facing several problems in supply chain management such as resource shortage, insufficient vendor support, hidden cost, forecasting error and so on.

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CHAPTER SIX: SUMMARY, CONCLUSIONS AND IMPLICATIONS

6.0 Introduction

Although there are many potential benefits from the application of information technology, software and Internet-based tools to buyer and supplier, as well as supply chain, relationships, it is imperative that buyers do not simply accept the marketing hype of application providers. There has been far too much of this in the past, and it is clear that companies must become more sophisticated about the relative costs and benefits of particular applications for specific types of Supply Chain Management (SCM) strategy. This chapter included summary, conclusions, and implications (both theory and practitioners) of the study. Here also included few recommendations for effective IT based supply chain management.

6.1 Summary and Conclusions

Information provides companies with a window to reality, and the more accurate and the more timely, the better businesses can make the decisions that will assist them to better service their customers, develop their workforces, invest their resources, control their costs, and remain competitive. Today, business concepts and applications like SCM, the Internet, open computing environments, and the focus on trading partner collaboration should be viewed, first and foremost, as methods to increase information availability. Unfortunately, during the dot-com and B2B bubble, everyone, including

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seasoned analysts, consultants, and practitioners lost sight of what the new Internet technologies should have been focused on, and that was increasing the utility and visibility of information in the supply chain. Now that the hype has finally cleared, companies can begin the task of sorting out what they need to do to transform their businesses by incorporating today's technologies before their competitors beat them to the finish line.

While obvious business applications such as ERP, CRM, SRM, Internet-enabled e-marketplace exchanges, and other computerized toolsets remain as the basis for information management, several new developments are reshaping the face of business computing today.

During the past few years, companies have begun to realize the benefits of wireless technology. While the time-honored process of gathering data and then manually inputing it into a computer application dominates computing, its days are numbered.

The application of wireless data technologies in today's computing environment is creating whole new realms of productivities: information can be gathered in the field and transmitted to a database in real time; customer and sales information is instantly available; and coworkers can share information instantly at the point of need. Wireless applications are appearing everywhere in hotels and stock brokerages, at sales meetings, and most recognizably when UPS comes to the door. Ready or not, wireless technology will become a critical component of IT strategies.

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Wireless can be defined, at its most rudimentary form, as the transmission of data between devices that are not physically connected. A wireless device may be anything from a *personal digital assistant* (PDA), to a laptop, a two-way pager, a global positioning satellite antenna, or a remote sensor. The data communication can occur at short range using infrared technology, at a wider range using high speed wireless LANs located at a fixed structure, or globally using satellites. The goal of wireless technologies is to provide mobile workers access and input to any database, any time. It enables collaborative information exchange where physical collocation is not feasible. It also assists in tracking, locating, and managing movable assets such as cargo, containers, laboratory equipment, and delivery trucks. The possibilities for the application of wireless technologies are virtually endless. Industries pioneering wireless today range from healthcare to transportation to manufacturing. Everyone is familiar with UPS use of wireless tracking and shipment verification devices that began in 1992. Wireless CRM devices permit the mobile sales force to view customer information and place orders. Today's shop floor has a variety of wireless data collection devices ranging from terminal emulation keypads to wireless computers and handhelds. New types of bar codes are enabling *radio frequency identification* (RFID) functions that permit the real-time posting of data by mobile operators. Through *radio frequency* (RF) the most up-to date information can be sent to customers on their PDA devices.

There can be little doubt that, as wireless technology expands and becomes even closer linked to the Internet, it will become an essential building block of e-SCM. Wireless technology provides another medium for e-SCM to extend its influence and increase its

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value to the supply chain. Wireless enables a wider audience of participants within the organization and outside in the supply network to bring automation and efficiency to a new range of processes by making information ubiquitous and real-time. While there are still many issues to resolve, such as security, bandwidth, device size, standards, and compatibility, wireless technology is destined to have as much of an impact on business and technology architectures as the arrival of the Internet. In the meantime, the evolutionary nature of the wireless revolution will enable companies to implement and experiment with the technology by focusing on high-payback applications currently available to the marketplace.

As companies emerge out of the era of isolated computing environments toward supply chain connectivity, the focus will be centered squarely on using technology to more closely integrate, standardize, and make more transparent internal business processes. The goal will be to leverage applications like ERP, CRM, data warehousing, procurement systems, and the Internet to abstract critical information that can be used to improve productivity and cost initiatives while opening new pathways to the marketplace. Relationships with supply chain trading partners in this stage will be primarily focused on short-term, operational benefits and will often lack a coherent overall strategy. This is the stage most companies are in today.

Once companies have fully integrated enterprise functions, executives will turn in earnest to their supply chains and inter-enterprise technologies for new sources of competitive advantage. As the efforts to reduce internal costs and reengineer

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productivities reach a level of diminishing returns, firms will search for supply chain interoperability to pull information from channel-facing application components such as forecasting, inventory management, product development, supply chain planning, and procurement processes to further competitive advantage. Utilization of e-CRM and SRM e-market exchanges will increase in importance as organizations search for greater agility, scalability, and customization in working with customers and to further outsource non-core functions. Relationships with supply chain trading partners in this stage begin to evolve from a concern with operational short-term gains to the creation of strategic ventures with critical customers, suppliers, and technology partners. The findings of this study have important implications for executives of pharmaceutical companies. The evidence of the study suggests that if pharmaceuticals companies use IT and internet based tools in supply chain management, they will be benefited in several ways. From the above findings, we recommend few things- As Enterprise Resource Planning (ERP) is the most advanced system so it must be used in the supply chain system, In the age of electronic system, electronic data and radio frequency identification must be implemented to support supply chain management system, the most advanced system bar coding system should be used in the pharmaceutical products and flow of information and level of forecasting must be conducted efficiently.

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6.2 Implications of the Study

After completing field work & analyzing the data and findings on the role of information technology in supply chain management of Pharmaceuticals Industry in Bangladesh, the organization will be benefited if they use IT in SCM.

So, in this case I can develop a model that, if we introduce information technology in supply chain management then performance of the firm will be increases. Thus the implications can be explained in following way:

1. Implications for the Theory
2. Implications for Practitioners
3. Future Research

6.2.1 Implications for the Theory:

This research argument is that Information Technology can play a vital role in managing the different elements of Supply chain management (SCM) and as a result benefits/performance of supply chain will improve. After field study, finding shows application of different information technology, software, networking and internet in the supply chain management of mentioned pharmaceuticals company in Bangladesh benefited a lot. In a broader sense, establishing the relationship between Information technology and supply chain management will contribute in the field of supply chain management.

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Here I can develop a model of "Role of Information Technology (IT) in Supply Chain Management (SCM)" figure 6.2.1. This model represents - if we can introduce proper information technology in all stages & drivers of supply chain management the performance of an organization will increase. This theory will contribute in the field of supply chain management.

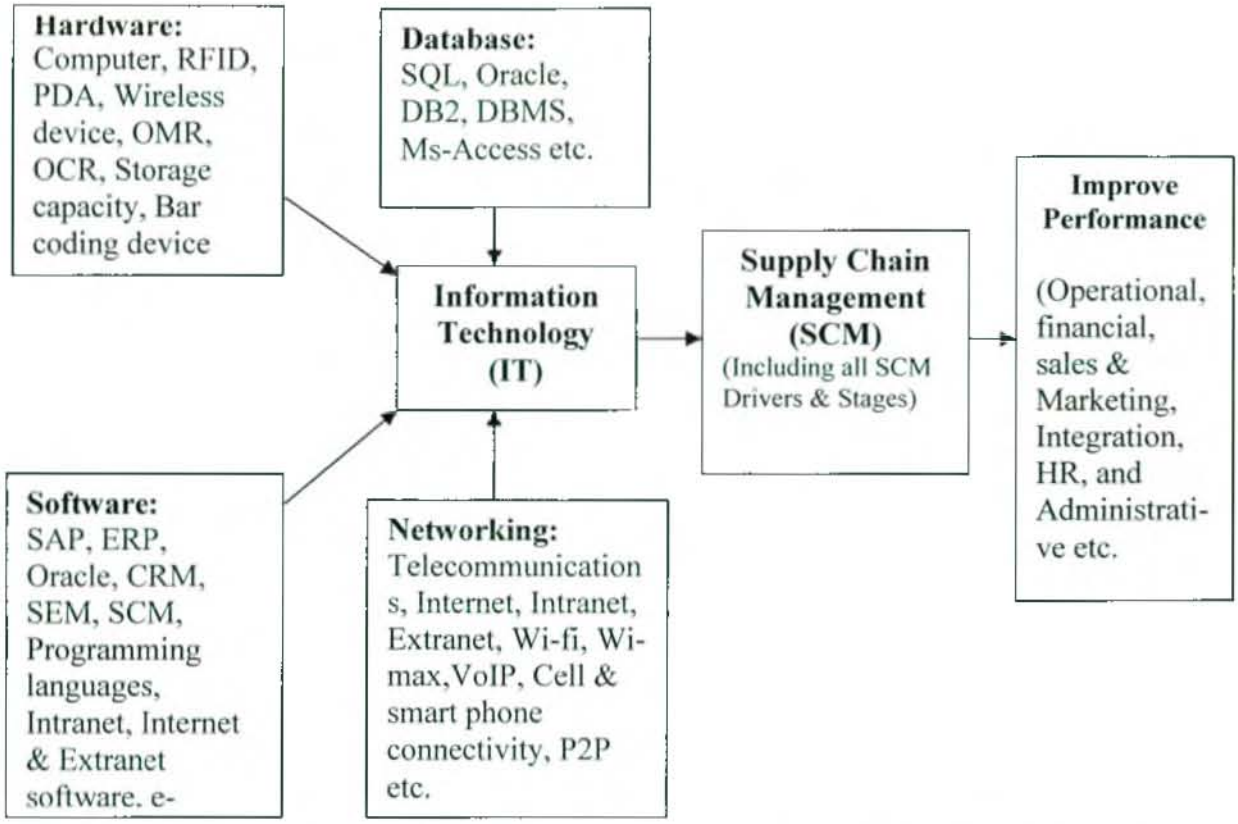

Figure 6.2.1: Model of the Role of Information Technology (IT) in Supply Chain Management (SCM)

Source: The Author

This theoretical development will not only help the academic world but also help the practicing manager to improve the performance of supply chain management. Next section I will explain the contribution of the theory to the practitioners.

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6.2.2 Implications for Practitioners:

The theory will contribute for the managers of an organization and studied organization also. If the practitioners follow the model (figure 6.2.1) then they will take their decision properly and their performance will improve. Practitioners including:

- Managers, and
- Studied Organization

➢ ***Managers:***

If the managers of an organization develop IT infrastructure like - quality hardware, sophisticated software, database systems and communications systems in the all drivers & stages of supply chain then the manger can take accurate and faster decision. Here integration of supplier and customer also possible. Managers can ensure the accountability and transparency here. For this reason, their performance of the organization (production and operation, marketing and sales, human resources, finance and accounting, administrative etc.) will improve. So, managers can introduce the model in their organization.

➢ ***Studied Organization:***

The theory will also contribute in academic world, because information technology is growing day by day and it is a popular discipline. In the case of supply chain management many research has been conducted on how to manage the different elements, drivers and stages of supply chain management and also how to improve the performance of supply chain management. In Bangladesh, the role of Information

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technology in the area of supply chain management has received inadequate attention. For this reason studied institution in Bangladesh can study this model and contribute to the academic world.

6.2.3 Future Research:

This study could serve as fertile ground for future research. The research will help in different dimension to the future researcher like – to develop the information technology strategy which is support the supply chain management, reorganize the supply chain pattern by using specific technology or systems, modify the theory with contribution etc. Analysis of the study would give the opportunity to identify dominant strategies. This study considered the case of Pharmaceuticals Industry in Bangladesh, but future researcher can study IT based other organization in Bangladesh and/or other country. Future research should evaluate the IT investment and compare the performance in small, medium, and large firm size. Future researcher may be faculty/students/professionals of Supply Chain Management (SCM) and/or Management Information Systems (MIS). If nobody done the research in future time, as a faculty member in the Department of MIS, University of Dhaka I will do the future research.

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6.3 Limitations of the Study

This study is not free from limitations. This is a cross-sectional study, and hence, measuring the dynamic nature of some of the constructs was not possible. In the study priority sequence of performance criteria of supply chain management are not available; it could vary between different industries, geographical locations or even strategic objectives.

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APPENDIX

Questionnaire

Role of Information Technology (IT) in Supply Chain Management (SCM): A Case of Pharmaceuticals Industry of Bangladesh

Serial No:
Date of Survey:
Name of the Respondents:
Designation:
Name of the Organization:

Variable	
Gender	Female Male
Respondent's Years of Work Experience	1-4 Years 5-8 Years 9-12 Years 13-16 Years 17-20 Years 21-24Years 25 Plus Years
Respondent's Years of IT Experience	1-4 Years 5-8 Years 9-12 Years 13-16 Years 17-20 Years 21-24Years 25 Plus Years
Respondent's Years of Relationship Management Experience	1-4 Years 5-8 Years 9-12 Years 13-16 Years 17-20 Years 21-24Years 25 Plus Years
Respondent's Position	Vice President of Purchasing Director/Manager of Operations Director/Manager of MIS Director/Manager of Logistics/Transportation Director/Manager(Other) Other Position

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Observed Variables	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Customer Integration(CI)					
We frequently are in close contact with our customers					
Our customers give us feedback on our quality and delivery performance					
We strive to be highly responsive to our customers' needs					
Our customers seem happy with our responsiveness to their problems					
Supplier Integration(SI)					
We are comfortable sharing problems with our suppliers					
In dealing with our suppliers, we are willing to change assumptions in order to find more effective solutions					
We believe that cooperating with our suppliers is beneficial					
We emphasize openness of communications in collaborating with our suppliers					
Buyer-Supplier IT Alignment					
Alignment of applications used in transaction processing					
Alignment of applications used in operations					
Alignment of applications used for communication					
Buyer-Supplier Integration					
Partnering with buyer					
Cross-functional teams with buyer					
Collaborative planning with buyer					
Strategic Performance Measures					
Learning about customers and markets for our products					
Creation of new products, product enhancements					
Development of new business					

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opportunities					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Operational Performance Measures					
Cost efficiencies from higher sales volumes					
Improvements to current processes or creation of new processes					
Increased profitability					
Lean Practices (Indicate the degree to which your firm has……..)					
Implemented the lean organizational model by e.g.reducing the number of levels and broadening the span of control during last three years					
Implemented continuous improvement programs through systematic initiatives(e.g.kaizen, improvement teams,etc.) during last three years					
Implemented action programs to increase the level of delegation and knowledge of your workforce(e.g. empowerment, training, autonomous teams, etc.) during last three years					
Increased the level of work force flexibility following your business unit's competitive strategy(e.g. temporary workers, part time , job sharing , variable working hours, etc.)					
E-commerce Use [Indicate to what extent do your key/strategic customers use electronic tools(internet or EDI based)with you for the following]					
Content and knowledge					

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management					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Order management and tracking					
RFx (request for quotation ,proposal and information)					
Access to catalogues					
Auctions					
E-procurement Use [Indicate to what extent do you use electronic tools(internet or EDI based)with your key/strategic suppliers for the following]					
RFx (request for quotation ,proposal and information)					
Content and knowledge management					
Access to catalogues					
Order management and tracking					
Auctions					
Enterprise Resource Planning (ERP) Use (To what extent are the following management areas supported through the use of enterprise resource planning system?)					
Purchasing and supply management					
Material management					
Production planning and control					
Sales management					
Distribution management					
Mass Customization (MC) Performance (How does your current performance compare with main competitors?)					
Manufacturing lead time					
Delivery speed					

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Unit manufacturing cost					
Mix flexibility					
IT Infrastructure (No ability-High Level of Ability) Please rate your firm's ability to:					
IT1 actively search out and acquire state of the art information technology					
IT2 effectively use state of the art information technology					
IT3 maintain knowledge and skills needed to put together the best information technology for your company					
IT4 maintain a strong network relationships with information technology suppliers					
IT5 constantly monitor and evaluate available information technology options					
Market –Oriented IT Competence (No ability-High Level of Ability) Please rate your firm's ability to:					
Information Generation: Routinely collect information using information technology					
GEN1from key customers					
GEN2 from your suppliers					
GEN3 about your competitors					
GEN4 about industry trends					
Information Dissemination: Electronically communicate information received from outside the firm					
DIS1 to the right people inside the firm					
DIS2 in user friendly formats					
DIS3 in a timely manner					
DIS4 effectively prioritize information from external					

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sources					
Information Use: Use information received over electronic links(e.g.EDI,Internet,e-mail) to:					
USE1 improve understanding of customers					
USE2 identify opportunities for new business					
USE3 improve decision-making					
USE4 improve customer service					
Market Information Flow (No information –too much information)					
Market Information Quantity: How much information does your firm receive electronically about:					
INQT1 customers' requirements?					
INQT2 suppliers' schedules?					
INQT3 competitors?					
INQT4 industry trends?					
Market Information Quality: To what extent do you feel the information your firm receives over electronic links is:					
INQL1 timely?(untimely-timely)					
INQL2 accurate? (inaccurate-accurate)					
INQL3 complete? (incomplete-complete)					
INQL4 credible? (not credible-credible)					
Informational Advantage (Strong disadvantage-strong advantage) Compared to your competitors, please rate your					

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firm's level of disadvantage or advantage in these areas: Having better information than our competitors about:					
IA1 how to provide high quality services					
IA2 how to meet customers' needs					
IA3 competition in our industry					
IA4 industry trends					
Relative Advantage (Strong disadvantage-strong advantage) Compared to your competitors, please rate your firm's level of disadvantage or advantage in these areas: Having stronger relationships than our competitors with:					
RA1 customers					
RA2 suppliers					
RA3 partners					