“EMPIRICAL INVESTIGATIONS OF SUPPLY CHAIN PRACTICES IN INDIAN HEALTHCARE INDUSTRIES”

Ph.D. Thesis

MS. BHAVANA MATHUR

Student ID:- 2012RME9024

Department of Mechanical Engineering
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
JAIPUR 302017, Rajasthan, INDIA

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“Empirical Investigations of Supply Chain Practices in Indian Healthcare Industries”

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By

Ms. Bhavana Mathur

Student ID:- 2012RME9024

Under Supervision of

Dr. Govind Sharan Dangayach

Professor, Department of Mechanical Engineering

Malaviya National Institute of Technology, Jaipur

Department of Mechanical Engineering
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
JAIPUR 302017, Rajasthan, INDIA

May, 2018

DEPARTMENT OF MECHANICAL ENGINEERING
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
JAIPUR (RAJASTHAN)-302017

CANDIDATE'S DECLARATION

I, Bhavana Mathur, declare that this thesis titled, **"Empirical Investigations of Supply Chain Practices in Indian Healthcare Industries"** and the work presented in it, are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this university.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this university or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
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- I have acknowledged all main sources of help.
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Date:

Bhavana Mathur
(2012RME9024)

DEPARTMENT OF MECHANICAL ENGINEERING
MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY
JAIPUR (RAJASTHAN)-302017

CERTIFICATE

This is to certify that thesis entitled **"Empirical Investigations of Supply Chain Practices in Indian Healthcare Industries"** being submitted by **Bhavana Mathur (2012RME9024)** is a bona-fide research work carried out by her. She has worked under my guidance and supervision in fulfillment the requirement for the award of the degree of Doctor of Philosophy in the Department of Mechanical Engineering, Malaviya National Institute of Technology, Jaipur, India. The matter embodied in this thesis is original and has not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.

Place: Jaipur
Date:

Dr. Govind Sharan Dangayach
Professor & Head,
Department of Mechanical Engineering,
Malaviya National Institute of Technology,
Jaipur

DEDICATED

This thesis is specifically dedicated to my

Husband ***Dr. Kshitij Mathur***

for believing in me and never giving up on me even when I didn't believe in myself.

&

To my loving Children ***NIHAR & MANVI*** *for their patience*

&

I would like to thank my ***Parents & Parents-in laws***

for their

Unconditional and unwavering support.

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(Bhavana Mathur)
(2012RME9024)

ABSTRACT

The main purpose of conducting this study was to investigate the understanding, practical implementation of SC practices towards organizational performance in Indian healthcare industries. Four key dimensions of SC practices (Supplier Integration, Top Management Commitment, Lean practices and Inventory Visibility) were used as independent variables accompanied by different measurement instruments under each variable, while Supply Chain Performance and Organizational performance were used as dependent variable. Data were obtained via questionnaires survey taken from 164 usable responses from a survey sample of 718. The quantitative analysis of data collected from different stakeholders of healthcare supply chain management particularly for medical devices and equipments the statistical tools were aligned with the objectives of the research. The analysis of data collected from the questionnaire survey includes demographic analysis, descriptive analysis, missing value analysis, reliability and validity of the data, comparative analysis, Factor analysis of variables and finally multiple regression analysis to examine the relationship between supply chain practices and organizational performance.

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From the study findings, it showed majority of Indian healthcare industries understood the concept of implementing SC practices. The level of practical implementation was uneven practiced that is only few practices were practiced at great extent. Practices such level of Supplier Integration and Lean Practices were lowly practiced. In addition to organizational performance, the result showed that SC practices of Supplier Integration, Top Management Commitment, Lean practices and Inventory Visibility were positively related to organizational performance along with Supply Chain Performance as mediating factor. Finally the researcher made some recommendations for further studies in the field of supply chain practices implementation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

CSC	Collaborative Supply Chain
CSCMP	Council of Supply Chain Management Professionals
GPO	Group Purchasing Organizations
HCSC	Healthcare Supply Chain
HCSCP	Healthcare Supply Chain Performance
IDN	Integrated Delivery Networks
IV	Inventory Visibility
LP	Lean Practices
OP	Organizational Performance
SC	Supply Chain Practices
SCP	Supply Chain Performance
SCI	Supply Chain Integration
SI	Supplier Integration
TMC	Top Management Commitment
VMI	Vendor Managed Inventory

CHAPTER-1 INTRODUCTION

1.1 INTRODUCTION

The Introduction chapter provides a general idea of the research. The reason for why the chosen research area is selected and brief description of central concepts on which the research is based. In section two, a description of research background is provided in detail. The chapter also indicated the general overview on the concept of supply chain practices, current trends of the healthcare industry in the global market followed by brief explanations of Indian healthcare industry along with the supply chain performance and organizational performance, statement of a problem, the research questions and the research objectives. The chapter also discussed the significance of the study.

1.2 DEFINITION OF SUPPLY CHAIN

One of the most important paradigm shifts in modern industries is that individual businesses no longer compete as entirely independent entities. The strength of competition has increased tremendously, and there has been growing demands for flexible and cost-efficient systems that can support customer satisfaction Barasa, (2014). The concept of Supply chain is essential to the success of any organization and its customer satisfaction. Supply chain performance is essential for industries as the performance their supply chain performance can judge a firm.

"Supply Chain (SC) is the relationship and integration between the major stakeholders through major cross-functional business processes (Brown et al., 2015). It integrates end user through original suppliers that provide products, services, and information and add value for customers and other stakeholders (Lambert, Cooper and Pagh 1998; Cooper, Lambert and Pagh 1997)'. (Christopher 1998) Defines SC as: "Supply chain defines a network of organizations, between different stakeholders in the business

processes and between various activities that add value to the business in the form of products and services to the end users." SC can be defined as a system of arrangements various organizational activities such as purchase, development, and distribution of material from the raw state to the finished product that performs the functions of procurement of materials, the conversion of these materials into intermediate and finished products, and the distribution of these finished products to customers. Turhan & Vayvay, (2009), explained that efficient supply chain plays a vital role inability, willingness, and development of an organization which is necessary for improving business competitiveness. Thus, to stay competitive in the market, it is essential to understand various SC practices and its implementation (Moslem et al., 2013). With the increasing significance of coordination between various supply chain partners, and importance of supply and demand the concept of SC is receiving significant attention in firm's performance. (Simatupang et al., 2004; Wong et al., 2005). SC is a network that includes both economic and information flow of products and services from raw material stage to finished products which are consumed by customers. SC requires a close integration between suppliers, manufacturers and end users, to continuously improve the synchronization and relationship between all relations and interfaces to enhance the overall performance of supply chain. Hence, there is a considerable requirement of providing attention to SC for acquiring the right product, at the right price, at the right time. Further, according to Council of Supply Chain Management Professionals (CSCMP), SC is considered to be an important constituent to improve the organizational efficiency. Hence there is a considerable number of studies on this concept conducted in many different sectors including manufacturing, medical missions, disaster relief operations and other kinds of emergencies, a cultural evolution which could improve quality of life (Christensen et al., 2007; Sila et al., 2006; Stevenson and Spring, 2009). Although the implementation of an integrated approach in this sector is still far from ordinary (Nachtmann and Pohl 2009, Villa et al. 2009), yet (McKone-Sweet et al. 2005) studied that the concept of SC is expanding rapidly in industries to satisfy customers in efficient and profitable manners.

1.3 CONCEPT OF SUPPLY CHAIN

The concept of SC emerged in early 1990 when there is an intense requirement of delivering right product or service at a right place and at the right time in the global market. Globalization of business makes organizations to realize that to be competitive in the global and local market it is important to improve the efficiencies within the organization and between the entire supply chain with an effective and efficient manner. Further, it is discussed that the theory of SC is gaining importance in the field of healthcare as a tool for improving productivity and increasing quality for better customer satisfaction (Jarret 1998, Radnor et al. 2006, Doerner and Reiman 2007).

It is found in the literature that there are various SC dimensions and practices that are implemented in the industries to enhance the firm's performance. According to (Cook and Heiser, 2011) SC practices such as information sharing, long-term relationships, improved planning techniques, internet techniques, and distribution networks, supplier structures helps to improve organizational performance. They found that there is a positive relationship between SC practices and OP with the moderating effect of supply chain performance. Also, (Li et al., 2004) identified five major variables of SC practices such as supplier integration and customer relationships, level of information sharing, quality of service and postponement which have a direct and positive effect on competitive advantage and organizational performance. Further Jabbour et al. (2011) developed and established SC integration, information sharing, customer and supplier relationships, and postponement as most significant constructs of SC for improving Organizational performance. Again, Sezen (2008) discussed the importance of SC integration, SC information sharing, and SC design for SC performance. Sundram et al. (2011) measured SC using the following constructs: supplier and customer relationships, level and quality of information sharing, postponement, and reward/risk sharing. They found that SCM practice customer relationship has no affect on SC performance. Ibrahim and Ogunyemi (2012) investigated that SC practices show a positive relationship between Supply practices such as supplier and customer partnerships and quality of information sharing. They found that practicing of these can enhance SC performance and organizational performance of the firm. Flynn et al. (2010) identified that the SC integration

improves the operational performance of a firm with no impact on business performance.

Thus the motivation of this study is to answer questions related to SC practices in Indian healthcare industries by assessing the understanding and the extent of practical implementation SC practices as well as their impact on the overall organizational performance.

1.4 STATEMENT OF PROBLEM

Recently, the concept of SC has gained importance in healthcare industries as a tool for increasing efficiency and improving quality Jarret (1998), Radnor et al. (2006), Doerner and Reiman (2007). Healthcare industry in India is differentiated by a dynamic environment and increasingly competitive markets. SC is more complicated in the healthcare industry as it directly deals with patient care and satisfaction Mustaffa & Potter, (2009); Turhan & Vayvay, (2009). The healthcare supply chain generally refers to obtaining resources, managing supplies, and delivering goods and services to providers and patients which usually go through a number of independent stakeholders, including manufacturers, insurance companies, hospitals.

Moreover, HSC is inclined to several risks leading to the obstruction of the availability of medical supplies and the wastage of significant resources Awad et al., 2016). In the HSC systems stakeholders around the focal hospital include its suppliers, GPOs, distributors, parent corporation, sister hospitals, and the CSC. These components correlate with each other in multiple ways. For example, suppliers may be associated with a hospital through direct sourcing contracts or contracts. Thus, the supply of medical equipment, devices, and other medical supplies are critical to all hospitals to enhance performance regarding quality, cost, responsiveness, and patient satisfaction (Asamoah et al., 2011). Thus, healthcare industries give more attention to improvement in usefulness and competence in providing quality of care, cost of service, customer satisfaction, etc. In an attempt to achieve all that kind, several strategies have evolved, and various approaches are implemented to help the healthcare industries to gain and maintain organizational performance. Thus, in Healthcare organizations worldwide adopt an approach called Supply Chain that

becomes a significant dimension to give maximum attention to excel in a competitive global market.

Although, there are various supply chain practices in literature depending on the type of organization; still there are commonalities among practices. This research work thus intends to focus on investigating the impact of supply chain practices for improving supply chain performance and ultimately overall organizational performance in particular context to Indian Healthcare industry.

1.5 RESEARCH OBJECTIVE

Present research mainly focused on the identification of various supply chain practices that improve the supply chain performance and in turn organizational performance, especially in Indian healthcare industries. The primary objective of this research is to gain insights of the impact of supply chain practices on organizational performance in the context of Indian healthcare industries. The specific objectives of the research were:

- To identify the importance of effective supply chain practices in the context of Indian healthcare industries through a literature survey.
- To develop a theoretical framework showing the linkage between supply chain practices, supply chain performance and organizational performance in Indian healthcare industry.
- To explore the association between Supplier Integration (SI), Top Management Commitment (TMC), Lean Practices (LP) and Inventory Visibility (IV) with Supply Chain Performance (SCP).
- To explore the relationship between Supply Chain Practices (SPs) and Supply chain Performance (SCP).
- To explore the relationship between Supply Chain Practices (SPs) and Organizational Performance (OP).
- To explore the relationship between Supply Chain Practices (SPs) and Organizational Performance (OP) with Healthcare supply chain performance as mediating effect.

- To study stakeholder wise comparative analysis of healthcare supply chain practices and its dimensions such as Top Management Commitment (TMC), Supplier Integration (SI), Lean Practices (LP) and Inventory visibility (IV).
- To develop the case study in two hospitals to closely examine the data and validate the results within a specific context.

1.6 SCOPE OF STUDY

Healthcare industry is becoming India's one of the largest sectors both regarding revenue and employment. This industry is growing at a remarkable rate by strengthening its coverage of service delivery and increasing expenditure by the public as well private players. It is established that Indian healthcare sector, is expected to grow at a CAGR of 22.87 per cent during 2015–20 to reach USD280 billion (IBEF 2015). This shows that there is an intense scope for improving healthcare services and its penetration in India. This study thus presents an ample opportunity for development of the healthcare industry. Rising income levels, an aging population, growing health awareness and changing attitude towards preventive healthcare is expected to boost healthcare services demand in future.

Further, to regulate the quality of service delivery controlled cost and improve patient engagement and satisfaction, healthcare providers are focusing on the technological aspect of healthcare delivery. SC is the backbone of healthcare delivery that includes a variety of practices that are carried out within an organization to improve healthcare organizational performance through a set of directly linked stakeholders in the chain. The healthcare supply chain has been identified as an opportunity for improving the performance and reducing the cost of healthcare delivery by managing the flow of medical devices and equipment, finished products & services, and information and knowledge from origin to consumption. The effectiveness of health care delivery is dependent on the easy accessibility of medical supplies at the right time and in the right quantities to the patients.

Private players in the industry are making their supply chain efficient and leveraging economies of scope to reduce cost through

- High procurement of medical supplies
- Improved Supplier Integration
- Improved visibility of Inventory
- Reduce wastage by applying Lean Practices.

1.7 CHAPATERIZATION OF THESIS

The thesis is organized into seven chapters. A brief outline of the chapters is as under:

Chapter One discusses the background of supply chain management and supply chain practices followed by healthcare supply chain management and various stakeholders of healthcare supply chain management and various dimensions supply chain practices. This chapter provides various connotations of supply chain management.

Chapter Two presents the review of the literature on concepts of supply chain and organizational performance. It also discusses various supply chain practices practiced in different industries and its effect on the performance of industries. The chapter literature review aims to identify the research gaps and development of a framework to fill these research gaps.

Chapter Three describes the systematic approach used in the research. It examined descriptive research as the type of design that was used in the study which focused on measuring and evaluating the performance of a supply chain. The section provided sample frames, techniques, and sizes that were used. The use of a structured questionnaire as a data collection method was illustrated. The questionnaire developed was pretested before being issued to respondents.

Chapter Four presents the quantitative analysis of data collected from different stakeholders of healthcare supply chain management particularly for medical devices and

equipment the statistical tools and was aligned with the objectives of the research. An inferential statistical technique was employed to analyze the information using SPSS version 22. The data has been categorically analyzed to give clear and vivid findings of the study.

Chapter Five discuss the stakeholder wise comparative analysis of supply chain practices, supply chain performance measures, and healthcare organizational performance measures. The study found significant Supply chain practices, supply chain performance measures and organizational performance in Indian healthcare industries. The result suggests that the customers or end users are highly aware of supply chain practices to improve healthcare organizational performance regarding customer satisfaction.

Chapter Six describes the case studies developed for the validation of results through studies of two healthcare industries. These healthcare industries are mapped to various supply chain practices such as SI, TMC, LP and IV, and supply chain performance and organizational performance. These cases are crossed compared, and the conclusion is made. The healthcare industries know what needs to be done at top management level for adopting various supply chain practices to improve organizational performance.

Chapter Seven provides a summary of findings, details of work done, contributions of the research, limitations, and recommendations of the study, scope for future work and finally the concluding remarks.

1.8 SUMMARY

This chapter presents the concept of the supply chain and supply chain practices and its importance in organizational performance. This chapter further provides various dimensions of supply chain practices in the context of Indian healthcare industries and need of supply chain in Indian healthcare industries followed by research objectives. The detailed literature review followed by proposed research framework will be discussed in further chapters.

CHAPTER-2 LITERATURE REVIEW

2.1 INTRODUCTION

This section helps to study the fundamental concepts and approaches used in the earlier literature to measure, analyze and improve SC performance. This study examines supply chain performance model for the HEALTHCARE industry, including supply chain practices, supply chain performance, organizational performance and the use of different methodology/approach to improving supply chain performance of healthcare industry in India.

There are three interconnected concepts in this literature review, covering the themes of supply chain practices, supply chain performance measures, and organizational performance. This study reviews various concepts of the supply chain, the evolution of supply chain and supply chain practices. The review then considers the supply chain performance measures. This supply chain performance measures assist in understanding the relationship between organizational performance and supply chain practices. Then, the review focuses on supply chain performance frameworks/models available in the literature.

2.2 SUPPLY CHAIN CONCEPT

"Supply Chain (SC) is a set of integrated processes that enable the production of valuable products from raw materials and provide it to the ultimate customers through proper distribution channel (Lambert, Cooper & Pagh 1998; Lambert and Pagh 1997). Again, (Christopher 1998) studied and defined SC as: "Complex network of upstream and downstream partners or stakeholders involved in different processes and activities to provide worth of products and services to the ultimate users." Supply

Chain is a network of manufacturers, providers and distribution channels that perform the functions of material purchase, raw materials transformation into usable finished products or intermediate raw material, and finally the distribution of these final products to the targeted customers. (Turhan & Vayvay, 2009), explained that efficient coordination between the supply chain helps in improving flexibility, easy accessibility, and efficiency of an organization which is necessary for their sustainability in a competitive environment.

Further, According to Habib, (2011), among the significant partners of the supply chain such as Manufacturers, Suppliers, Distributors, and end users, the end users are of main focus as for the existence of any supply chain it is important to fulfill the needs of its customers or end users.

Thus, to remain competitive in the current global market, it is important to understand and implement various SC practices in the organization to improve performance (Moslem et al., 2013). The concept of SC has received significant attention as businesses across different industries have witnessed the values added through the incorporation and coordination of supply, demand, and associations. (Simatupang et al., 2004; Wong et al., 2005). The supply chain is a movement that includes both financial and information flow of equipment and materials from raw material phase to final products which are consumed by customers and undertaken in an organization to support efficient supply chain (Adebayo, 2012).

Hence, SC has a significant importance and calls for serious research attention for acquiring the right product, at the right price, at the right time. Further, according to Council of Supply Chain Management Professionals (CSCMP) Supply chain is considered as a link between all supply partners such as vendors, manufacturers, and customers. These partners interchange information and materials right from the acquisition of raw material to the delivery of final service or finished product to the end users which is an essential element to improve the organizational performance.

Although there are considerable number of studies on SC concept conducted in many different sectors including manufacturing, medical, automobile, disaster and other kinds of emergencies, which could improve quality of life (Christensen et al., 2007; Sha et al., 2008; Sila et al., 2006; Stevenson and Spring, 2009). SC can be defined

differently by the different industry due to its multidisciplinary actions and origin (Croom et al., 2009). Some of the definitions of Supply chain according to literature review are shown in the Table: 2.1

Table 2.1: Supply Chain Definitions

Author	Year	Definitions
Mentzer et al.,	2001	The supply chain is defined as, "a set of three or more entities (organizational or individuals) directly involved in the upstream and downstream flow of products, services, finances, and information from source to the customer."
Kuei et al.	2002	Defines SC as a holistic and strategic approach to demand, operations, procurement, and logistics process management.
Benton and Maloni	2005	Supply chain involves the strategic process of coordination of firms within the supply chain to deliver a product or service to the ultimate customer competitively.
Li et al.	2006	SC is the key to building sustainable competitive edge for their products and services in an increasingly crowded marketplace.
Chopra and Meindl	2007	Supply chain as a set of decisions involving design, planning, and operation in a multi-organizational environment.
Cuthbertson and Piotrowicz,	2008	Supply chain practices are the initiative implemented that influence the whole supply chain, its parts or key processes
The Council of Supply Chain Management Professionals (CSCMP)	2009	Supply Chain is an integrating function with primary responsibility for linking major business function and business process within and across companies
Schniederjans et al.	2010	Supply chain as the coordination of supply chain partners to achieve the objectives of a business firm. Such objectives may include cost reduction, adding value to the product or service, and maintaining a quick response, among others.
Wieland and Wallenburg	2011	The supply chain is an integration of business partners to advance the level of efficiency and productivity of their company bringing them a significant return on investments.
Estampe et al.	2013	Supply chain is defined at the strategic level of a company and aims at coordinating operational tasks within a chain
Global Supply Chain Forum		Supply Chain is the integration of key supply processes from manufacturers, suppliers and ends users to provide products, services, and information that add value for customers and other stakeholders.

Recently, the concept of SC has also gained momentum in the field of healthcare as a tool for increasing productivity and improving quality (Jarret 1998, Radnor et al. 2006, Doerner and Reiman 2007). Although the concept of Supply chain is highly complicated in the healthcare industry as it directly deals with patient care (Mustafa & Potter, 2009; Turhan & Vayvay, 2009, the adoption of an integrated approach in this sector is still far from common (Nachtmann and Pohl 2009, Villa et al. 2009). Further, (McKone-Sweet et al. 2005) studied that the concept of SC is expanding rapidly in industries to provide facilities and services to customers in effective and profitable manner. Further, (Lee, 2002) discussed that an efficient supply chain aims for reducing the cost of product supply by eliminating wastages and non-valued activities thus applying lean practices.

The concept of SC of the healthcare industry is different from the manufacturing sector as HSC involves the complex flow of a wide range of products between several stakeholders. The main purpose of the healthcare supply chain is to deliver products promptly and to accomplish the needs of providers to satisfy customers. Based on the functions, the level of partners of healthcare supply chain can be divided into three major groups: producers, purchasers, and providers. Regarding the level of customization of services provided and the degree of participation of a partner or consumer the complexity and the uncertainty underlying the basic process in healthcare supply chain can be defined (Pitta and Laric, 2004). All these processes make the healthcare value chain more dynamic and complex (Evans and Berman, 2001) and this significantly impacts on the performance of the healthcare organizations. Thus this paper deals with a complete literature review on the supply chain of the healthcare industry and focuses on defining standards and components of Healthcare supply chain (HSC) that would help hospitals to assess and improve their supply chain performance in the healthcare context and the overall organizational performance.

2.3 HEALTHCARE SUPPLY CHAIN (HSC)

In general, healthcare supply chain (HSC) is very complex and fragmented. Inequity in healthcare provision and complexities in the healthcare systems persist across the

globe. The main concern about healthcare supply chain is that its complexity due to varied types of product flow and participation of a number of stakeholders. The most important measure for a HSC to be efficient is the quality of products and services delivered, reduced cost of delivered service, waste reduction, responsiveness to customers and the satisfaction of the ultimate customer.

Dobrzykowski & Vonderembse, (2009) studied that lack of coordination and information sharing affects the performance of the healthcare supply chain. (Gibbons 2009) studied that effective information sharing is an important aspect of improving the performance of healthcare supply chain and safer healthcare. Ritchie, et al., (2010) Focuses on reverse logistics and recycling of medical products to improve organizational performance of healthcare industry. Further, Meijboom et al. (2011) discussed over major problems occurred due to the ineffective supply chain in a healthcare organization is communication, patient safety, waiting times, and integration. Further, McKinsey & Company, (2013) in his recent research discussed that problem of product shortages occur due to the ineffective supply chain are increasing constantly and leads to increasing costs for healthcare industries. Due to this increasing complexity, the healthcare professionals are facing problems.

It is thus important to identify areas of SC aspects of healthcare. Healthcare SC processes have three types of flows: physical product flow, information flow, and financial flow. The physical product flow deals with providing customized products and services for the treatment of patients and their needs. Information flow manages supply chain design decisions for effective product development and improved organizational performance. Financial flow provides product and services to the ultimate customers at reasonable costs.

The major partners of the supply chain of healthcare include manufacturers, distributors, healthcare providers and payers Musttaffa & Potter, (2009). Manufacturers are producers that include pharmaceutical companies, medical equipment manufacturers, surgical product companies, device manufacturers, and manufacturers of capital equipment. Distributors are purchasers that include group purchasing organizations (GPOs), pharmaceutical wholesalers, medical-surgical distributors, independent distributors, and product representatives from manufacturers. Providers provide services directly to the customers. These are

hospitals, systems of hospitals, integrated delivery networks (IDNs) Toba et al., (2008). Payers are the end users of the supply chain such as individual patients, healthcare employees, and employers. The basic healthcare supply chain network is shown in Figure 2.1.

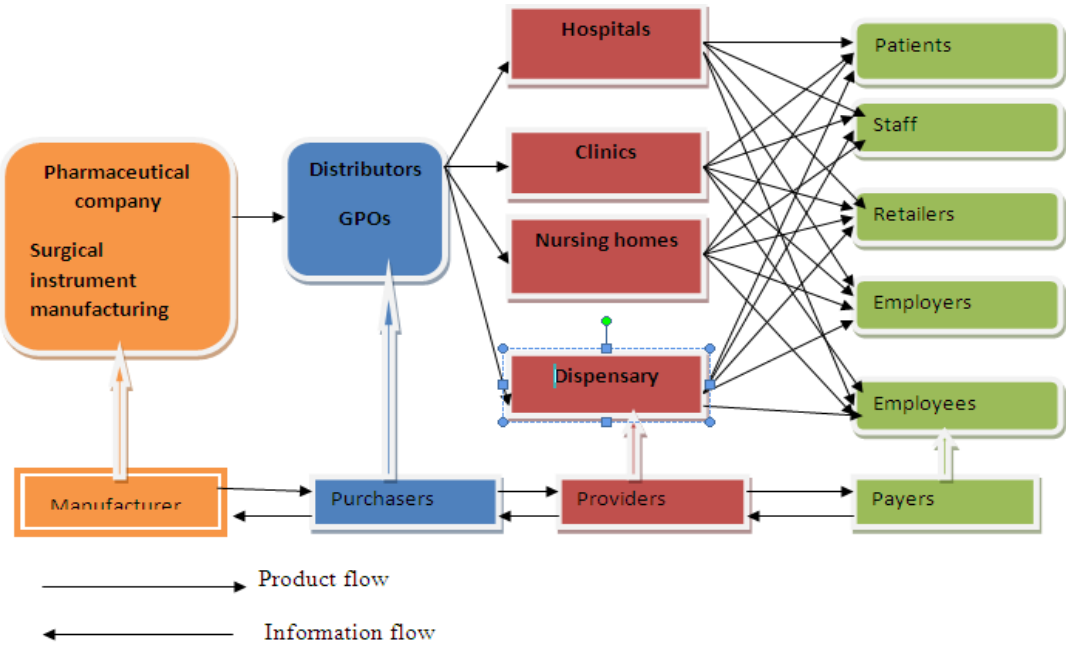

Figure 2.1: Basic health care supply chain network

2.3.1 Healthcare Supply Chain of Medical Devices

Medical devices play an increasingly important role in healthcare as it is used for diagnostic and therapeutic purposes. The medical devices include an extensive range of healthcare products such as equipment, devices and consumable products that helps in improving patients' health and the quality of life Sorenson and Drummond, (2014). Medical Device supply chains start from raw material supplier of medical supplies such as medical equipment and devices to healthcare and end with the final service recipient. HSC becomes critical when hospitals act as health care service supplier and customer or end users for receiving the medical device supplies. As demand increases with the increasing population, the global market for medical devices is expanding rapidly. Similarly, Wang, 2013; Wood, (2008) in his study discusses the high rate of expansion of medical device industries with the continued growth in the future.

Because of such large variety of products the medical device becomes an integral part of the healthcare supply chain Burns et al., (2002). This raises the urgent requirement of a well-organized network of subcontractors and suppliers, who are capable of supplying quality materials, to meet regulatory standards and also keep pace with global market demands Koepfer, (2010). The overview of supply chain processes can be divided into two main levels of distribution channels. Level 1 is the chain between medical device manufacturers and medical device suppliers. Level 2 is the chain between medical device distributors and the focal firms that can be hospitals, healthcare, clinics, nursing homes, etc. The study concentrates on the different healthcare as the customers for the medical device supply chain and as the focal firms for the study. The Figure: 2.2 show the supply chain of a medical device in the healthcare industry and the changing market demands that make the production of medical equipment more complex. Medical device products are prone to some supply chain disruptions as there are varied types of medical devices required in hospitals or healthcare that increases the costs and thus creates quality issues of products. Thus an efficient SC is in high demand, to improve coordination and control of medical equipment and medical device supply. Thus the study aims to implement HSC practices and investigate its impact on healthcare organizational performance in the context of Indian healthcare industries empirically.

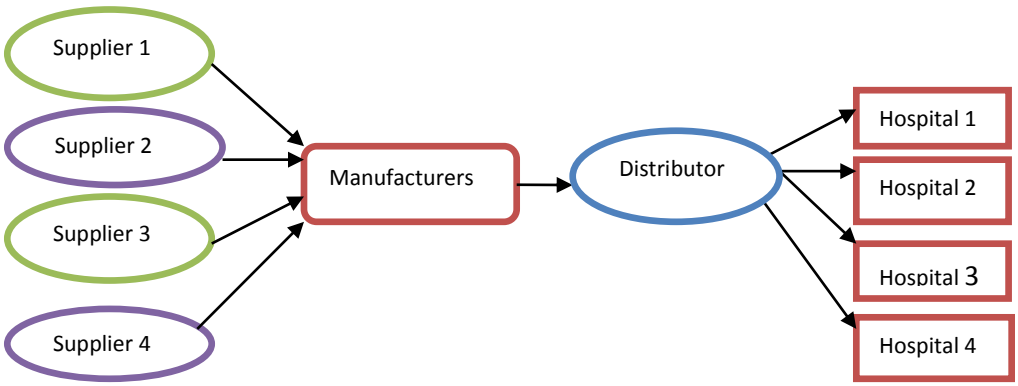

Figure 2.2: Medical Device supply chain network

2.3.2 Strategies for Healthcare Supply Chain

In this regard, the literature is classified to gain detailed comprehension of SC performance systems, approaches, and techniques which help researchers to find:

(I) Which SC "dimensions" are prevalently applied particularly in Indian healthcare industries?

(II) Which "techniques" were used to facilitate supply chain performance of the Indian healthcare industries?

(III) Which evaluation "criteria" for organizational performance in Indian healthcare industries?

Thus a theoretical framework is developed that identifies the research gap existing in Indian healthcare industries by providing a theoretical framework showing various dimensions of SC practices and their impact on the organizational performance with a particular context to Indian healthcare industries. The study thus delves into how organizational performance of health care can be improved by implementing supply chain practices in medical device supply chain.

2.4 REVIEW METHODOLOGY

Many papers on SC and performance have been published in the past decades. However, only those papers were considered that deals with SC for healthcare as a major concern in the review. The literature survey has been done through online databases relating to publishers such as Emerald, Elsevier, Taylor & Francis, Springer, Inderscience and some reputed conference proceedings. In this regard some keywords and sentence strings, such as "SC performance", "SC", "SC metrics", "HCSC", and SCOR (Supply chain operations reference)", and "SC management and BSC (Balanced scorecard based model)" were searched in the mentioned databases to acquire a list of papers for research objectives. To ensure the holistic view of SC, we further filtered the preliminary search results by screening titles and keywords of the identified articles. At last, 181 journal articles have been selected as the base of this review from esteemed scholarly journal outlets in the healthcare SC field. Some of these journals are: Decision Sciences Journal, International Journal of Operations and Production Management, International Journal of Production Economics, Journal of Operations Management, Journal of Supply Chain Management, European Journal of Operations Research, Health Care Management

Review, Journal of Management and Strategy, Science Journal of Business and Management, Production and Operations Management Society . The review methodology is illustrated in Figure.2.3

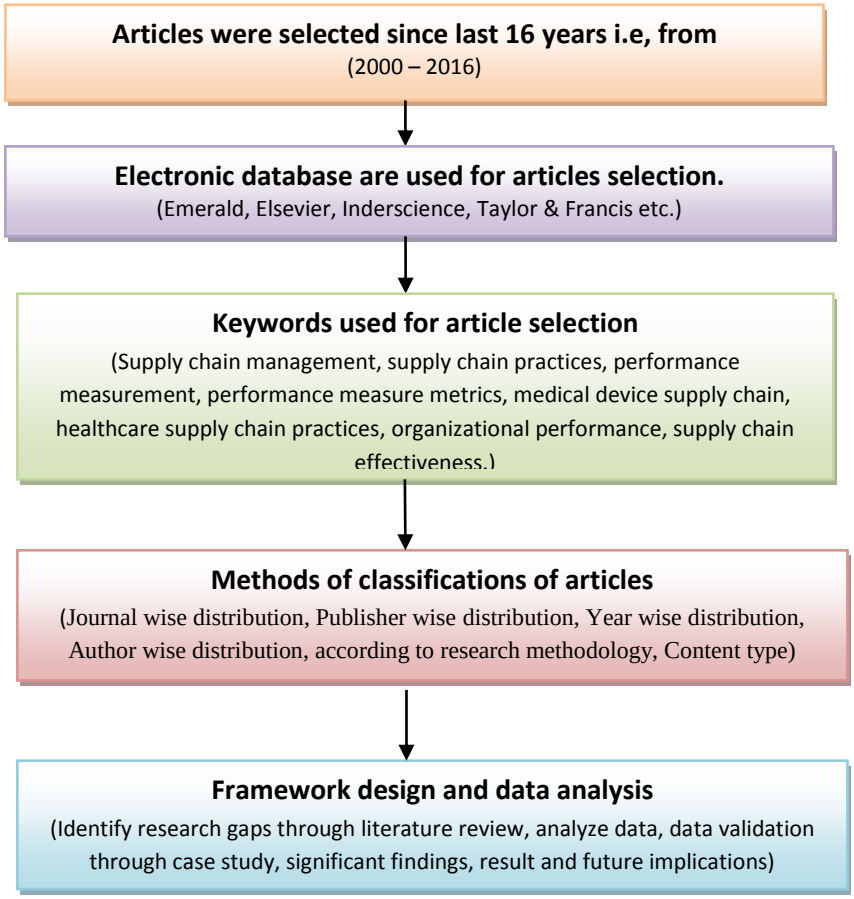

Figure 2.3: Review Methodology

The detailed classification of the 181 final selected articles concerning author, title, approach, and technique are shown in Appendix A.

2.5 LITERATURE REVIEW SUMMARY

A plethora of research papers on SC and its practices have been published in the past decades, but the supply chain performance in the healthcare industry is still under study. Thus we have reviewed various literature published in various refereed journals and conferences regarding supply chain and performance measurement. In this regard around 540 papers have been collected from the various database, however on

screening only those papers that regard with SC for healthcare as a whole entity has been considered in the review. Around 181 references are thus considered for the research.

2.5.1 *Journal wise distribution of research papers*

It is clear from the Table 2.2. That from 181 journal papers from 59 refereed journals the maximum number of paper is from Supply Chain Management: An International Journal and is about 26 papers (14.37%), followed by 24 papers (13.26%) from International Journal of Operations & Production Management while International Journal of Productivity and Performance Management contributing 11 papers (6.07%). Other active journals associated with the field are Journal of Operations Management, International Journal of Supply Chain Management, contributing nine papers each with approximately (4.98%). Further, there are three journals Operations Research for Health Care and International Journal of Production Economics that contribute 8 (4.42%) and 7 (3.87%) papers. Further, there are two journals Computers & Industrial Engineering and journal of Production, Planning, and Control having five papers each contributing (2.78%). Eight journals are having two papers each whereas thirty-three journals contributing one paper each. Twelve leading journals together contributed to about 64.1% of the total selected article in the review. It is further to be noticed that there are 6, 5 and ten journals directly related to Supply Chain, Performance Measurement and healthcare respectively contributing 42(23.2%), 15(8.33%) and 25(14.1%) papers respectively of the reviewed papers. Thus, it is denoted from the database collected for the review papers that my research is directly related to the supply chain and performance measurement of the supply chain with a special context to Healthcare sector. Thus this research contributes to the benefit of the healthcare industry for the efficient supply chain.

Table: 2.2 Journal wise distributions of research papers

S.No.	Name of journal	No. of papers	%
1	Supply Chain Management: An International Journal	26	14.37
2	International Journal of Operations & Production Management	24	13.26
3	International Journal of Productivity and Performance Management	11	6.07
4	Journal of Operations Management	9	4.98
5	International Journal of Supply Chain Management	9	4.98
6	Operations Research for Health Care	8	4.42
7	International Journal of production Economics	7	3.87
8	Computers & Industrial Engineering	5	2.78
9	Journal of Production, Planning & Control	5	2.77
10	Health Care Management Review	4	2.20
11	Engineering Management Journal	4	2.20
12	International Journal of Business Performance Management	4	2.20
13	Benchmarking: An International Journal	3	1.66
14	Technology Forecasting and Social Change	3	1.66
15	Leadership in Health Services	3	1.66
16	International Journal of Physical Distribution & Logistics Management	3	1.66
17	Health Care Financial Management	3	1.66
18	Health Policy	2	1.10
19	Operations And Supply Chain Management	2	1.10
20	International Journal of Production Research	2	1.10
21	Procedia Economics and Finance	2	1.10
22	The International Journal of Logistics Management	2	1.10
23	European Journal of Purchasing Supply Management	2	1.10
24	International Journal of Health Care Quality Assurance	2	1.10
25	Journal of Supply Chain Management	2	1.10
26	International Journal of Logistics Systems & Management	1	0.55
27	International Journal of Critical Accounting	1	0.55
28	International Journal of Health Planning and Management	1	0.55
29	Industrial Management & Data Systems	1	0.55
30	The International Journal of Accounting	1	0.55

31	Computers & Operations Research	1	0.55
32	Health Care Purchasing News	1	0.55
33	Health Services Management	1	0.55
34	International Journal of Services, Economics and Management	1	0.55
35	International Journal of Business Excellence	1	0.55
36	International Journal of Business and Social Science	1	0.55
37	International Journal of Management	1	0.55
38	International Journal of Management Science	1	0.55
39	International Journal of Manufacturing Technology	1	0.55
40	International Journal of Quality Innovation	1	0.55
41	Journal of Management and Strategy	1	0.55
42	International Journal of Academic Research in Accounting, Finance and Management Sciences	1	0.55
43	SAGE Journal	1	0.55
44	Service Industries Journal,	1	0.55
45	Social and Behavioral Sciences	1	0.55
46	International Journal of Globalization and small business	1	0.55
47	Logistics & Operations management	1	0.55
48	Procedia Manufacturing	1	0.55
49	Management Research Review	1	0.55
50	E-Commerce and Web Technologies	1	0.55
51	Journal of Global Business Advancement	1	0.55
52	Decision Support System	1	0.55
53	Decision sciences	1	0.55
54	International Series in Operations Research & Management Science	1	0.55
55	Journal of Purchasing & Supply Management	1	0.55
56	Omega	1	0.55
57	Procedia - Social and Behavioral Sciences	1	0.55
58	Computers in Industry	1	0.55
59	Business Process Management Journal,	1	0.55
	Total Refereed Journals	**181**	**100**
	Papers from International/National Conferences/Book review/Thesis	16	
	Total	**197**	

2.5.2 *Publisher wise distribution of research papers*

The major publishers of the 181 considered literature review papers are Emerald, Elsevier, Taylor & Francis, Springer, and Inderscience. Apart from these, there are other publishers also published articles on Performance measurement, Supply Chain Management, and Supply Chain Practices. According to the literature review, the contributions of these publishers to publish research papers on Performance Measurement and Supply Chain are shown in Table 2.3. From the Table:3 it is shown that the maximum research papers are from Emerald published 85 papers (46.97%) followed by Elsevier published 48 (26.52%). There are other publishers also having research articles on the related field of my research such as Taylor & Francis 12 (6.63%), Inderscience 10 (5.52%), Excelling Technologies 9 (4.97%), Springer 4(2.20%) and Wiley Online 2(2.20%). There are other journals also that are contributing to publishing research paper 9 (4.97%).

Table: 2.3. Publisher wise distribution of research papers

S.No.	Publisher	No. of papers	Percentage
1	Emerald	85	46.97
2	Elsevier	48	26.52
3	Taylor & Francis	12	6.63
4	Inderscience	10	5.52
5	Excelling Technology Publication	9	4.97
6	Springer	4	2.20
7	Willey online	4	2.20
8	Others	9	4.97
	Total	181	100

2.5.3 *Year wise distribution of research papers*

Year wise distribution of research papers under consideration in the literature review for a period between 2000 -2016 regarding Performance Measurement and Supply Chain Practices has been tabulated in Table: 2.4. It clearly indicates from the table that earlier there were little research papers in the literature concerning healthcare supply chain performance, i.e., between years 2000 to 2005, but during last few years between 2006 to 2016 and still in 2017 significant amount of research work about (%) has been taken in this regard by various researchers. This shows a vast scope of the research in the field of healthcare supply chain performance.

Table: 2.4 Year-wise distributions of research papers

S.No.	Year	No. of papers	Percentage
1	2017	6	3.31
2	2016	13	7.18
3	2015	21	11.60
4	2014	11	6.07
5	2013	14	7.73
6	2012	14	7.73
7	2011	13	7.18
8	2010	10	5.52
9	20009	9	4.97
10	2008	8	4.41
11	2007	12	6.62
12	2006	13	7.18
13	2005	11	6.07
14	2004	5	2.76
15	2003	5	2.76
16	2002	5	2.76
17	2001	5	2.76
18	2000	6	3.31

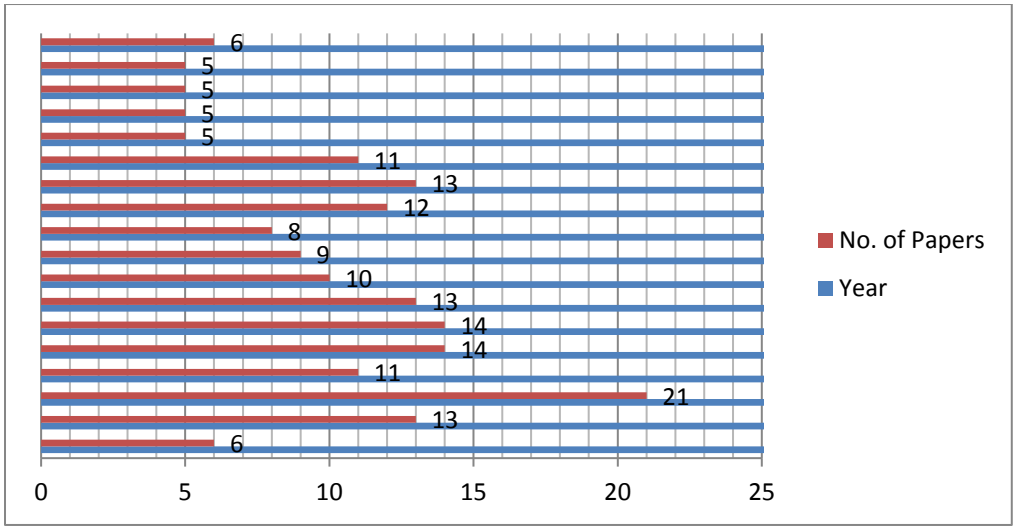

Figure: 2.4. Year-wise distribution of research papers

2.5.4 *Author wise research papers distribution*

The comprehensive author wise distribution of research papers is given in Table: 2.6

Table.2.6 Author wise distribution of research papers

Author (Year)	Name of Journal	No. of paper	Publisher
Soares, et.al, (2017), Danese & Romano, (2011), Vries, (2011), Arosson, et.al, (2011), Kim,et.al, (2010), Chae, (2009), Mustaffa & Potter, (2009), Green, et.al, (2008), Kumar, et.al, (2008), Giannakis, (2007), Lee, et.al, (2007), Kim, (2006), Seth, et.al, (2006), Wong, et.al, (2005), Tracey, et.al, (2005), Chan & Qi, (2003), Bhakoo et al., (2012), Huan et al., (2004), Rajagopal, (2005), Power, (2005), Othman, (2008), Sahay et al., (2006), Quayle, (2003), Bhakoo et al., (2010), Meijboom et al., (2011), Lillrank et al., (2011)	Supply Chain management: An International journal	26	Emerald
Zepeda, et.al, (2016), Koufteros, et.al, (2014), Chen, et.al, (2013), Cao & Zang, (2011), Zhou & Benten, (2007), Devraj, et.al,	Journal of Operations Management	9	Elsevier

(2007), Gowen, et.al, (2006), Li, et.al, (2005), Jhonston, et.al, (2004),			
Yusoff, et.al, (2016), Jones, et.al, (2015), Albarune, et.al, (2015), Pule, (2014), Pedroso, et.al, (2009), Lenin, (2014), Wijewardana et al., (2013), Afzal et al., (2015), Kritchanchai et al., (2015)	International Journal of Supply Chain Management	9	Excelling Technology Publication
Piotrowicz, et.al, (2015), Gorane, et.al, (2015), Gopal, et.al, (2012), Cuthburtson & Piotrowicz, (2011), Kollberg & Elg, (2011), Taticchi, (2010), Bakar, et.al, (2009), Shepherd, et.al, (2006), Kollberg, et.al, (2006), Toni, et.al, (2007), Purbey, et.al, (2007).	International Journal of Productivity and Performance Management	11	Emerald
Mandal, et.al, (2017), Prajogo, et.al, (2016), Upadhayay, et.al, (2014), Elg, et.al, (2013), Shi, et.al, (2013), Liu, et.al, (2013), Najmi, et.al, (2012), Tung, et.al, (2012), Lee, et.al, (2011), Zhang, et.al, (2011), Pavlov & Bourne, (2011), Kennerley & Neeley (2002), Cigolini et al., (2004), Hugo et al., (2002), Beamon, (1999), Neeley et al., (2000), Gunasekaran et al., (2001), Tan et al., (1999), Pearson, (2002), Storey et al., (2006), Hudson et al., (2001), Burgress et al., (2006), Vereecke et al., (2006), Bourne et al., (2000),	International Journal of Operations & Production Management	24	Emerald
Maestrini, et.al, (2017), Dobrzykowski, et.al (2014), Chan, et.al, (2014), Cho et al., (2012), Lin et al., (2005), Pedroso et al., (2009), Bayraktar et al., (2009)	International Journal of production Economics	7	Elsevier
Bhagwat & Sharma, (2007a), Cho et al., (2012), Giri & Sarkar. (2017), Bhatacharjee & Ray, (2014), Sakhuja & Jain, (2012)	Computers & Industrial Engineering	5	Elsevier
Abadallah, et.al, (2017), Thakkar et al., (2009), Dey et al., (2008)	Benchmarking: An International Journal	3	Emerald
Adebanjo, et.al, (2016), Lega, et.al, (2013), Bhagwat & Sharma, (2007b), Bhagwat & Sharma, (2009), Bohme et al., (2013)	Journal of Production, Planning & Control	5	Taylor & Francis
Meherialian, et.al, (2017)	International Journal of Logistics Systems & Management	1	Inderscience
Yoon, et.al, (2016), Falasca & Kros, (2016), Kwon, et.al, (2016)	Technology Forecasting and Social Change	3	Elsevier

Habidin, et al., (2016)	International Journal of Critical Accounting	1	Inderscience
Vanvactor, (2011), Xiong et al., (2007), Jarrett, (2006),	Leadership in Health Services	3	Emerald
Andreamatteo et al., (2015), Davis et al., (2013)	Health Policy	2	Elsevier
Kritchanchai, (2012), Msimangira et al., (2013)	Operations And Supply Chain Management	2	Emerald
Burns, (2000), Birken et al., (2015), Xue et al., (2013), Ford et al., (2007)	Health Care Management Review	4	LWW
Chen & Paulraj, (2004), Akyuz et al., (2010)	International Journal of Production Research	2	Taylor & Francis
Claro, (2002)	International Journal of Health Planning and Management	1	Willey online
Chakraborty, et al., (2014), Sukhri et al., (2015)	Procedia Economics and Finance	2	Elsevier
Chin et al., (2004), Sahay & Mohan, (2003), Amrik et al., (2002)	International Journal of Physical Distribution & Logistics Management	3	Emerald
Togar et al., (2005), Keely et al., (2001)	The International Journal of Logistics Management	2	Emerald
Koh et al., (2007)	Industrial Management & Data Systems	1	Emerald
Aptel & Porjalaji, (2001)	The International Journal of Accounting	1	Emerald
Bernnan, (1998), Yolk, (2011), Parker, (2008)	Health Care Financial Management	3	Emerald
Lapierre et.al,. (2007)	Computers & Operations Research	1	Elsevier
Smith et al., (2015), Carlos Callender, (2015), Jayaraman et al., (2015)	Engineering Management Journal	4	Taylor & Francis
Croom et al., (2013), Narayana et al., (2014)	European Journal of Purchasing Supply Management	2	Elsevier
Garvin et al., (2006)	Health Care Purchasing News	1	
Freemen, (2002)	Health Services Management	1	SAGE
Kritchanchai et al., (2010)	International Journal of Services, Economics and Management	1	Inderscience
Narul et al., (2014)	International Journal of Business Excellence	1	Inderscience
Suleiman, (2012), Neeley et al., (2003), Chan	International Journal of Business	4	Inderscience

et al., (2006), Karpagam & Suganthi, (2013)	Performance Management		
Yap et al., (2012)	International Journal of Business and Social Science	1	Centre for Promoting Ideas
Kumar et al., (2005), Samuel et al., (2010)	International Journal of Health Care Quality Assurance	2	Emerald
Acharyulu et al., (2012)	International Journal of Management	1	Elsevier
Li et al., (2006)	International Journal of Management Science	1	Elsevier
Chan et al., (2003)	International Journal of Manufacturing Technology	1	Springer
Lee, (2015)	International Journal of Quality Innovation	1	Springer
Al-Saa'da et al., (2013)	Journal of Management and Strategy	1	Sciedu Press
Kathleen et al., (2005), Elmuti et al., (2002)	Journal of Supply Chain Management	2	Willey Online
Kanda et al., (2015)	International Journal of Academic Research in Accounting, Finance and Management Sciences	1	Elsevier
Kelle et al., (2012), Uthayakumar et al., (2013)	Operations Research for Health Care	8	Elsevier
Mala et al., (2008)	SAGE Journal	1	SAGE
Baltacioglu et al., (2007)	Service Industries Journal,	1	Taylor & Francis
Gupta et al., (2015)	Social and Behavioral Sciences	1	Elsevier
Sharma et al., (2005)	International Journal of Globalization and small business	1	Inderscience
Nsamzinshuti et al., (2014)	Logistics & Operations management	1	Elsevier
Syahrir et al., (2015)	Procedia Manufacturing	1	Elsevier
Samuel et al., (2015)	Management Research Review	1	Emerald
Kim, (2005)	E-Commerce and Web Technologies	1	Springer
Afshan & Sindhuja, (2015)	Journal of Global Business Advancement	1	Inderscience

Thrasher et al., (2010)	Decision Support System	1	Elsevier
Sinha & Kohnke, (2009)	Decision Sciences	1	Willey online
Rossetti et al., (2012)	International Series in Operations Research & Management Science	1	Springer
Walker et al., (2008)	Journal of Purchasing & Supply Management	1	Elsevier
Grigoroudis et al., (2012)	Omega	1	Elsevier
Gupta & Ramesh, (2015)	Procedia - Social and Behavioral Sciences	1	Elsevier
Balfaqih, et al., (2016)	Computers in Industry	1	Elsevier
Charan et al., (2008)	Business Process Management Journal,	1	Emerald

2.5.5 *Classification according to research methodology*.

The research papers are further classified according to the type of research article as per the classification scheme is shown in Table: 2.6. Distribution of research papers reviewed in the research according to the type of paper is shown in Figure: 2.5. From the table, it is clear that the literature consists of Case Study, Conceptual, Descriptive, Empirical, Exploratory and review papers.

Table: 2.6 Classification scheme for the type of research paper.

S.no.	Research paper Type	Description
1	Case Study	8
2	Conceptual	44
3	Descriptive	13
4	Empirical	58
5	Exploratory	36
6	review	22

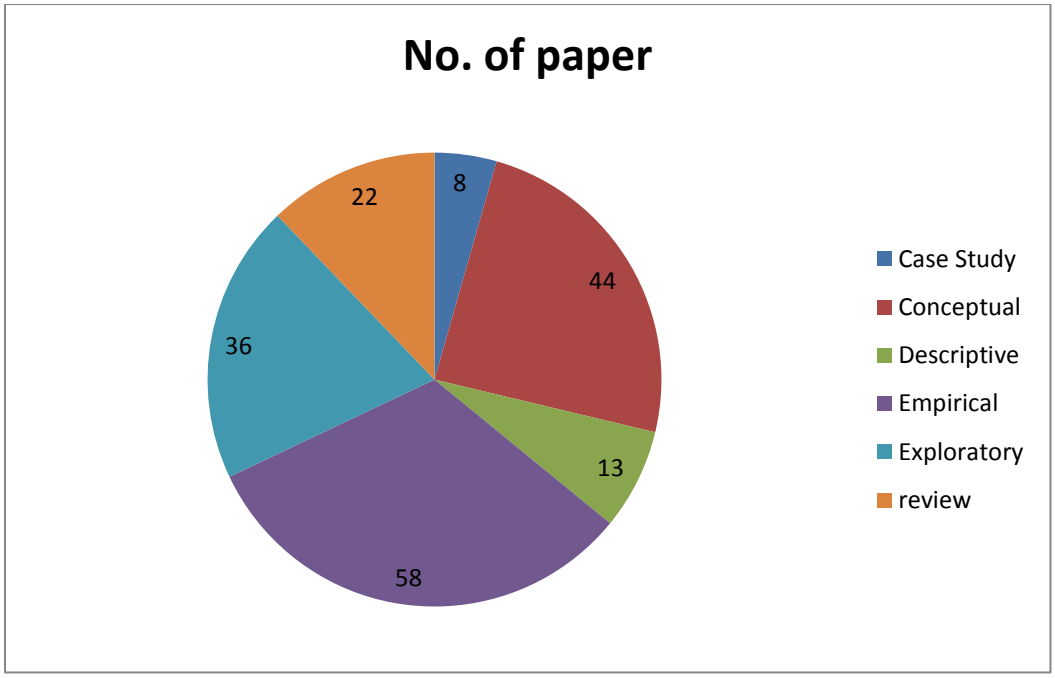

Figure 2.5: Distribution of research paper according to methodology

2.6 CONTENT ANALYSIS

A Content Analysis helps to determine the nature of the content, identify the patterns, and estimate the relationships between the research papers being analyzed. Content analysis helps to code and classify reviewed papers in different categories related to the research. The content analysis of this research has categorized the review papers in eight categories and tabulated in Table: 2.7. Descriptions for each topic group were then assigned appropriately. This Table provides a practical categorization for future researchers in investigating various elements of performance measurement and supply chain management with a particular context to the healthcare industry.

The eight categories used in this research are Health Care Supply Chain Management, Healthcare Supply chain Practices, Healthcare Organizational Performance, Healthcare Supply Chain performance. The distribution of the papers according to the content is tabulated in the Table: 2.8 and Figure: 2.6.

Table: 2.7 Detailed descriptions of Content type

S.No.	Content of Paper	Description
1	HC Supply Chain Management	Healthcare Supply chain involves the flow of different product types through the participation of various stakeholders to deliver products in a timely manner at a right quantity and quality to fulfill the needs of the providers.
2	HC Supply chain Practices	SCM practices are the set of activities that organizations undertake to promote effective management of the supply chain.
3	HC Organizational Performance	Organizational performance refers to how sound an organization achieves their goals and objectives while satisfying its social responsibilities.
4	HC Supply Chain performance	Supply chain performance investigates performance from supply chain perspective through business process to create efficiency to the supply chain as a whole.

Table: 2.8 Distribution of research paper according to Content type

S.No.	Content of Paper	No. of paper	%
1	HC Supply Chain Management	12	6.67
2	HC Supply Chain performance	59	32.5
3	HC Supply chain Practices	61	33.7
4	Organizational Performance	17	9.40
5	HC Performance	32	17.6
	Total	181	100

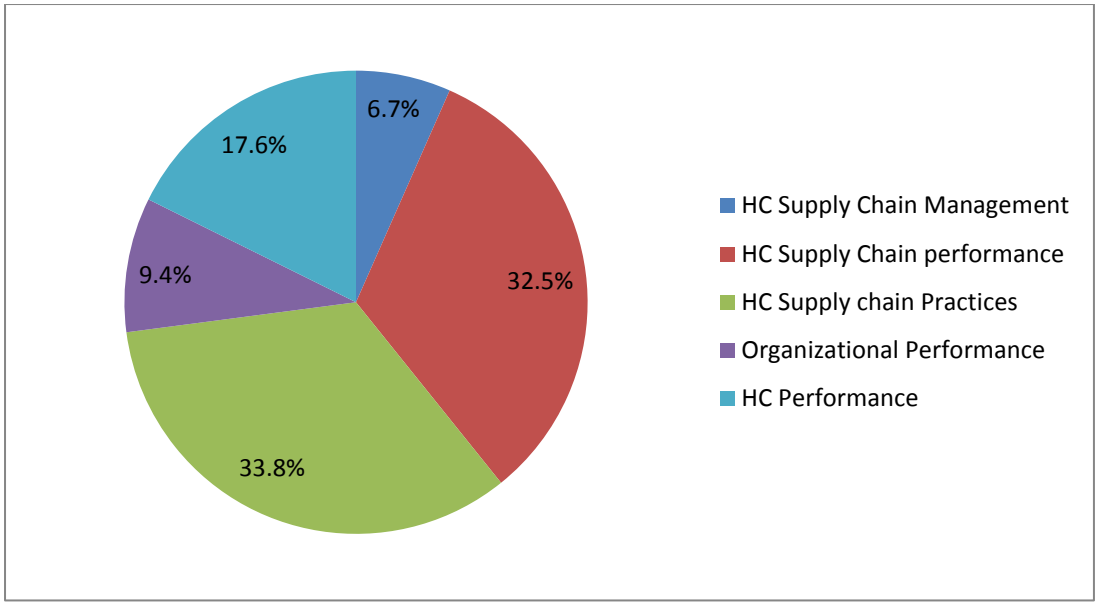

Figure: 2.6: Content-wise distribution of research paper

2.6.1 *Healthcare Supply chain Practices*

Supply chain practices provide a set of activities undertaken in an organization that helps the organization in the effective management of its supply chain by integrating its stakeholders such as Manufacturers, Distributors, Suppliers, and Customers, thus rising the effectiveness of supply chain performance and overall organizational performance.

Supply chain management is the backbone of any healthcare delivery. This arises from the fact that quality of health care delivery is so dependent on the availability medical supplies at the right time and in the right quantities to the patients. Lack of which may create dissatisfaction. Several types of research have been done in the literature about healthcare supply chain practices to improve the performance of healthcare supply chain. Gowen et al., (2006) proposes that healthcare quality program practices, employee commitment, and control initiatives are critical dimensions for healthcare supply chain. Chong, Chan, Ooi & Sim, (2010) Further categorized SC practices into demand management, customer relationship management, supplier relationship management, resource management, service performance, information and technology management, service supply chain finance, and order process management. As critical supply chain dimensions.

In the literature before different researchers defined Supply chain practices in different ways. Tan, 2002, Chow, 2008 and Koh et al., (2007) coined supply chain practices as "A set of activities help to promote the performance of whole supply chain. Tan et al., (2005) Has given various important dimensions of SC practices for effective supply chains such as Quality management, supply chain practices and JIT production. Further, Otto and Kotzab, (2003) studied SC practice as a special form of strategic partnership between retailers and suppliers. Li et al., (2005) evaluate the performance of the overall supply chain and validates six dimensions of SC practices (strategic supplier partnership, customer relationship, information distribution, information quality, internal lean practices, and postponement). Zhou & Benten, (2007) further pointed out that effective information sharing and effective supply chain practice are critical to achieving good supply chain performance. Jhonston et.al, (2004) Recognized supplier relationships as a dimension of supply chain practice that link supplier's level of trust to the buyer's perception in improves overall supply chain performance. Further, Koh et al. (2007) categorized SC practices from the following aspects: supplier integration, Customer integration, just-in-time supply, strategic planning, few suppliers, holding safety stock and sub-contracting, e-procurement, outsourcing and many suppliers.

Jones et al., (2015) explained that RFID technology ensures better customer satisfaction by appropriate handling and maintaining a reasonable safety stock of essential equipment and surgical items in the hospital by integrating RFID into an ERP system.

Bayraktar et al., (2009) identified a link among supply chain practices that have a significant influence on the organizational performance. Sahay and Mohan, (2003) explained four major supply chain dimensions, i.e., supply chain strategy, supply chain integration, inventory management, and information technology and recommends that organizations must align supply chain strategy with business strategy to achieve organizational excellence.

Burgess et al. (2006) focused on SC process and identify SC practices which include leadership, intra organizational relationship, inter-organizational relationship, process improvement orientation, information systems which help in improving SC performance.

According to Kritchanchai et al., (2015), the inventory management in hospitals should be fitted according to equipment categories and demand characteristics, which are unique in the healthcare supply chain. A single inventory management system cannot be effective for healthcare supply chain and thus could be done by their value and clinical importance.

Wijewardana et al., (2013) implies that performance excellence can be achieved through lean best practices through benefiting Healthcare administration, medical staff, and patients. Kollberg, et al., (2006) finds that lean thinking is appropriate in healthcare settings, and that a flow model is a suitable tool that measures changes towards lean thinking in healthcare.

Further, Kollberg & Elg, (2011) concludes that the BSC is used as a tool for improving internal capabilities and supporting organizational development. Prajogo et al., (2016) in his study showed that lean processes have a positive effect on internal supply performance.

Li et al., (2006) further concluded that Supply chain practices as a multi-dimensional construct that encompasses upstream and downstream sides of the supply chain. Lee, (2004) Focused on five practices of the supply chain, i.e., outsourcing, strategic supplier partnerships, customer relationship, information sharing, and product modularity that are key to create supply chain responsiveness. Again, Lyson and Farrington, (2006) points out that supply chain management is an amalgamation of all activities such as information, awareness and financial resources associated with the flow and transformation of goods and services up from raw-materials suppliers, components suppliers, and other suppliers such that the expectation of the users and the organizations are met. Stock & Boyer, (2009) pointed out that supply chain practices provide a framework that integrates various supply chain stakeholders thus results in overall organizational performance.

Further, Sandberg and Abrahamsson, (2010) discovered that top management commitment plays an essential role in the effectiveness of supply chain. Further Singh, (2011) identified coordination and responsiveness factors which consist of top management commitment, organizational factors, mutual understanding, the flow of information, relationship & decision making, and responsiveness.

Zeng et al. (2013) proposed supply chain management practices which include top management leadership, strategic planning, quality information, process management, workforce management and product design process to improve the supply chain.

Thus it is depicted in the literature that the supply chain practices have a goal of improving supply chain performance thus, improving organization performance of a firm. Although, there are various supply chain practices in literature depending on the type of organization; still there are commonalities among practices. This research work thus intends to focus on identifying a framework for improving supply chain performance and in the end overall organizational performance in particular context to Indian Healthcare industry. This also reveals from the literature that there is some research done in the field of performance supply chain practices and its performance. Most of them are focused on general forms of SCM that are applicable mostly to manufacturing organizations, and there are very few researchers in the service industry's SCM practices particularly for the healthcare industries. Further, there is no study found to describe the effect of supply chain practices on medical device supply chain in a particular perspective to Indian Healthcare Industry.

Table 2.9 presents the summary of different dimensions of SC practices undertaken in an organization to encourage effective management of its supply chain performance to enhance organizational performance from different perspectives. The literature depicts SC practices with a variety of perspectives having a common aim of improving organizational performance.

Table: 2.9 Dimensions of Healthcare Supply Chain Practices

Dimensions	Literature Support
Vendor managed inventory	Charles (1996); Disney and Towill (2003); Borade and Bansood (2012).
Top management commitment	Singh and Kant (2008); Sit et al. (2009); Sandberg and Abrahamsson (2010); Qureshi et al. (2011); Singh (2011); Morgan et al., (2000); Kiplagat J., (2015);
Supplier selection	De Boer et al. (2001); Wang et al. (2004); Haq and Kannan (2006); Power (2006); Kaynak and Hartley (2008); Pal et

	al. (2013); Trkman and McCormack, (2009).
Organizational leadership	Sila and Ebrahimpour (2005); Burgess et al. (2006); Sit et al. (2009); Khang et al. (2010).
Long term relationship	Chen and Paulraj, (2004); Min and Mentzer, (2004);
Lean Practices	Li et al. (2005); Kou et al., (2008); Vermaak, (2008); Shazali et al., (2013); Folinas and Faruna, (2011); Steed, (2012); Najem et al., (2012); Shah et al., (2008)
Just in time	Tan et al., (2001); Koh et al., (2007);
holding safety stock	Koh et al., (2007)
Strategic Supplier Partnership	Tan et al., (2002); Balsmeir, (1996); Gunasekaran et al., (2001); Stuart.FI, (1997); Sundram et al., (2011); Flynn and Flynn, (2005;
Customer relationship	Sundram et al., (2011);Moberg et al., (2002); Mentzer, (2000); Li et al. (2005); Flynn and Flynn, (2005; Flint et al., (2008); Ellram et al., (2007); Chong et al., (2010); Cho et al., (2012); Tan et al., (2002);
Information sharing	Dolon, (1996); Tan et al., (2001); Cho et al., (2012); Min and Mentzer, (2004); Li et al. (2005); Croom et al., (2000); Vereecke et al., (2006); Sundram et al., (2011); Seth et. al, (2006); Sahin and Robinson, (2002);
Postponement	Li et al. (2005); Croom et al., (2000); Alvarado and Kotzab, (2001); Koh et al., (2007); Sundram et al., (2011);
Data standardization	Christos et.al (2014); Chircu et.al (2014); Karthikeyan Lenin (2014)
Supplier Integration	Das et al., (2006); Koufteros et al., (2007); Petersen et al., (2005), Croom et al., (2000); Kim et al'. (2006); Mentzer et al., (2001); Koh et al., (2007); Chong et al., (2010); Baltacioglu et al., (2007); Cho et al., (2012);
Leadership	Jarrett, (2006);
Inventory Management	Alvarado and Kotzab, (2001);
Out sourcing	Dolon, (1996); Koh et al., (2007);
On time delivery	Tan et al., (2002); Shin et al., (2000); Dobrzykowski et.al,

	(2014); Ozdamar& Zhang, (2008); Devar, Krajewski & Wei, (2007)
E-procurement	Rahman,(2004); Gunasekaran and Ngai, (2008); Koh et al., (2006); Gunasekaran et al., (2004).
Few Suppliers	Chandra and Kumar, (2000); Chen and Paulraj,(2004); Yap &Tan, (2012)
Long term relationship with suppliers.	Carlos Callender, (2010); Min & Mentzer, (2004); Chen & Paulraj, (2004)
Flexibility for innovative product or process adoption	Chantanapokul. et.al, (2015); Dobrzykowski et.al, (2014); Karthikeyan Lenin, (2 014);Dobrzykowski et.al, (2009); Ozdamar& Zhang, (2008)

Based on this research gap, the first research question is as:

RQ-1 What are the significant supply chain practices of medical devices Indian healthcare industry?

With the extent of literature review, this study discusses four supply chain practices (Top Management Commitment, Supplier Integration, Lean Practices and Inventory visibility) in healthcare industries which have shown a close relationship with the performance of healthcare organization.

2.6.1.1 Top Management Commitment (TMC)

The extent of healthcare care performance depends mostly on the attitude of Top management towards the inner and outer supply chain of the healthcare. Human factors such as top management commitment have been effectively associated with healthcare service delivery and hence to the HSC. Important empirical studies of US hospitals have also linked and revealed that top management commitment and customer satisfaction are important to the success of supply chain initiatives. This means that they are also significant for HSC deliverables as customer satisfaction come in the domain of HSC operations Gowen et al., (2006). Based on the above literature the next research question is as:

2.6.1.2 Supplier Integration (SI)

Previous researchers identified that suppliers are the key driver of supply chain management. High levels of SI not only enhance healthcare SC performance but also improve the trust of suppliers which improves the supply chain performance and thus enhance organizational performance Abdallah et al., (2016). Supplier Integration describes a long-term relationship between a firm and its suppliers that aims at enhancing operational and strategic capabilities of participating firms to help them attain considerable ongoing benefits Li et al., (2004). SI includes different aspects such as coordinated schedules, integrated processes, shared information, shared technology, long-term contracts, reinforced quality improvements, improved supplier's overall capabilities, and shared risks and rewards (Dyer et al., 1998; Echtelt et al., 2008). Supplier Integration encourages problem-solving efforts Gunasekaran et al., (2001) and is serious to operate as a leading-edge supply chain. Azar et al. (2009) have investigated the impact of supplier integration on the performance and have found that effective supplier integration is directly related to higher level of performance conformance. Successful SI results in many advantages such as cost reduction, improved service levels, risk improvement, agile response to a changing environment and changing market needs (Zhao et al., 2013; Lee et al., 2011; Cao and Zhang, 2011). In the current study, the focus is on external integration between buying firms (hospitals) and their suppliers. Hospital-SI can be defined as the ultimate process synchronization between a hospital and its suppliers Chen et al., (2013). Hospital-SI is considered among the most fruitful strategies for adding value Carr and Pearson, (1999) and cutting ever-increasing costs in the healthcare sector and for exploiting efficient SC processes Lee et al., (2011). In this context, Frohlich and Westbrook, (2001) reviewed two forms of integration: first, delivery integration, which is related to the physical forward movement of materials; and second, information integration, which is related to the backward flow of information from the customer to supplier. Hence, effective integration with suppliers will be able to enhance the supply chain efforts to better performances. From the extent of literature the following research question is raised:

2.6.1.3 Lean Practices (LP)

Lean practices can be measured as a concept, a work culture, practice, a management view, value, a concept or an ethos Mark, Wilson and Ram, (2009). It improves all the dimensions at each level of an organization (Womack *et al*., 1990; Liker, 1998). According to Manrodt and Vitasek, (2008) lean practices directly link upside and downside flow of products, services and information that trim down cost by eliminating wastage by delivering right quantity of right product at the right time according to the need of the customer. Lean principles include a set of strategies and tools with the aim of reducing costs, both inside and on the outside to increase customer satisfaction through value addition in its goods and services. It is continuous improvement processes to focus on the removal of wastage or non valued-added activities that reduce set of times to allow for the economical production of small quantities. Further, (Holden, 2011; Joosten et al., 2009; Kollberg et al., 2007; Papadopoulos, 2011; Yousri et al., 2011) in their study discussed lean practices in healthcare industry while showing its positive benefits for the patient, clinicians, and stakeholders.

2.6.1.4 Inventory Visibility

Inventory insight and visibility helps in providing the real-time data of the stock and goods to make knowledgeable decisions and helps imperfect inventory at a quicker pace, increase the exactness of data, update ERP system, and advance client contentment with real-time information by controlling isolated inventory. Maintaining the right inventory is a challenge for any healthcare organization. It was anticipated that a hospital could reduce its total expenses through better inventory management and sharing of finished medical materials Schneller, (2006). It is nearly impossible to quickly track which medications should be used and in what quantities. On top of this, doctors often have the preferred equipment, which can lead to several brands of similar supplies being needed. To this end, many hospitals are started just-in-time methodology in favor of using isolated warehouses and organizing their inventory distribution. For these local warehouses, systems are started that holds inventory of products that are more appropriate to regional demand.

2.6.2 *Healthcare Supply Chain Performance*

Different researchers described Supply chain performance in a different way for measuring the usefulness of supply chain. Gunasekaran et al., (2004) Discussed a unified process-oriented approach model: the Supply Chain Operations References (SCOR) model for analyzing diverse supply chain partners in different decision areas like development, sourcing, making & delivering. Further, (Gunasekaran et al., 2003; Bhatnagar & Sohal, 2008) defined Supply chain performance as "The overall efficiency and effectiveness of SC."

Improving hospital supply chain performance is increasingly important as an organization strive to improve customer satisfaction at a reduced cost. Chen et al., (2003) delineate trust, knowledge exchange, IT integration and supplier integration as the major factors that influence hospital supply chain performance. Lenin, (2014) studied that the optimization of effective coordination and integration between all the supply chain partners will help to improve supply chain performance. Bakar et al., (2009) in his research insights on the importance of the dimensions of Doctor's satisfaction and supply chain inputs for better supply chain performance. Dey et al., (2008) studied that a combination of outcome, structure and process-based critical success factors helps in managing the performance of healthcare services. Kritchanchai, (2012) Developed a framework showing factors such as standardized drug coding, operational re-engineering and implementing information technology helps in performance improvement of healthcare supply chain. Further, Aptel & Porjalaji, (2001) advocated that Just-in-Time (JIT) philosophy applied to hospitals results in inventory cost reduction and improved performance of the supply chain. Ford et al., (2007) discussed that the ability of supply chain network techniques to significantly impact the healthcare marketplace in the short run.

In spite of vast literature available on the different ways to measure the supply chain performance, researchers still found the need for continued studies in this area due to lack of clarity and competence in the measurement of supply chain performance in the field healthcare industry. Thus this research tends to fill this gap by identifying measures of supply chain performance for medical device supply chain in context to Indian healthcare industry. Based on this research gap, the second and third research question is as:

RQ-2. How is different Supply chain practices related to the supply chain performance of Indian healthcare Industries?

2.6.3 *Healthcare Organizational Performance*

Healthcare Organizational performance is the outcome of the supply chain process. It refers to "How well an organization achieves its targeted goal as well as a financial goal" Deshpande, (2012). There is a large number of researchers in the literature discussing organizational performance, but still, no standardized definition has been evolved Ou et al., (2010). Cao & Zang, (2011) studied that supply chain practices improves collaborative advantage and indeed has an influence on firm performance, and the mutual advantage is an intermediate variable that enables supply chain partners to achieve synergies and create superior performance. Liu, et al., (2013) in his study found that Operational coordination is positively associated with operational performance and organizational performance. Giannakis, (2007) argued that organizational performance measures can be considered from various aspects regarding the relative importance of the performance measures to the organization.

Further, Hsiao et al., (2008) use cost, flexibility, quality, and delivery to assess business performance. Tan, (2002) explored his study on SC performance to be considered with variables such as On time delivery, single source items, acceptable raw materials, number of suppliers, supplier qualifications, and total cost of purchased parts. Tan, (2006) Again explained organizational performance to be considered with procedures such as quality and lead time improvements, cost reductions. Further Li et al., (2006) in this study used both economical and noneconomical indicators for measuring OP. Yang & Su, (2009) in their research added new dimensional measures for organizational performance such as ROI, inventory income and market share which are further used by many studies for evaluating organizational performance. Shin et al., (2000) identifies dimensions of organizationionional performance as supplier performance and buyer performance.

In the healthcare industry, the organizational performance is measured both financially and clinically. For financial measurement the variables used our return on investment, return on asset and market share (Vickery et al., 1999; Chen and Paulraj,

2004; Flynn et al., 2010). Whereas, the clinical measurement variables are the length of stay & customer satisfaction (Dobrzykowski, 2012).

Thus the literature suggests that both financial and nonfinancial performance of a supply chain characterize the overall organizational performance. Although there are abundant of literature available on supply chain measures and organizational performance there are very less literature available showing linkage between supply chain practices with organizational performance and supply chain performance with organizational performance particularly in the field of the medical device healthcare supply chain. Identifying this as a research gap our other research questions are as;

RQ-3. How is Supply chain practices related to the overall organizational performance of Indian healthcare Industries?

RQ-4. How is Supply chain performance related to the healthcare organizational performance of Indian healthcare Industries?

2.7 FRAMEWORK FOR HEALTHCARE ORGANIZATIONAL PERFORMANCE

Chakraborty, et.al, (2014) developed a framework showing SC Collaboration as an antecedent to value co-creation (VCC), which acts as an intermediary in the relationship between SCC with firm's performance. Lee et al., (2011) Projected a research model connecting the relationships among SC improvement, supplier collaboration, SC efficiency, and QM practice are the factors that will improve organizational performance through SC. This study contributes useful information to organizational leaders and managers in the healthcare industry, as the results suggest the successful implementation of SC is attained through continuous SC innovation with supplier cooperation, which in turn improves organizational performance. Rajagopal et al., (2007) showed in its framework that Supply chain integration: information sharing, internal integration, external integration with suppliers, external integration with customers plays a significant role in the overall success of the

business. Thakkar et al., (2009) formulated a framework that conceptualized the various decision areas such as plan, source, makes, and delivers in a way that they are built on a returning vision of the supply chain (procurement cycle, manufacturing cycle, etc.) and hence ensuring the association between organization-specific performance measures and SC-based metrics.

Li et al., (2006) Proposed a relationship framework using structural equation modeling indicate a result that higher levels of SC practice can lead to improved competitive advantage and improved organizational performance. Also, competitive advantage can have a straight, constructive impact on organizational performance.

Koh et al., (2007) Provided observed justification for a frame that identifies two groups of SC practices and suggested the connection among SC practices, OP and SC-related organizational performance within the framework of manufacturing industries. The study indicates that SC practices amplify the operational performance of in the first place, and Operational performance will, in turn, direct to enhance organizational performance related to SC. The findings thus show that operational performance has an inter mediating effect on SC practices and SC-related organizational performance of manufacturing industries.

Zhou et al., (2007) showed the following basic tenet about the role of information sharing and supply chain practice in supply chain management showing that both effective information sharing and effective supply chain practice are necessary to achieve improvement in supply chain performance.

Tan et al., (2007) Provides an empirically support structure that supply chain practices mediate the impact of operations ability on performance. The study also gives further verification of the direct influence of operations capability and supply chain practices on firm performance.

Bayraktar et al., (2009) Empirically experienced a structure identifying the fundamental links among supply chain (SC) and information systems (IS) practices. The framework identified a causal link among supply chain (SC) and information systems (IS) practices indicating its positive and significant influence on the operational performance of firms.

The limitation of this study was its narrow focus on SMEs of only two sub-sectors of manufacturing industry, thus precluding the generality of findings may benefit the effective use of SC and IS practices.

Bakar et al., (2009) Developed a framework that comprises of two dimensions DSD and SCI showing relationship patient satisfaction. The constraint of the study is that the data under study was taken only from two hospitals.

Cho et al., (2012) develops a framework for service supply chain performance measurement, providing 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.

Huo, (2012) Developed a framework that examined the relationships among Supply chain integration with company performance and firm performance. The framework focuses that the supply chain integration significantly influences Firm Performance directly, but they can improve the latter via the mediating roles of Company Performance.

Chen et al., (2013) proposed a research model based on a relational view that shows influences of factors such as trust, knowledge exchange, IT integration between the hospital and its suppliers, and hospital–supplier integration on hospital supply chain performance.

Hauque & Islam, (2013) Proposed a conceptual framework showing relationships between supply chain practices and customer satisfaction results that SC practices comprise three dimensions, namely, collaboration and information sharing, logistics design and IT infrastructure that influence customer satisfaction, while organizational culture (OC) does not have any influence on customer satisfaction. The drawback of this study was that the study is performed only in a particular industry and with a questionnaire survey.

Habidin et al., (2014) proposed a framework showing the relationship between Lean healthcare practices (LHP) and Supply chain integration (SCI) efforts in Malaysian

Healthcare Industries that indicate the applicability of LP such as leadership, employee involvement, organizational culture and customer focus will improve SCI effectiveness.

Kiplagat & Kiarie, (2015) proposed a framework which reveals that supply chain performance was significantly influenced by supplier selection and supplier performance measurement, but the limitation of the study is that the effectiveness of the framework was affected by the inaccessibility of supplier information, the false information offered by companies and customer collusion.

Some of the limitations of above-discussed frameworks are: Cho et al., (2012); Koh et al., (2007) focused its research on a particular service industry supply chain. Li et al., (2006) there was an only limited number of observations, and since the SC is complex and involves a network of companies in the effort of producing and delivering a final product, its entire domain cannot be covered. Although Huo, (2012) proposed an important the relationships among SCI and company performance in China, yet the generalizability of the study findings may be limited, as the cross-sectional data we used were only from one country.

Thus the literature review has revealed that the most of the framework significantly discussed the linkage between SC practices and firm performance, but there are limited studies on SC in healthcare and the performance of SC in healthcare. Thus there exists a knowledge gap on this particularly so in Indian healthcare industry. Further, the previous researches fail to provide literature on performance measurement of supply chain management in healthcare and its effect on the organizational performance of the healthcare industry.

2.8 RESEARCH GAPS

- Although there is a plethora of literature available on the supply chain and its performance, but there is a **lack of literature available on the effectiveness of supply chain performance in the context of Indian healthcare industries.**
- It is found in the research that **measurement of supply chain performance in regards to supply chain practices in context to Indian healthcare industry is still**

under research as there is no guidance or set rules to measure supply chain performance.

- Majority of research has been done on the manufacturing industry supply chain and its distribution, but there is **lack of research available on healthcare supply chain particularly on medical device and equipment supply chain and its practices.**
- It is found that no research has been done that can empirically test the **relationships between SC practices and supply chain performance effectiveness and healthcare organizational performance in the context of Indian healthcare industries.**
- It is found in the literature that most of the framework developed is **not validated hence it is important to validate the result through proper case studies.**

2.9 DEVELOPMENT OF RESEARCH FRAMEWORK

Based on the identified gaps in the literature, this research focuses on supply chain practices (SCPs), Supply chain performance (SCPs) and organizational performance (OP) in context of Indian healthcare industry with a particular concern to medical devices and equipment supply chain. The proposed research framework is shown in Figure: 2.7 to provide a linkage between healthcare supply chain practices and its impact on healthcare supply chain performance and ultimately its impact on healthcare organizational performance in Indian healthcare industry.

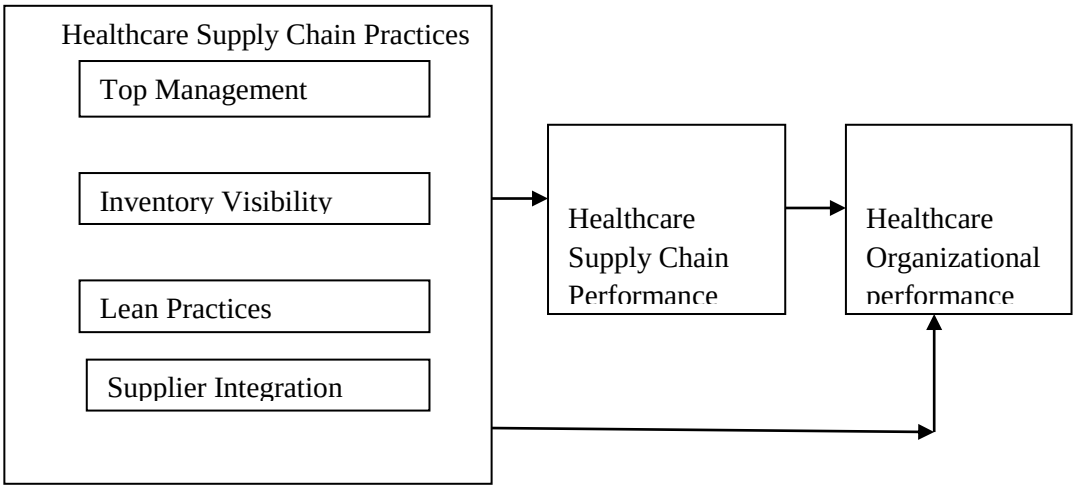

Figure: 2.7: Proposed Theoretical Framework

2.10 DEVELOPMENT OF RESEARCH HYPOTHESES

Based on the literature review of earlier research work a conceptual model has been developed, and the research hypotheses have been framed.

The objective of this research is to empirically find important measures of performance measurement of healthcare supply chain in context to Indian healthcare industry and also assess the influence of supply chain practices on supply chain performance and ultimately on the organizational performance. Thus the discussion above reveals that supply chain performance could be improved with the better implementation of supply chain practices and thus can achieve organizational performance in Indian healthcare industry. The hypotheses involving all the links are discussed as:

2.10.1 Healthcare Supply Chain Practices (SPs)

There are various supply chain practices discussed in the literature in different frameworks to improve the efficiency of the supply chain performance and then to improve the organizational performance. Various researchers have identified various supply chain practices used in healthcare industries. Chin et at., (2011) Proposed information sharing, customer relationship, strategic supplier partnership, material management and corporate culture as dimensions to measure supply chain practices. Further, Sukati et al., (2012) considered dimensions to measure supply chain practices for consumer goods industries of Malaysia as Strategic supplier corporation, customer relationship, and information sharing. Alvarado & Kotzab, (2001) discusses inter-organizational system dimensions such as EDI, removal of excess stock levels, rearrangement to measure the performance of supply chain. Chen & Poulraj, (2004) Identified different supply chain practices such as long-term relationship, leadership, supplier involvement as elements in measuring the performance of supply chain. Further, Li et al., (2005) empirically identified six dimensions of supply chain practices such as strategic supplier partnership, information quality, lean practices, postponement, and information sharing and customer relationship for developing a framework for performance measurement. Singh, (2011) identified coordination and responsiveness factors which consist of top management commitment, organizational factors, mutual understanding, the flow of information, relationship & decision making, and responsiveness. Agus and Hajinoor, (2012) Described some lean practices such as

setup time reduction, constant improvement programs, pull production system, smaller lead time, and lesser lot size for improving supply chain performance and organizational performance. Further, Sundarakani et al., (2012) investigated that implementation of inventory visibility application can enhance the SC performance by reducing cycle time and by reducing order fulfillment time. Thus based on the literature and to achieve RQ-1, following hypotheses are formulated healthcare industries.

RQ-1 What are the various supply chain practices particularly in the context of medical device supply chain specific to Indian healthcare industry?

Based on the literature review, the following hypotheses were formulated to achieve **RQ-1**

H1: Supplier Integration practices have a positive link with Supply Chain Performance.

H2: Top Management commitment practices have a positive link with Supply Chain Performance.

H3: Lean practices have a positive link with Supply Chain Performance.

H4: Inventory visibility practices have a positive link with Supply Chain Performance.

Based on above hypotheses a conceptual model is developed as shown in Fig: 2.8.

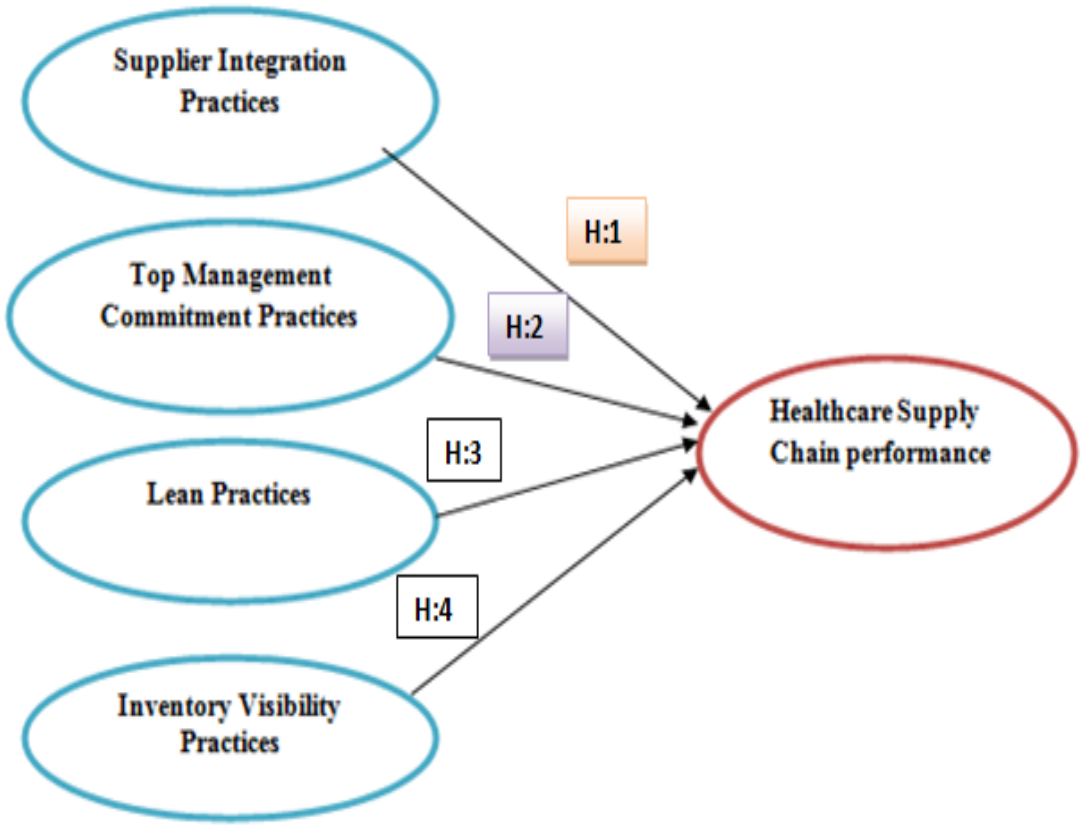

Figure: 2.8: Dimensions of supply chain practices

2.10.2 *Healthcare Supply Chain Practices and Healthcare Supply Chain Performance*

Huo, (2012) In his research investigated the impact of supply chain integration on organizational potential and performance through structural equation modeling (SEM) from the data collected from Chinese companies. The research findings revealed that supply chain integration has straight and not a direct effect on organizational ability while supply chain amalgamation act as limited and full mediating effect on organizational performance. Further, Deshpande, (2012) has conducted studied the effect of supply chain dimensions on SCP and organizational performance with the purpose of analyzing and emerging a conceptual framework that shows the relation of supply chain management dimension on supply chain performance and the relationship of supply chain performance and organizational performance.

(Ou et al., 2010) Investigated the effect of supply chain practices on industry performance using SEM by studying a sample from Taiwan manufacturing industries. They concluded that SC practices have an encouraging effect on performance while it will put forth an indirect impact on economic performance and customer value.

Koh et al., (2007) identified a direct positive effect of supply chain practices on organizational performance during his study in small and medium enterprises.

Rossetti, (2008) Highlights that to enable the efficient organizational performance it is required to have sufficient delivery of high-quality information on the demand and supply sides of the healthcare. Thus, the healthcare providers effort to integrate upstream with the manufacturers, wholesalers, and distributors.

Kreysa and Denecker, (2009) Studied that Implementation of supply chain standard data contributes to information synchronization in healthcare that helps in improving the effective supply chain. Gibbons (2009) highlights that more efficient process and improved relationships provide a higher quality supply chain. Further, Cook et al., (2010) in his research explored that the linkage among SC practices and OP with a moderating effect of company role on supply chain by surveying US manufacturing enterprises. The data analyzed using Regression reveal that supply chain practices have a considerable impact on organizational performance and business role on supply chain has a significant difference concerning supply chain practices.

Thus based on the review, as a whole, the hypothesis is formulated related to research question RQ-2

RQ-2. How is different Supply chain practices related to the supply chain performance of Indian healthcare Industries?

H5: There is a positive relation between Supply Chain Practices (SPs) and Supply chain Performance (SCP).

2.10.3 Healthcare Supply Chain Performance and Healthcare Organizational Performance

Lee et al., (2011) In his study establish that organizational performance has a relationship with SC improvement factor constructs, while Ellinger et al., (2012) have found out that higher supply chain competence higher exerts an impact on customer satisfaction, organizational performance and shareholder value. Further, Gunasekaran et al., (2008) suppose that competent supply chain could improve firm performance. Cohen and Roussel, (2005) in their study pointed that efficient supply chain should always support effective business strategy. Narasimhan and Kim, (2002) highlighted the roles of supply chain effectiveness on firm performance suggesting that efficient supply chain improve a firm's performance through moderating the correlation between product diversification (developing different products) and international market diversification. Shin et al., (2000) Also through case study explained that how an excellent SC impacts a firm's performance. Thus based on the arguments above and research question *RQ-3* & *RQ-4* it is hypothesized that:

RQ-3. How is Supply chain practices related to the Healthcare Organizational Performance of Indian healthcare Industries?

RQ-4. How is Supply chain performance related to the Healthcare Organizational performance of Indian healthcare Industries?

H6: There is a positive relation between Supply Chain Practices (SPs) and Healthcare Organizational performance

H7: Healthcare SC practices are positively associated with Healthcare Organizational Performance with Healthcare supply chain performance as mediating effect.

Based on the hypotheses H5 to H7, a conceptual model for the relationship of supply chain practices (SPs), supply chain performance (SCP) and Organizational performance (OP) in the healthcare industry is developed as shown in the Figure: 2.9.

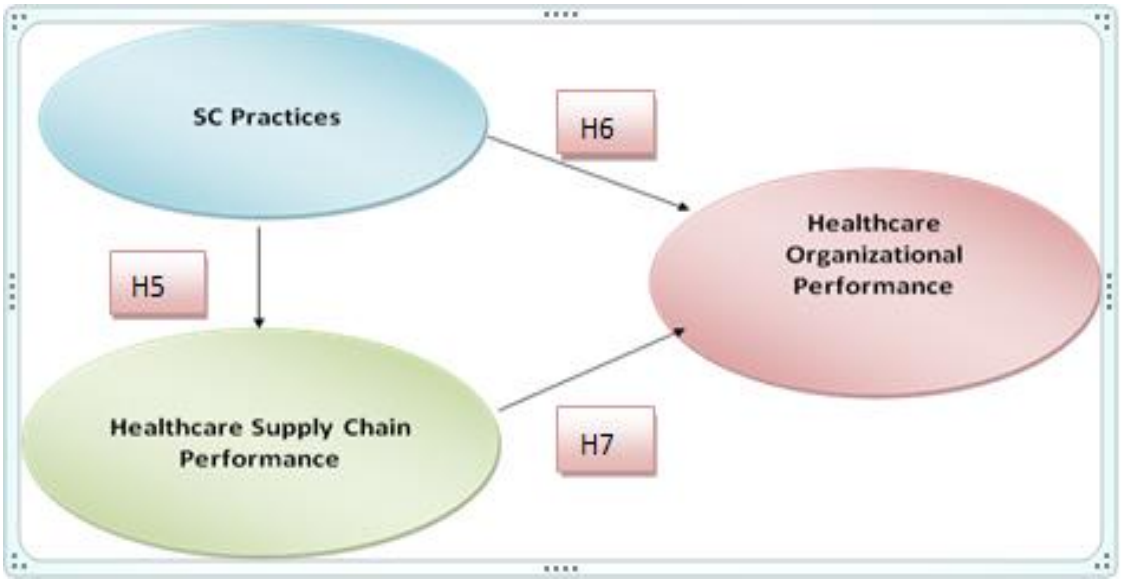

Figure: 2.9: A conceptual model showing relationship between SPs, HC SCP & HC OP

2.11 SUMMARY

The relationship between SCs and SCP has been the topic of many studies. Certainly, there have been a significant number of researchers that shows an obvious connection between different supply chain practices and its impact on organizational performance, and the relationship between supply chain performance and organizational performance. However, there is no study on the effect of SC practices on SCP and in turn its effect on OP, particularly in Indian healthcare industry. This has been identified as the research gap for the proposed study. The literature aims to develop a conceptual framework to fill these gaps.

This chapter presents a review of the literature on the relationship between supply chain practices and supply chain performance and is based on the premise that more the efficiency of the supply chain, the better the performance of the organization. The chapter presents a review of literature of various supply chain practices to improve the

performance of the Indian healthcare industries. Based on the literature review and research questions a projected a framework had been proposed that includes four important supply chain practices (TMC, SI, LP and IV) that have its impact on the effectiveness of supply chain performance and in turn impacts on Organizational performance.

CHAPTER-3 RESEARCH METHODOLOGY

3.1 INTRODUCTION

In the earlier chapter, we have discussed the detailed literature review of Performance of Supply chain in the healthcare industry and its effects on Organizational performance, projected framework and research hypotheses. This chapter specifies the nature research methodology and describes the following: research design, target population, data collection techniques, sampling techniques and data analysis methods along with appropriate justifications that will be followed in the research process. The research methodology is based on the survey questionnaire from the various stakeholders of the supply chain of Indian healthcare industry to assess the effect of SC practices on healthcare performance. The research process is completed in two stages; the first stage is to design a theoretical framework through literature survey, survey instrument from various stakeholders of Indian healthcare industry, research analysis, and results. The second stage consists of a case study related to supply chain of two private hospitals and its effect on organizational performance to validate the results of the survey.

3.2 RESEARCH DESIGN

It is essential to design the study properly before actually surveying to obtain desired results Burns et al., (2001). This research aims to explore supply chain practices that effect on organizational performance through survey instrument and validate the results through case study thus measure the performance of the supply chain in a particular context to Indian healthcare industry. The research design consists of data collection through survey questionnaire used to assess the relationship between supply chain practices from different stakeholders of healthcare industry supply chain.

This study is based on primary data about supply chain related variables and organizational performance. Data were collected using well-structured questionnaire survey which was administrated to a total sample of 164 respondents classified by

their job functions such as Manufacturer, distributor, supplier, and customers. Personal interview method was employed to collect primary data.

3.3 RESEARCH APPROACH

This section provides the overview of research approach. There are three basic approaches to research, i.e., quantitative approach, qualitative approach, and case study approach.

3.3.1 Quantitative Approach

The quantitative approach involves the production of data in a quantitative form which can be subjected to rigorous quantitative analysis. Creswell (2005) asserted that quantitative research is a learning research in which the researcher decides study direction, asks detailed, tapered questions, collects numeric (numbered) data from participants, analyzes these numbers using statistics, and investigates an unbiased, objective manner. The quantitative approach emphasizes the measurement and analysis of the causal relationship between variables Denzin & Lincoln, (2005). Quantitative approach classifieds in two types: a survey-based approach and non survey-based approach. As this research has data collection from various healthcare industries and different other stakeholders of healthcare supply chain thus the thesis approach is survey based.

In this research, to determine the variables of healthcare performance metrics, the structured questionnaire was designed using a five-point Likert scale for supply chain practices with specifically mentioned terms related to Top Management Commitment, Supplier Integration, Lean Practices and Inventory Visibility. A set of 16 questions were used to measure the performance metrics as independent variables. A questionnaire was sent to the different stakeholders of the healthcare industry as respondent for the survey.

3.3.2 Qualitative Approach

A qualitative approach is concerned with the individual evaluation of attitudes, opinions, and actions. Through this approach, we can evaluate various factors which stimulate people to behave in a particular manner. In other words, qualitative research is a kind of systematic research which consists of an examination looking for an answer to questions, systematically uses a predefined set of procedure to answer the questions, collects evidence, produce a finding that was not determined in advance and produce conclusion that are appropriate beyond the immediate boundaries of the study. It helps to gather detailed data, generally from small numbers of people, through interactions of the researcher with respondents. For this qualitative study, the approach helps to answer fundamental objectives of the questionnaire regarding top management behavior towards implementation of supply chain practices, Employee behavior towards training programs, supplier relationship, etc. The experts from industries and academia found a conceptual relationship between various dimensions of supply chain practices and organizational performance.

3.3.1Case study

In a Case study research, hypotheses were formulated to investigate the connection between supply chain magnitude and SC performance. To confirm the hypothesis, empirical analysis has been done. According to Yin, (2007) Case study research is employed to explore real-life events. A case study approach can thus be used to provide models, frameworks, or theories, which can be extended to another case in similar situations. In this research, case study method is adapted to test and validate various conceptual framework developed with an aim to improve SC performance.

3.4 RESEARCH PROCESS

In this study, the research process was done in three stages. In the first stage of the research, the research problems were identified in the field of healthcare supply chain through a literature review of the articles related to the concerned field. Several potential research questions were then generated from the research problems, and

finally, the research gaps were identified within the field of research interest. A further thorough literature review was done to search answers to the research questions. The research aim was then recognized based on the final selection of the research gap, and the research objectives resulted from the primary aim of the research. The research aim was then identified based on the research objectives.

Further, from the literature review done on some areas such as supply chain management, supply chain performance measurement, supply chain practices, supply chain performance, organizational performance, various issues regarding supply chain performance measurement and involving the variety of frameworks and their related factors/metrics involved in the research were focused. After that, the conceptual supply chain performance framework was developed, and the performance measurement practices were identified according to the extensive review of the literature.

As a result of the first stage, a set of different supply chain practices suitable for healthcare industries were identified. Further, the framework developed for Supply chain performance and supply chain practices are then validated by a panel of experts from all the stakeholders of healthcare supply chain for possible suggestions. From the academic aspect, the panel encompassed many scholars from the industrial engineering field were chosen. For the industrial aspect, Doctors or end users from Indian healthcare industries and other stakeholders of medical devices and equipment were included in the panel.

Finally, the third stage involves data collection through qualitative and quantitative approach such as interviews, questionnaire-based survey, case study approach. The conceptual framework so developed consists of four dimensions such as Top Management commitment, Supplier Integration, Lean Practices and Inventory visibility to improve the supply chain performance of healthcare industry. Further, to examine the relationship between SC practices and SC performance measures, a practical analysis has been done by formulating various research hypotheses. A structured questionnaire was developed based on the original feedback received against a pilot questionnaire and successive personal interactions held with academicians, and people from various stakeholders of healthcare supply chain of Indian healthcare industry particularly in the northern part of the country.

Further, to examine the relationship between SC practices and SC performance measures, an empirical analysis has been done by formulating various research hypotheses. A structured questionnaire (Appendix 1) was designed based on the original feedback received from a pilot study.

3.5 DEVELOPMENT OF QUESTIONNAIRE

3.5.1 Justification for selecting Indian Healthcare Industry

Based on the literature it was found that to explore supply chain management the most common instrument is surveyed questionnaire Dangayach & Deshmukh, 2001; Li, (2014). However, the impact of essential components of SC practices on the performance of the supply chain and also on the organizational performance particularly in Indian healthcare industry is unexplored. Thus with this as a motivation, a new questionnaire was developed related to supply chain practices in context to Indian healthcare industry.

3.5.2 Questionnaire design

Based on the extensive study of previous research, a research questionnaire was developed, which represents a group of dimensions of healthcare supply chain practices, healthcare supply chain performance and healthcare organizational performance relevant to Indian healthcare industry. The questionnaire was developed on a five-point non comparative Likert scale. Likert scale was simple to create and was easy for the respondents to read, understand and respond appropriately.

3.5.2.1 Informal Testing

In the first phase, the questionnaire was distributed to their colleagues, associates, and researchers to get their attitude as an informal testing Biemer & Lyberg, (2003). With this informal testing, the researcher gets the first feedback on the draft that helps to get the content validity of the questionnaire. Some of the items were found redundant and were dropped. The informal test helps to detect mistakes in writing; wording and format thus

avoid unnecessary questions and lead to a validated questionnaire which can be sent to experts for pilot testing.

3.5.2.2 Pilot Testing

Pilot testing employs a little number of respondents to check the suitability of the questions and their comprehension. It helps to recognize questions that don't make logic to participants or problems with the wordings or measurement that might direct to a biased answer.

For this research, the pilot study of the questionnaire was done by the 30 experts both from the healthcare sector field and academicians. From healthcare sector, experts are clinical practitioners, medical equipment manufacturers, suppliers, and distributors. Pilot testing was done to ascertain the suitability of the questionnaire for objectivity and efficiency of the process and clarity and relevance of questions. Experts were requested to check the questionnaire, and their comments were recorded and included in the questionnaire for suitable modifications. After a few iterative reconsiderations and constant improvements in the questionnaire, authors finally developed the final questionnaire.

Again for further refining of scale items quantitative assessment was done by computing corrected item-to-total correlation. The corrected item-to-total correlation equal to or better than 0.6 is considered acceptable (Nunnally, 1978; Flynn et al., 1990). The result found that the computed item-to-total correlation was higher than 0.6. Therefore no item was deleted. The questionnaire was then finalized for administration.

3.5.2.3 Final Questionnaire

The final questionnaire was divided into four segments: Part A contains nine questions that cover demographic outline of the organization and the respondent such as Name of Organization, Type of organization, no. of employees, Type of supply chain partner, year of experience, Age and whether the organization is using any performance measurement system. Part B deals with supply chain management practices that contain sixteen questions related to supply chain practices dimensions such as Top Management

Commitment (TMC), Supplier Integration (SI), Lean Practices (LP) and Inventory Visibility (IV). Part C deals with seven questions related to the performance of the supply chain. All the variables in part B and C are measured using an ordinal scale, where the respondents assess the concept by rating on a five-point Likert scale ranging 1= strongly disagree to 5= strongly agree. Part D entails four questions having variables regarding the organizational performance of the healthcare ranging from 1- very low to 5= very high.

Table 3.1 summarizes the issues regarding supply chain practices, supply chain performance and organizational performance relevant to Indian healthcare industry along with the literature support.

Table 3.1 Issues in Questionnaire

S.No.	Construct	Variable	No. of Items	Items	Literature Support
1.	Healthcare Supply chain Practices	Top Management Commitment	5	High-quality suppliers.	Yap &Tan, (2012); Carlos Callender, (2010); Min & Mentzer, (2004); Chen & Paulraj, (2004); Kiplagat J., (2015); Seth et. al, (2006); Li et. al., (2006); Sundram et al. (2011); Chen, D.Q, (2012); Lenin,K., (2014); Li et al., 2005; Wong et al., 2005; Zhou and Benton, 2007; Koh et al., 2007; Li et al., 2006; Claycomb et al., 1999; Tan et al., 1998.
				Long term relationship	
				Commitment to supply chain performance.	
				High quality products and services.	
				Proactive and systematic	
		Supplier integration	4	Information sharing	Li et al., 2005; Li and Lin, 2006; Monczka et al., 1998; Li et al., 2006; Mohr and Spekman, 1994; Claycomb et al., 1999; Tan et al., 1998.
				Strategic Planning with key Suppliers	
				Little or no expediting.	
				Supplier of managed inventory	
		Lean Practices	4	High level of emergency supplies of critical items.	Li et al., (2006); Li et al., (2005); Handfield and Nichols, (1999); Mason-Jones and Towill, (1997); McIvor, (2001); Taylor, (1999); Womack and Jones, (1996); Shah et al., (2008); Alvarado & Kotzab, (2001);
				Eliminating duplicate processes and unnecessary procedures.	

				Utilization of available equipment and facilities	
				Right product at the right time.	
		Inventory Visibility	3	Track on actual and accurate inventory levels.	Li et al., (2006); Li et al., (2005); Naylor et al., (1999); van Hoek et al., (1999); Beamon, (1998); Carlos Callender, (2007);
				Reducing frequent use of inventory.	
				Forecast demand and provides actual information	
2.	Healthcare Supply Chain Performance		7	Increased Overall product quality.	Gunasekaran et al., (2004); Shepherd and Gunter, (2005); Sukati et al., (2012); Bhagwat and Sharma, (2007); Gunasekaran et al., (2003); Bhatnagar and Sohal, (2008); Vijayasarathy, (2010); Trkman et al., (2010); Deshpande, (2012); Olugu and Wong, (2009); Ou et al., (2010); Chantanapokul. et.al, (2015); Dobrzykowski et.al, (2014); Lenin.K, (2 014);Dobrzykowski et.al, (2009); Ozdamar& Zhang, (2008); Samuel et. al., (2009); Schneider et. al, (2012); Zheng et.al, (2006); Alain Beerens, (2005); Matinelly et. al, (2006); Aptel & Pourjalli, (2001); Dobrzykowski et.al, (2014); Devar, Krajewski & Wei, (2007)
				Increased Responsiveness to customer request.	
				Reduced Reliability in the delivery of materials.	
				Smaller Order fulfillment lead times.	
				Increased Flexibility of service to meet customer need.	
				Acceptance of strategic changes in the supply chain.	
				Improved Accessibility to product supply.	
3.	Healthcare Organizational Performance		4	Customer Satisfaction	Ou et al., (2010); Hsu et al., (2007); Lin et al., (2004); Li et al., (2006); Kristal et al., (2010); Deshpande, (2012); Kannana and Tan, (2004); Tan et al., (1998); Hsu et al., (2009); Yang and Su, (2009); Tan (2002); Cook et al., (2010); Ellinger et al., (2012); Koh et al., (2007); Qrunfleh and Tarafdar (2012);
				Return on investment	
				Improved Resource Utilization	
				Improved cost to service	

3.6 CONCEPTUALIZATION OF INSTRUMENT DESIGN

Conceptualization of instrument deals with ensuring that the concepts such as healthcare supply chain practices, healthcare supply chain performance and healthcare organizational performance, are converted into questionnaire such that relevant empirical data can be analyzed. This can be ensured by sample adequacy test. Further, to make sure the correctness of the study, it is essential to test the goodness of the data by checking reliability and validity Mentzer and Flint, (1997).

3.6.1 Sample Adequacy Test

The Kaiser-Meyer-Olkin (KMO) test is performed to evaluate the sample adequacy, before checking the reliability and validity. Dubey et al., (2015) Suggested that the KMO test value must be higher than 0.6 for future analysis. The KMO value in this study comes out to be more than 0.6 thus the sample can be used for future analysis.

3.6.2 Reliability and Validity

Reliability is the measure of consistency, dependability, and accuracy that shows that data gives consistent results on repeating the trails with the same subject and in similar circumstances. Thus the term reliability shows the degree of intercorrelation between various items. For measuring the internal consistency between the items, Cronbach's alpha coefficient test is used Conca et al., (2004). Nunnally, (1978) advocates that the measures with minimum Cronbach's alpha value more than 0.6 are recommended.

Validity testing means testing the instrument whether it can measure what it intends to measure. There are diverse types of validity testing such as Construct validity, Content validity, Convergent validity.

Content validity: Content validity ensures that the selected items under various construct extend the past empirical, theoretical and practical considerations and correlate the aim to measure with the theorized construct (Anupam et al., 2008). For content validity, the questionnaire was sent to few practitioners and academicians for pilot testing. Thus, questionnaire content validity was confirmed based on the option

and suggestion of the subject experts, and some of the following changes were made to make the questionnaire appropriate and more understandable and purposeful.

Construct Validity: Construct validity confirms the extent to which the variables are used for the study, measure the intended performance in comparison to the intended measurement standards. To create construct validity, one must first ascertain a relationship and examine them empirically. This is then interpreted regarding how they can clarify the construct validity.

Convergent Validity: Convergent validity examines whether the measures of the same construct are correlated highly. It shows the degree to which the measurement instrument accomplishes steadiness.

Discriminant Validity: Discriminant validity measures the degree to which items intended to measure the construct that does not correlate too high with other constructs.

3.7 POPULATION OF STUDY AND SAMPLING

A population is the group of essentials about which we wish to make some inferences (Copper and Schindler, 2001). It can also be described as a collection of data that describes some phenomenon of interest (Quang and Hong, 2003). The target population of interest in this study consisted of all the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) of healthcare medical devices and equipment supply chain. The customers for the supply chain are the end users, and for this particular research, the end users are Doctors and technical staff in healthcare.

3.8 DATA COLLECTION

This study used a qualitative, quantitative approach combined with case study methods. By these approaches, multi-research methods were developed, including questionnaire, interviews, observation and secondary data gathering. Data collection in this study is based on primary data. Main data about the supply chain management

practices related variables, organizational performance, and profile of healthcare industry in northern India. The primary instrument for primary data collection was a structured questionnaire that allowed for uniformity of responses to questions.

According to Mugenda & Mugenda, (2003), the questionnaire is a fast way of obtaining data. In this research the primary information regarding healthcare industries, medical equipment manufacturers, distributors, and suppliers are collected from a directory of Confederation of Indian Industry (CII), (CLAA), Association of Indian Medical Device Industry (AI-MED), Indiamart e-portal, etc.

As a result, a database of 1086 data all related to various stakeholders that are evenly distributed across north India was created. The process of data collection was started in August 2016 and was completed by April 2017. The data was collected through mail and online link. Initially, the questionnaire was e-mailed to 432 addresses along with a cover letter clearing up the rationale for the survey. Out of complete mailed questionnaires, only eight responses returned through the mail. Then the online survey form was prepared through Google forms, and the link was emailed to all the contacts of the database. Although much care was taken to verify the e-mail addresses, telephonic contacts were also done to check correct e-mail addresses; still few emails returned due to wrong e-mail addresses. Further, due to inadequate response to the e-mail sent repeat reminders was sent to the respondents through e-mail, SMS and by contacting telephonically. These repeated efforts helped, and increased the response rate. Further, to improve the response rate, the data was then collected personally by the author by taking prior appointments and interviewing respondents on the telephone. The responses are collected after proper debriefing and explanation to the respondents as and when required. Since the majority of data is collected personally, there is a negligible number of nonresponse bias, incomplete and ambiguous responses. Finally, 164 usable responses from a survey sample of 718 (8 through the post, 52 through the online link, 104 by personal interview) were received yields a response rate of 22.8% which is sufficient number for further analysis.

3.9 DATA ANALYSIS

Data analysis can be defined as a methodical and logical approach taken towards the collection of data so that the compulsory information can be collected from the data. It is difficult to portray conclusions from empirical data and to simplify them without the support of statistical evidence. The software package used for analysis of data and presented in the report in the form of tables, bar charts, and graphs is IBM statistical package for Social Sciences (SPSS) version 22.0.

3.10 TOOLS AND TECHNIQUES USED FOR ANALYSIS

Research tools are statistical techniques used for data analysis and to test the research hypotheses thus to arrive at meaningful conclusions. The following statistical tools were used to analyze the data:

1. Preliminary Analysis
2. Descriptive Statistics
3. Chi-square test
4. Independent Sample T-Test
5. Analysis of Variance (ANOVA)
6. Factor Analysis
7. Multiple Regressions

3.10.1 Preliminary Analysis

In the first stage of data analysis, the preliminary examination of data was carried out. In this stage, the data collected from various methods are first entered into an excel sheet format to compile all the data at one place. Again the data obtained from online survey was also downloaded into excel format and then compiled together. These data were then used to conduct a preliminary examination to ensure the validity of

responses. The data was then imported into SPSS version 22.0 software for further analysis.

3.10.2 Descriptive Statistics

Descriptive Statistics provides statistics and graphical displays that are helpful for describing many types of dimensions. These are occurrence counts, percentages, increasing percentages, mean, median, mode, sum, standard deviation, variance, range, standard error of the mean, skewness and kurtosis (both with standard errors), bar charts, pie charts, and histograms. Descriptive Statistics is used for computing segment wise and overall statistics for various issues of healthcare supply chain management.

3.10.3 Chi-square test

The statistical test Chi-Square is most usually used the test to assess Tests of independence between two variables. The Test of Independence assesses an association either exists between the two variables. Chi-Square test compares the practical pattern of responses in the cells to the pattern that would be expected if the variables were authentically autonomous from each other. Calculating the Chi-Square statistic and comparing it in opposition to a critical value from the Chi-Square distribution allows the researcher to evaluate whether the practical cell counts are appreciably different from the probable cell counts. If the level of significance is less than 0.05, then the particular null hypothesis can be discarded, and the alternate hypothesis can be affirmed that there exists a considerable association between those two attributes. The better Chi-square statistic indicates a more important discrepancy between the observed cell counts and the expected cell counts that shows that the two variables are not independent.

3.10.4 Independent Sample T-Test

The T-test procedure compares means for two groups of cases. It is used to discover out whether SC related software usage of healthcare industries is dissimilar with factored variables of supply chain performance and organizational performance. SPSS

22.0 produces statistics like mean, standard deviation, and standard error of the mean for each variable. For arriving conclusion, only t-value along with the significance is used. If the significance value is less than 0.05, then the null hypothesis will be rejected, and the accepted alternate hypothesis is that there exists a significant difference between usage and not the usage of SCM related software on that particular dependent variable.

3.10.5 Analysis of Variance (ANOVA)

ANOVA is a statistical procedure used to analyze the differences among group means. The null hypothesis for an ANOVA shows that there is no considerable difference among the groups. The alternative hypothesis assumes that there is at least one major difference among the groups. If the p-value (associated probability value) associated with the F-ratio is lesser than .05, then the null hypothesis is discarded, and the alternative hypothesis is accepted. If the null hypothesis gets rejected, one concludes that the means of all the groups are not equal. A one-way ANOVA has just one independent variable. Two-way ANOVA is used to examine the interaction between the two independent variables. In this research one-way ANOVA is used to find out the impact of healthcare profile variables and factored variables of healthcare supply chain practices, performance, and organizational performance. If the significant value is less than 0.05, then it is presumed that categories in independent variable are differing on the mean values of dependent variable.

3.10.6 Factor Analysis

Factor analysis was applied to reduce the number of items or variables into a minimum number of manageable items or variables. The need to use factor analysis is to test the two statistical test that is Bartlett's test and KMO test. The Kaiser-Meyer-Olkin (KMO) test of sampling adequacy signifies the proportionate variance of variables or items which may be caused by new factors. A higher value that is more than 0.50 value of KMO test depicts that factor analysis will be helpful for the particular data set. There are various methods of factor extraction are available but in this study Principle Component analysis is used. The factor analysis applied in this research work on the variables of healthcare supply chain practices, performance and

organizational performance into manageable factor based on loadings of each variable.

3.10.7 Multiple Regression Analysis

Multiple regression analysis is performed by taking into consideration a set of independent variables and each dependent variable individually to identify a set of variables which conjointly contribute significantly towards the creation variable.

3.11 CHAPTER SUMMARY

This chapter discusses the methodology that is used in carrying out the study. It examined descriptive research as the type of design that was used in the study which focused on measuring and evaluating the performance of a supply chain. The section provided sample frames, techniques, and sizes that were used. The questionnaire methodology for data collection was illustrated. The questionnaire developed was pretested before being issued to respondents.

4.1 INTRODUCTION

In the previous chapters, the author has presented research methodology, and a theoretical framework has been developed. The goal of this research project was to determine if four dimensions of SC practices Top Management Commitment, Supplier Integration, Lean Practices and Inventory Visibility (TMC, SI, LP and IV) are co-related to supply chain presentation and organizational performance.

After the data was collected, an inferential statistical technique was employed to analyze the information using SPSS version 22. This chapter summarizes the findings of a survey taken from 164 usable responses from a survey sample of 718 (8 through post, 52 through online link, 104 by personal interview) that yields a response rate of 22.8% which is sufficient number for further analysis (Anseel et al., 2010; Cooper and Schindler, 2003). The six hypothesis presented earlier in this research project are evaluated using multivariate correlation analysis. Figure: 4.1 shows the details regarding response obtained.

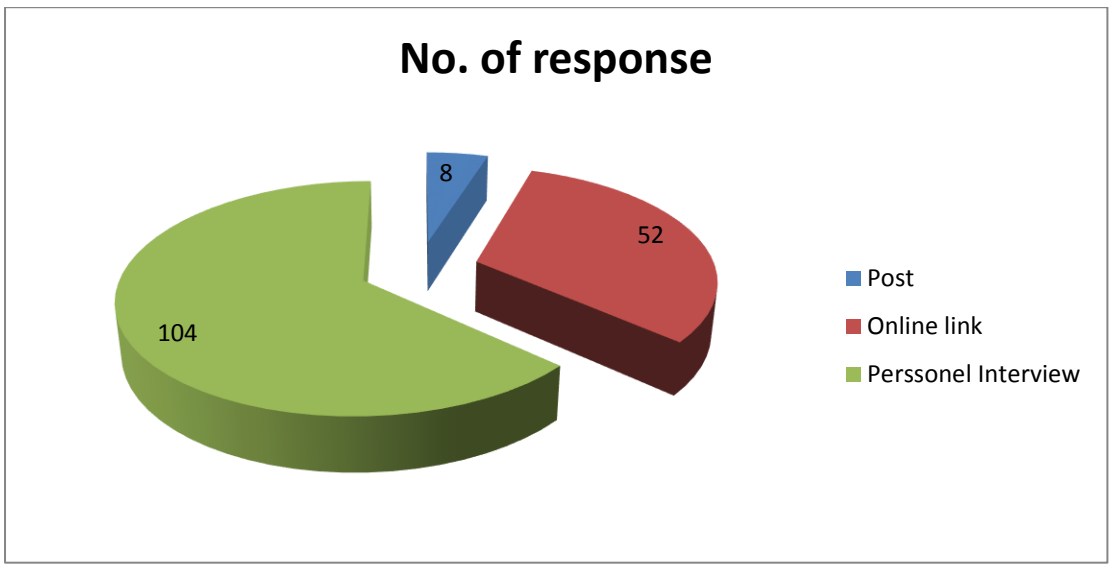

Figure: 4.1 Responses Obtained

As this chapter presents the quantitative analysis of data collected from different stakeholders of healthcare supply chain management particularly for medical devices and equipment the statistical tools were aligned with the objectives of the research. The data has been categorically examined to provide clear and intense outcomes of the study. The analysis of data collected from the questionnaire survey includes demographic analysis, descriptive analysis, missing value analysis, reliability and validity of the data, comparative analysis, Factor analysis of variables and finally multiple regression analysis.

4.2 RELIABILITY

The reliability of an instrument refers to its ability to produce consistent and stable measurements. Reliability tests were conducted to select and assess the final items of the independent constructs that were used for statistical testing. Since data for the study were generated using a multi-scaled response, it was necessary to test for reliability (Agus, A., 2010; Frohlich, M.T. et al., 2001). It estimates in what way perfectly the data obtained in the study characterizes a given variable or framed in the study (Mugenda & Mugenda, 2008). According to Bryman and Bell (2007), reliability analysis is concerned with the internal consistency of the research instrument which measures the closeness between the related set of items in a group. It is assessed with Cronbach's Alpha and the reliability values for all constructs which are considered acceptable if the alpha value is greater than 0.6 (Nunnally, 1978).

In this research, multiple items in all constructs were used. The internal consistency/reliabilities of SCM practices, supply chain performance, and organizational performance were assessed with Cronbach's Alpha, and the reliability values for all constructs are confirmed with Cronbach's Alpha value of 0.911, which is considered acceptable (Nunnally, 1978). The following Table: 4.1 shows the summary of reliabilities of all constructs.

Table 4.1 Reliability of Data

Reliability Statistics		
Cronbach's Alpha	N of Items	Sample size
.911	27	164

4.3 MISSING VALUE ANALYSIS

The Missing Value Analysis explained the outline of missing data. Missing value analysis assists to addresses various concerns caused by inadequate data. If cases with misplaced values are thoroughly different from cases without misplaced values, the outcomes can be misrepresentative.

4.4 NON RESPONSE BIAS

A non-response bias test was assessed using a Chi-square test which was conducted between two groups of respondents to assess if there is any significant difference between the two types of respondent such as those who responded late as compared to those who responded late. In this study, a total of 164 surveys were divided into 81 early respondents and 83 as late respondents. The results of the comparison in this study between early and late respondents were insignificant for all variables at the 5% significance level. Thus the nonresponse bias was not present in this study.

4.5 DEMOGRAPHIC ANALYSIS

The demographic information describes both individual and firm profile. Individual profile section includes aspects of the age of respondent, the gender of respondent, work experience of respondent and type of supply chain partner, whereas firm profile section includes a number of employee in the organization, type of organization and whether the firm is using any performance measurement system.

4.5.1 Individual profile information

The researcher sought to determine the ages of the respondents, from the findings on Table: 4.2 and Figure: 4.1, 81.7% are male while 18.3% are female implying that the gender distribution of different stakeholders in healthcare supply chain in Indian scenario is not balanced.

Table 4.2 Respondent's Gender

Gender	
Gender	Percent
Male	81.7
Female	18.3
Total	100.0

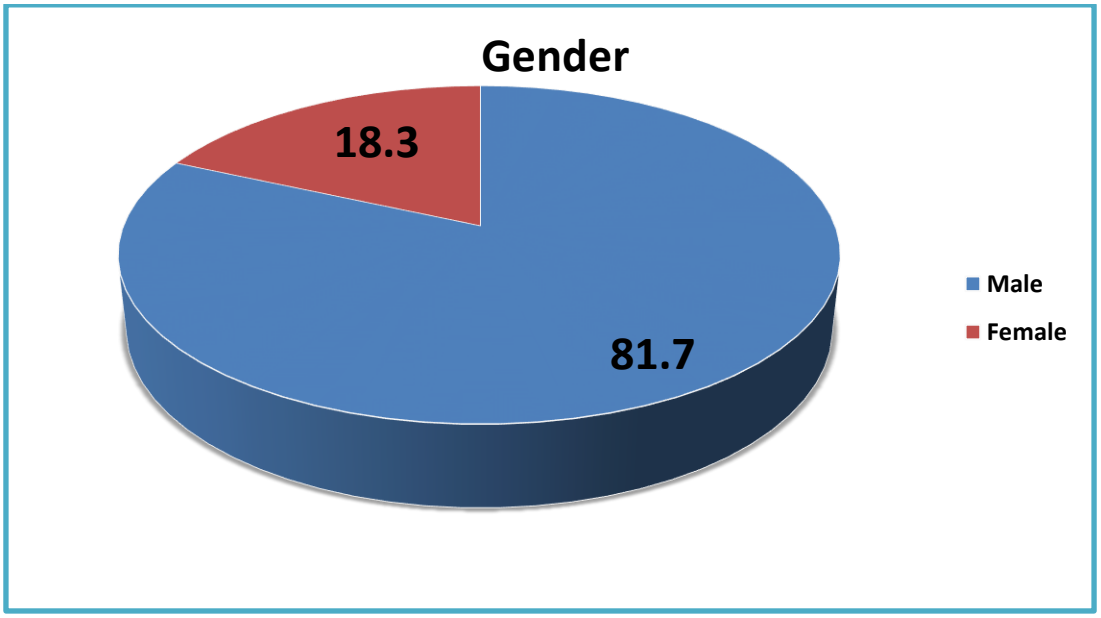

Figure: 4.2 Respondent's Gender

Findings from Table 4.3 and figure 4.2 revealed that majority of the respondents 42.1% were aged between 35-44 years, followed by 26.8% between 25-34 years, 22% between 45-54 years and 9.1% above 55 years. This shows that majority of the respondents are of young age group and are mature with appropriate work experience and therefore they are well versed with relevant information on supply chain management which is was needed for the study.

Table 4.3 Respondent's Age

Age	
Age	Percent
25- 34 Years	26.8
35- 44 Years	42.1
45- 54 Years	22.0
Above 55 Years	9.1
Total	100.0

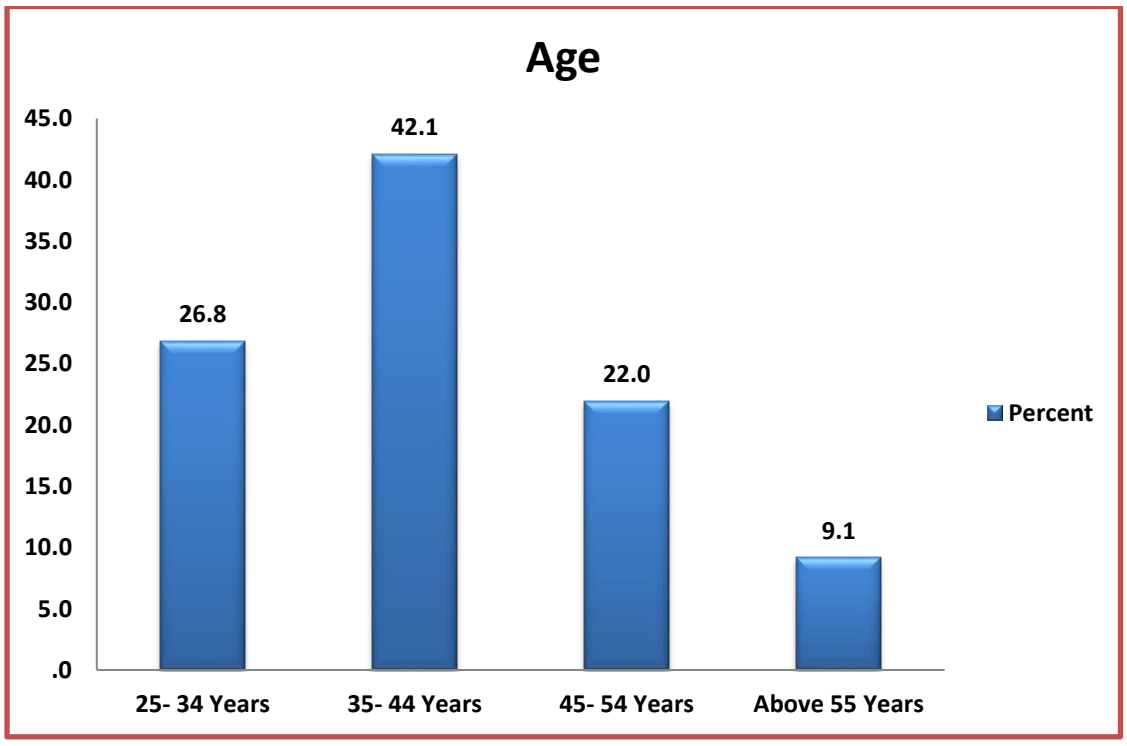

Figure 4.3 Respondent's Age

The Findings from Figure 4.3 reveal that majority of the respondents 32.3% working under different organizations dealing with medical device supply chain in healthcare organizations have an experience for about 6-10 years, while 28.0% have functioned for 11-15 years. This confirmed their accustomedness with activities done within their respective companies and was well conversant with the supply chain procedures. Hence was able to provide a clear picture regarding supply chain management practice implementation and how it affects their organizational performance and therefore the information collected from the respondents are correct and accurate as needed by the researcher for the study.

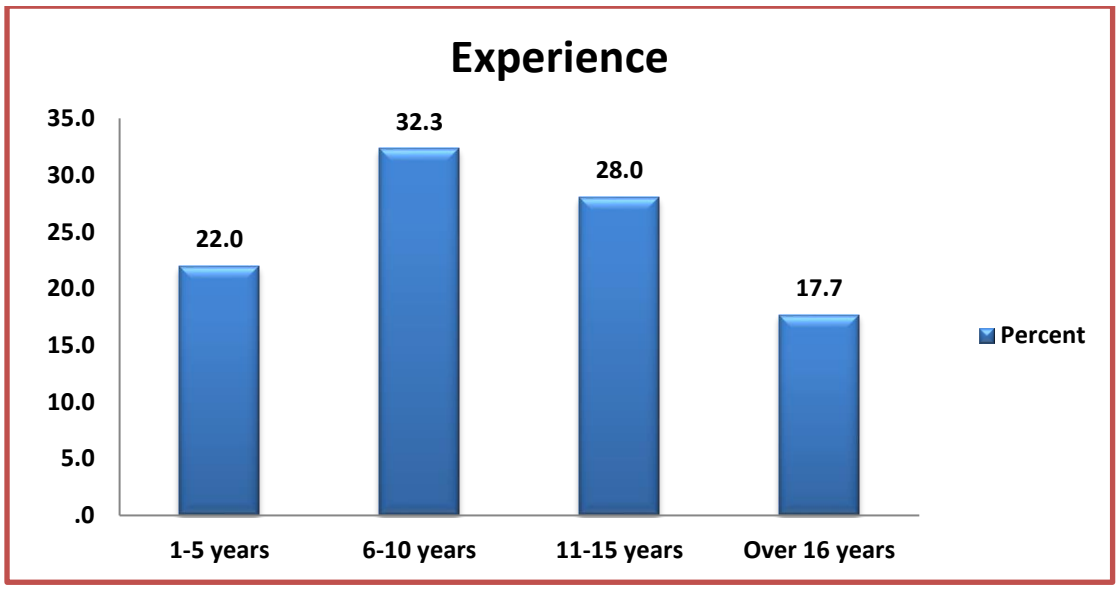

Figure: 4.4 Work experiences of the respondents

The major buddies of the supply chain of remedial equipment and devices in healthcare organization contain industrialists, providers, dealers, and customers. Industrialists are manufacturers that include medical operating products corporations, device builders, and constructors of capital equipment and material systems. Providers are purchasers that include assembled buying organizations (ABOs), medical-surgical traders, autonomous contracted wholesalers, and product representatives from manufacturers; Suppliers are providers that link between distributors and customers. Customers or the end users include hospitals, clinic, nursing homes, diagnostic centers

and systems of hospitals that actually use the equipment and devices for the benefit of patients.

Table 4.4 indicates that majority of the respondents (37.2%) were falling in the customer category, 18.9% in the manufacturer category, (23.8%) in the supplier category while (20.1%) respondents are under the category of medical equipment or devices manufacturer. Figure 4.4 shows a graphical representation of different stakeholders of medical device and equipment.

Table 4.4 Type of Respondents

Type of Supply Chain partner.		
Type of Supply Chain partner	Responses	Percent
Customer	61	37.2
Distributor	31	18.9
Manufacturer	33	20.1
Supplier	39	23.8
Total	164	100.0

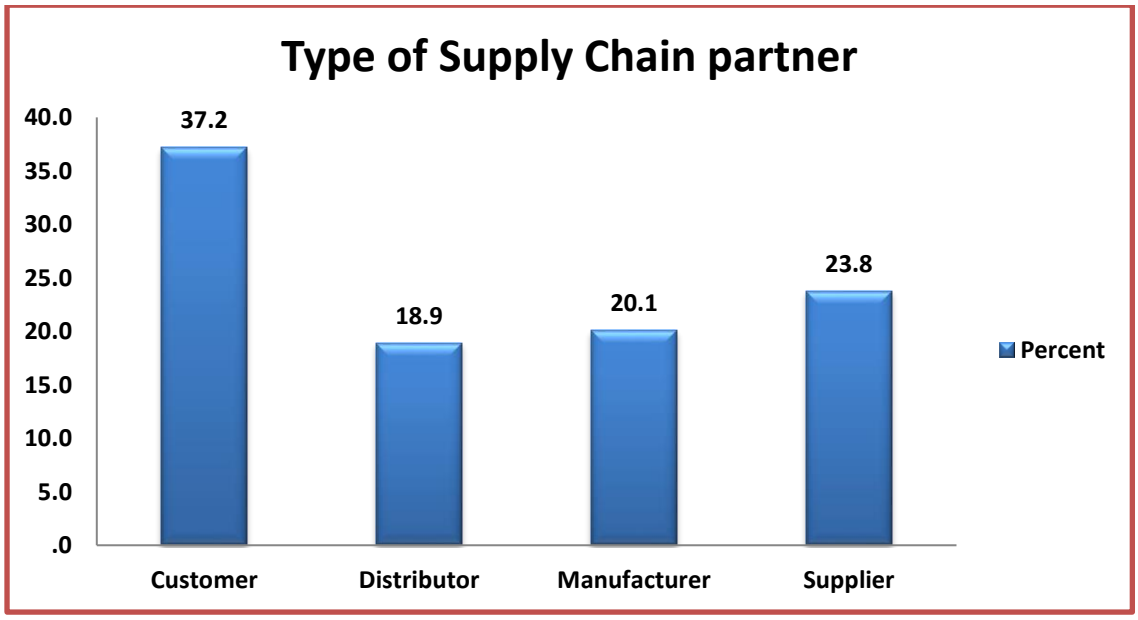

Figure: 4.5 Types of Respondents

4.5.2 Firm profile information

Some employees were used as a measure of firm size. From Small Productions Development Organization (SPDO) website explains small enterprises as enterprises, not more than 50 workers while medium enterprises employ between 51 and 100 people hence firms with more than 101 employees are regarded as large-scale enterprises. It is clear from the data Table: 4.5 and Figure: 4.5, that 45.7% respondents represented firms with less than 51 employees most of these are suppliers of medical devices and equipment distributors, 39.0% of respondents represented firms with number of employees lies between 51-500 employees these organizations include small manufacturers of surgical equipment, nursing homes, health centers, etc., while the remaining 15.3% respondents represented firms with more than 500 employees which includes big hospitals, big manufacturing units of precision machines, equipment, etc.

Table 4.5 Number of Employee in organization

No. of employees in the Organization	
No. of employees in the Organization	Percent
Less than 50	45.7
50-500	39.0
500-1000	4.9
more than 1000	10.4
Total	100.0

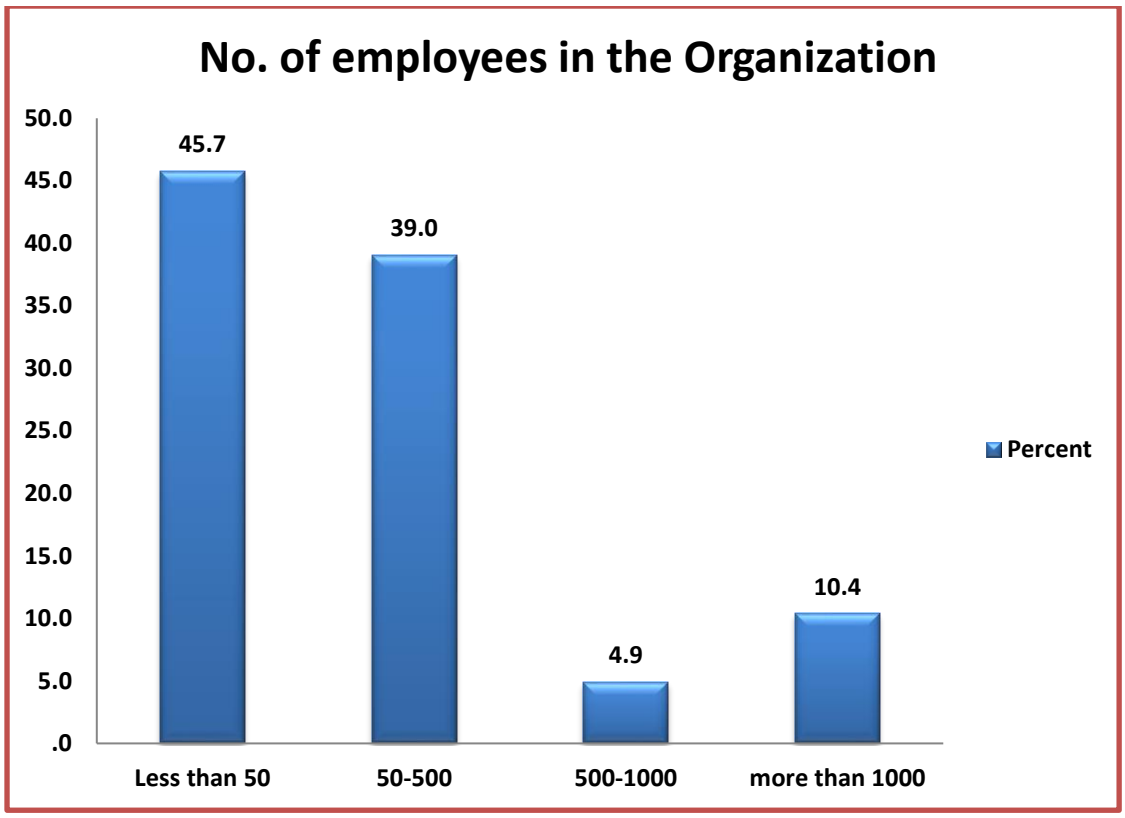

Figure: 4.6 No. of employees in the Organization

Table 4.6 shows that 47% of the respondents of different organization related to medical device supply chain say that they were not aware of different supply chain practices to measure Supply chain performance at all. The rest is using some supply chain practices to improve Supply chain Performance.

Table 4.6 Use of Supply Chain Practices in Organizations

Organization use Supply Chain Practices	
	Percent
Yes	53.0
No	47.0
Total	100.0

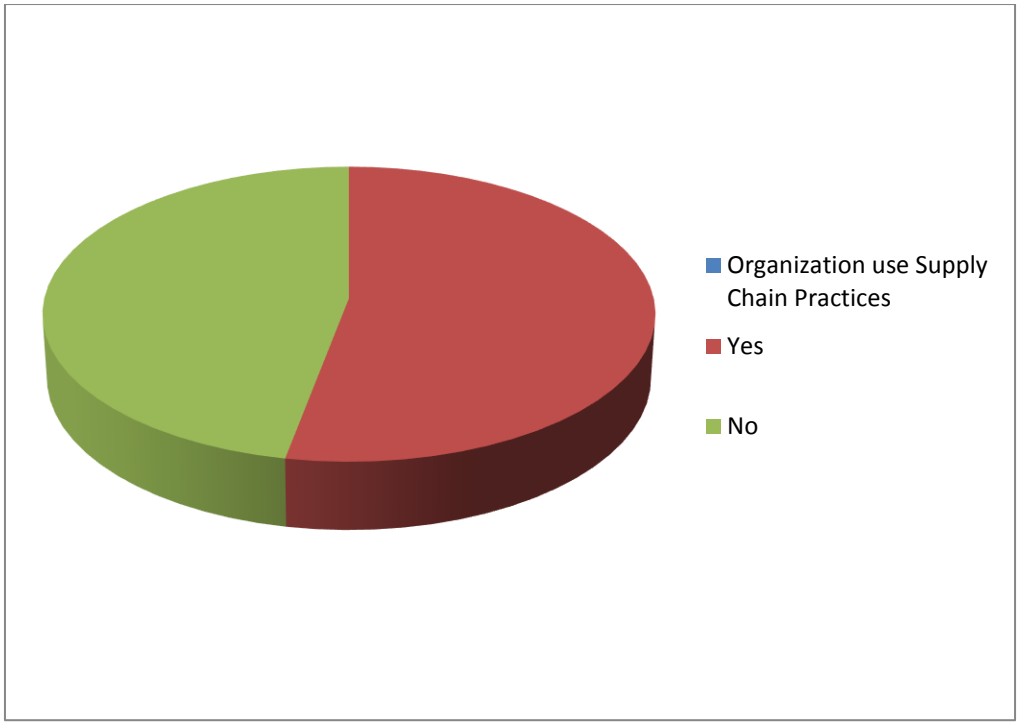

Figure: 4.7 Use of Supply Chain Practices in Organizations

4.6 DESCRIPTIVE ANALYSIS

Descriptive statistics are used to define the basic structures of the data in a study. They deliver simple reviews about the sample and the measures. This section basically analyses preliminary data for generating descriptive statistics whereby frequencies and percentages were used to present quantitative data in the form of tables and charts for a demographic description of respondents and firms. Also, calculation of arithmetic means and standard deviations was made to measure the extent of SCM practices implementation and organizational performance in the respective firms.

The contextual variables in this study were based on healthcare supply chain management practices, healthcare supply chain performance and healthcare organizational performance. The opinions of the respondents were sort of how the application of the healthcare supply chain practices affects the effectiveness of supply chain performance and structural performance of the healthcare industry. 16 healthcare SCM practices dimensions were investigated represented as SC, seven

healthcare supply chain performance dimensions represented as SCP and four healthcare supply chain organizational performances represented as OP. The survey was set on a five-point Likert scale arrangement. They could either strongly agree=5, agree=4, neutral =3 disagree =2 or strongly disagree = 1. The results were as shown in Table 4.7. It is noted from the Table 4.5.1 and Figure 4.5.1 that the supply chain practices are being used by all the stake holders of Indian healthcare industries with a mean value of **3.56** to improve the Organizational Performance

Table 4.7 Descriptive Statistics of Supply Chain Practices

Construct	Construct Description	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Mean	SD
Supply Chain Practices (SC)	Promotes small number of high quality suppliers.	SC1	0.00	2.44	31.10	39.63	26.83	100.00	3.91	0.82
	Establishes a long-term relationship with our suppliers.	SC2	3.05	9.15	20.73	32.93	34.15	100.00	3.86	1.08
	Top management is committed to supplying chain performance.	SC3	0.00	3.05	32.32	33.54	31.10	100.00	3.93	0.87
	Our company works for continuous commitment to providing high-quality products and services.	SC4	0.00	0.61	40.85	34.15	24.39	100.00	3.82	0.81
	Strives to maintain a high level of emergency supplies of	SC5	0.00	4.27	32.93	42.07	20.73	100.00	3.79	0.82

critical items.									
Improved information sharing with suppliers and customers.	SC6	11.59	37.20	29.88	19.51	1.83	100.00	2.63	0.99
Strive for eliminating duplicate processes and unnecessary procedures.	SC7	0.00	1.22	22.56	42.68	33.54	100.00	4.09	0.78
Keep track on actual and accurate inventory levels.	SC8	3.66	18.29	32.32	32.32	13.41	100.00	3.34	1.04
Top management is proactive and systematic in the supply chain management	SC9	0.00	0.61	41.46	34.15	23.78	100.00	3.81	0.80
Provides excellence in reducing the frequent use of inventory.	SC10	3.66	20.12	35.37	35.98	4.88	100.00	3.18	0.94
Emphasis on improving the utilization of available equipment and facilities	SC11	0.00	1.22	20.73	50.61	27.44	100.00	4.04	0.73
Promotes right product at the right time.	SC12	0.00	1.83	31.10	45.12	21.95	100.00	3.87	0.77
Our company and our key suppliers keep each other informed about events or	SC13	7.93	22.56	33.54	32.93	3.05	100.00	3.01	1.00

	changes related to financial, service design, strategy, research that may effect to our customers.									
	Forecast demand and provides this information to our key suppliers.	SC14	4.88	17.68	28.66	30.49	18.29	100.00	3.40	1.12
	Promotes little or no expediting.	SC15	7.32	19.51	25.00	32.32	15.85	100.00	3.30	1.17
	Promotes supplier to manage inventory on their behalf. (VMI system).	SC16	7.32	27.44	28.05	31.71	5.49	100.00	3.01	1.05
Supply Chain Performance (SCP)	Increased Overall product quality.	SCP1	0.61	7.32	19.51	38.41	34.15	100.00	3.98	0.94
	Increased Responsiveness to customer request.	SCP2	4.27	14.63	26.22	28.05	26.83	100.00	3.59	1.16
	Reduced Reliability in the delivery of materials.	SCP3	6.10	20.12	32.93	27.44	13.41	100.00	3.22	1.10
	Smaller Order fulfillment lead times.	SCP4	7.32	20.73	21.34	34.15	16.46	100.00	3.32	1.19
	Increased Flexibility of service to meet customer need.	SCP5	0.61	15.85	34.15	27.44	21.95	100.00	3.54	1.02
	Acceptance of strategic changes in the supply chain.	SCP6	0.61	19.51	26.22	34.15	19.51	100.00	3.52	1.04

	Improved Accessibility to product supply.	SCP7	0.00	11.59	30.49	37.20	20.73	100.00	3.67	0.93
Organizational Performance (OP)	Customer Satisfaction	OP1	3.05	6.71	20.73	35.98	33.54	100.00	3.90	1.04
	Return on investment	OP2	1.22	13.41	25.61	37.80	21.95	100.00	3.66	1.01
	Improved Resource Utilization	OP3	1.83	7.93	34.76	33.54	21.95	100.00	3.66	0.97
	Improved cost to service	OP4	1.22	7.32	20.73	42.68	28.05	100.00	3.89	0.94

Small number of high-quality suppliers (SC1)

Table 4.7 shows that about 27% of the respondents strongly agreed while about 40% of the respondents agreed with a mean value of **3.91** that only a few suppliers supplying quality products has an impact on the effective supply chain performance and finally to the organizational performance of any healthcare industry. Further, nobody toughly disagreed while only 2.44% of respondent disagree which is a negligible percent which shows that the small number of high-quality suppliers is an important practice for an efficient supply chain and organizational performance.

Long-term relationship with suppliers (SC2)

Table 4.7 shows that about 63% of the respondents (33% strongly agreed and 34% agreed) that **Long-term relationship with suppliers** has an impact on the efficient supply chain performance and finally to the organizational performance of any healthcare industry as good working relationships with suppliers will not only deliver cost savings; they will also reduce availability problems, delays, and quality issues. A longstanding bond between supplier and buyer agrees for the free-flow of response and thoughts which will make an efficient supply chain over the period.

Commitment to Supply Chain Performance (SC3)

Commitment is an important component of fruitful, strong relations that are a constituent of the implementation of Supply Chain Organization (Gundlach, Achrol, and Mentzer 1995). From the Table 4.7, it is clear that approximately 65% of the

respondent agrees about the importance of commitment to SCP. Whereas nobody strongly disagrees, and only 3.05% of respondent disagrees about the importance of senior level commitment. It is also suggested by (Toni and Kelvin, 2007) that human factor is meaningfully affecting the SCM usefulness and the role of top management is important in achieving organizational objectives in the supply chain (van Hock, 1998).

Continuous commitment to providing high-quality products and services (SC4)

The Table 4.7 shows that about 35% of the respondents agreed that continuous commitment is important for providing high-quality products and services in healthcare industry.

Maintaining high level of emergency supplies of critical items (SC5)

The Table 4.7 shows that about 25% of the respondents strongly agreed while about 35% of the respondents agreed that **Maintaining a high level of emergency supplies of critical items** has an impact on the efficient supply chain performance and finally to the organizational performance of any healthcare industry. Further, nobody strongly disagreed while only 0.61% of respondent disagree which is a negligible percent which shows that it is essential for an efficient supply chain to maintain emergency supplies efficiently as it improves customer satisfaction and thus improves organizational performance.

Improved Information sharing with suppliers (SC6)

Research has established that higher information sharing among supply chain partners, brings high transparency and thus higher trust. This leads to higher performance of the buyer-supplier network, but from the Table 4.7 indicates that only 1.83% of the respondents strongly agreed while only 19.51% respondents agree that information sharing has an impact supply chain performance. Whereas 11.83% respondents strongly disagreed. This means that information sharing does not have a strong impact on the effectiveness of supply chain performance.

Strive for eliminating duplicate processes and unnecessary procedures (SC7)

The Table 4.7 shows that about 34% of the respondents strongly agreed while about 43% of the respondents agreed that **elimination of duplicate processes and unnecessary procedures** have an impact on the efficient supply chain performance and finally to the organizational performance of any healthcare industry. Further, nobody strongly disagreed while only 1.22% of respondent disagree which shows that it is essential for an efficient supply chain to maintain emergency supplies efficiently as it improves customer satisfaction and thus improves organizational performance.

Keep track on actual and accurate inventory levels (SC8)

Data responses show that about 14% respondents strongly agreed that **track on actual and accurate inventory levels** has an impact on the efficient supply chain performance and finally to the organizational performance of any healthcare industry. However, 32% shows agreement that it is important to keep track of inventory level to improve supply chain performance.

Top management is proactive and systematic in the supply chain management (SC9)

The Table 4.7 shows that about 23% of the respondents strongly agreed while about 35% of the respondents agreed that **Proactive and systematic behavior of Top Management** has an impact on the effective supply chain performance and finally to the organizational performance of any healthcare industry. Further, nobody strongly disagreed which shows that it is essential for an efficient supply chain to maintain emergency supplies efficiently as it improves customer satisfaction and thus improves organizational performance.

Provides excellence in reducing frequent use of inventory (SC10)

The Table 4.7 shows that 35.98% of respondents agreed to the fact that healthcare industries must provide excellence in reducing frequent use of inventory so as to improve better supplier- customer relationship through improved product forecasting and supply.

Emphasis on improving the utilization of available equipment and facilities (SC11)

It is clearly depicted from the Table 4.7 that 50.61% of respondents agreed that their organization strictly emphasize on maximum utilization of available equipment and facilities as it will help in improving supply chain performance and organizational performance by providing right product at right time.

Promotes right product at right time (SC12)

Data responses show that about 45.21% respondents agreed that it is important to **promote right product at right time** to make the healthcare supply chain efficient.

Our key suppliers keep each other informed about events or changes related to financial, service design, strategy, research (SC13)

The Table 4.7 shows that about 35.98% of the respondents agreed that by keeping **key suppliers informed about events or changes related to financial, service design, strategy, research** the effectiveness of healthcare supply chain can be improved as 32.93% respondents agreed the fact that this has an impact on the effective supply chain performance, whereas, 22.56% respondents shows disagreement to the fact.

Provide forecast demand information to key suppliers (SC14)

The Table 4.7 shows that about 30.49% of the respondents agreed to the fact that **proper information sharing of accurate demand forecast** has positive impact on the efficient supply chain performance and will in turn effect on Organizational Performance.

Promotes little or no expediting (SC15)

The Table 4.7 shows that about 30.49% of the respondents agreed to the fact that it is important to have quality products at right time at right place to improve customer satisfaction that will improve Organizational Performance.

Promotes supplier to manage inventory system (VMI) (SC16)

The Table 4.7 shows that majority of respondents either strongly agree or agree to the concept of Vendor Managed Inventory for better customer satisfaction that will improve Organizational Performance.

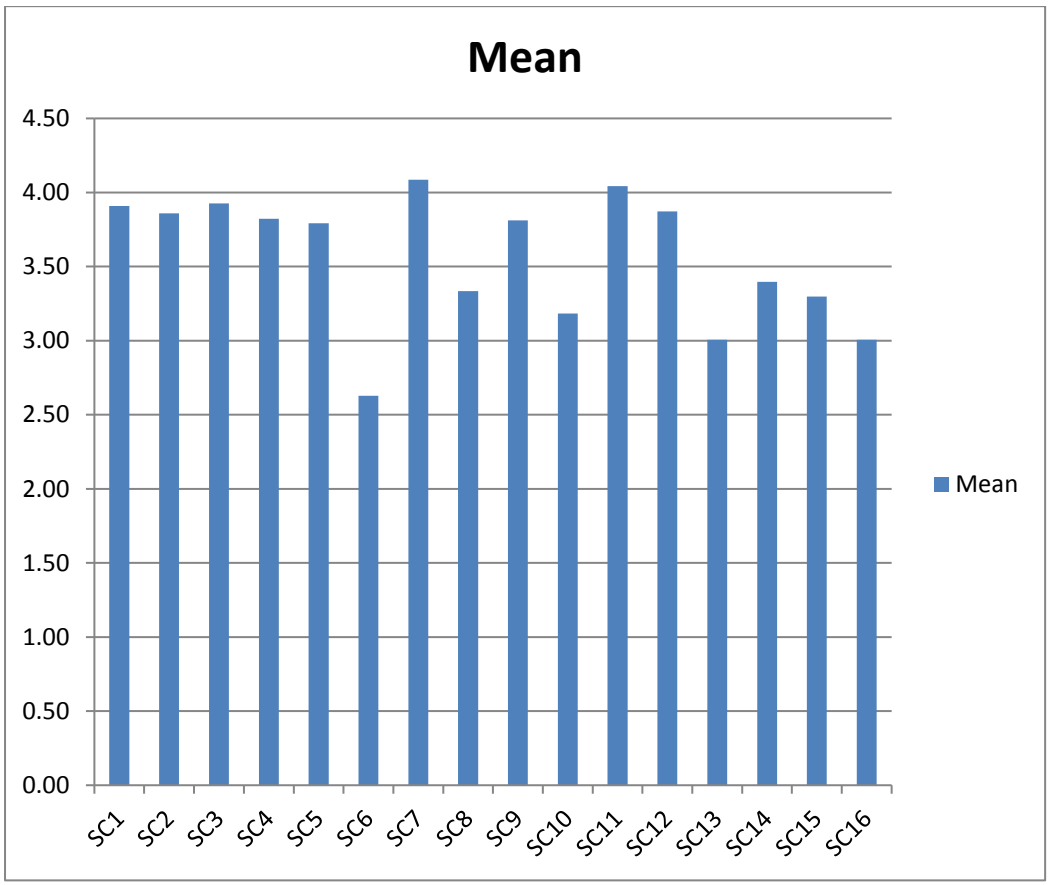

Figure: 4.8 Mean scores of supply chain practices

According to the results on Table 4.7 and Figure 4.7 above, SC7 scored the highest mean at 4.09, followed by SC11 at a mean of 4.04, SC3 at mean of 3.93, SC1 at mean of 3.91 and SC2 at mean of 3.82, whereas SC6 scored poorest at mean of 2.63. This means that stakeholders of healthcare industries are more conscious about eliminating duplicate processes and unnecessary procedures as compared to other supply chain practices.

Table 4.8 Descriptive Statistics of Supply Chain Performance

Construct	Construct Description	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Mean	SD
Supply Chain Performance (SCP)	Increased Overall product quality.	SCP1	0.61	7.32	19.51	38.41	34.15	100	3.98	0.94
	Increased Responsiveness to customer request.	SCP2	4.27	14.63	26.22	28.05	26.83	100	3.59	1.16
	Reduced Reliability in the delivery of materials.	SCP3	6.1	20.12	32.93	27.44	13.41	100	3.22	1.1
	Smaller Order fulfillment lead times.	SCP4	7.32	20.73	21.34	34.15	16.46	100	3.32	1.19
	Increased Flexibility of service to meet customer need.	SCP5	0.61	15.85	34.15	27.44	21.95	100	**3.54**	1.02
	Acceptance of strategic changes in the supply chain.	SCP6	0.61	19.51	26.22	34.15	19.51	100	3.52	1.04
	Improved Accessibility to product supply.	SCP7	0	11.59	30.49	37.2	20.73	100	3.67	0.93

Again from the Table 4.8 and Figure 4.8 it is clear that the overall mean of the dependent variable is **3.54** which shows that all the stakeholders agree to the effectiveness of supply chain performance depends on the supply chain practices dependent variable. Further, SCP1 scored the highest mean value of 3.98 which shows that overall product quality is a primary concern for healthcare performance.

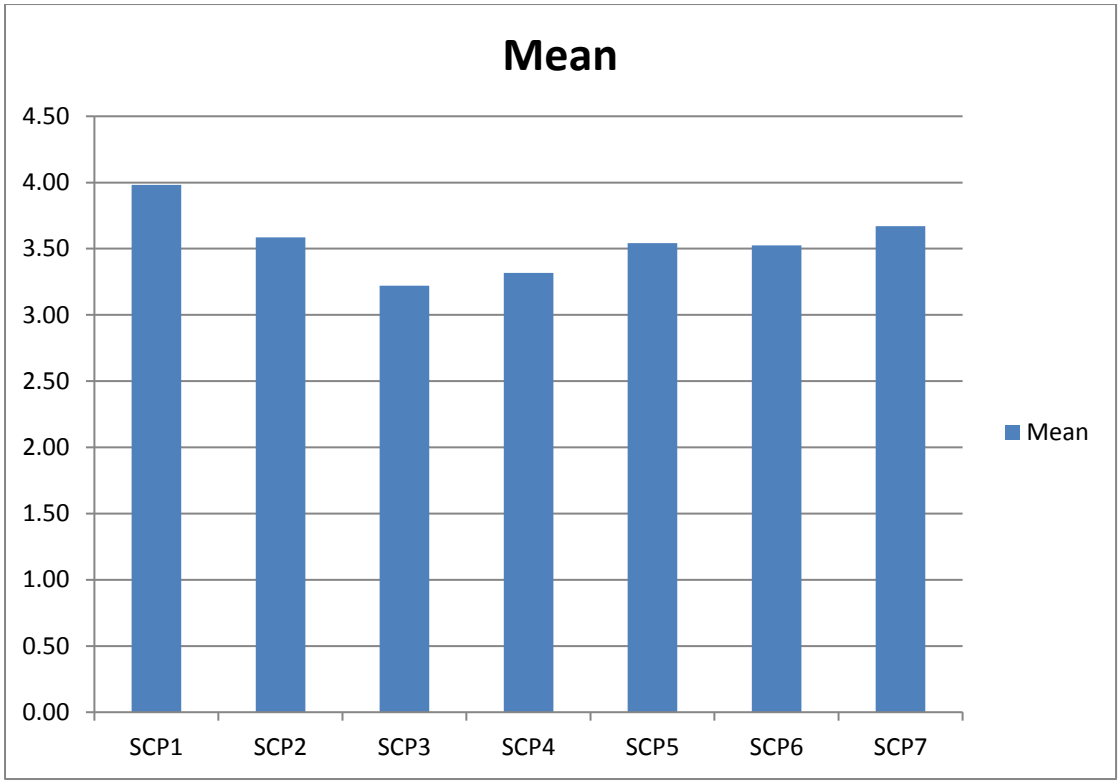

Figure: 4.9 Mean scores of supply chain performance

Table 4.9 Descriptive Statistics of Organizational Performance

Construct	Construct Description	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	Total	Mean	SD
Organizational Performance (OP)	Customer Satisfaction	OP1	3.05	6.71	20.73	35.98	33.54	100	3.9	1.04
	Return on investment	OP2	1.22	13.41	25.61	37.8	21.95	100	3.66	1.01
	Improved Resource Utilization	OP3	1.83	7.93	34.76	33.54	21.95	100	3.66	0.97
	Improved cost to service	OP4	1.22	7.32	20.73	42.68	28.05	100	3.89	0.94

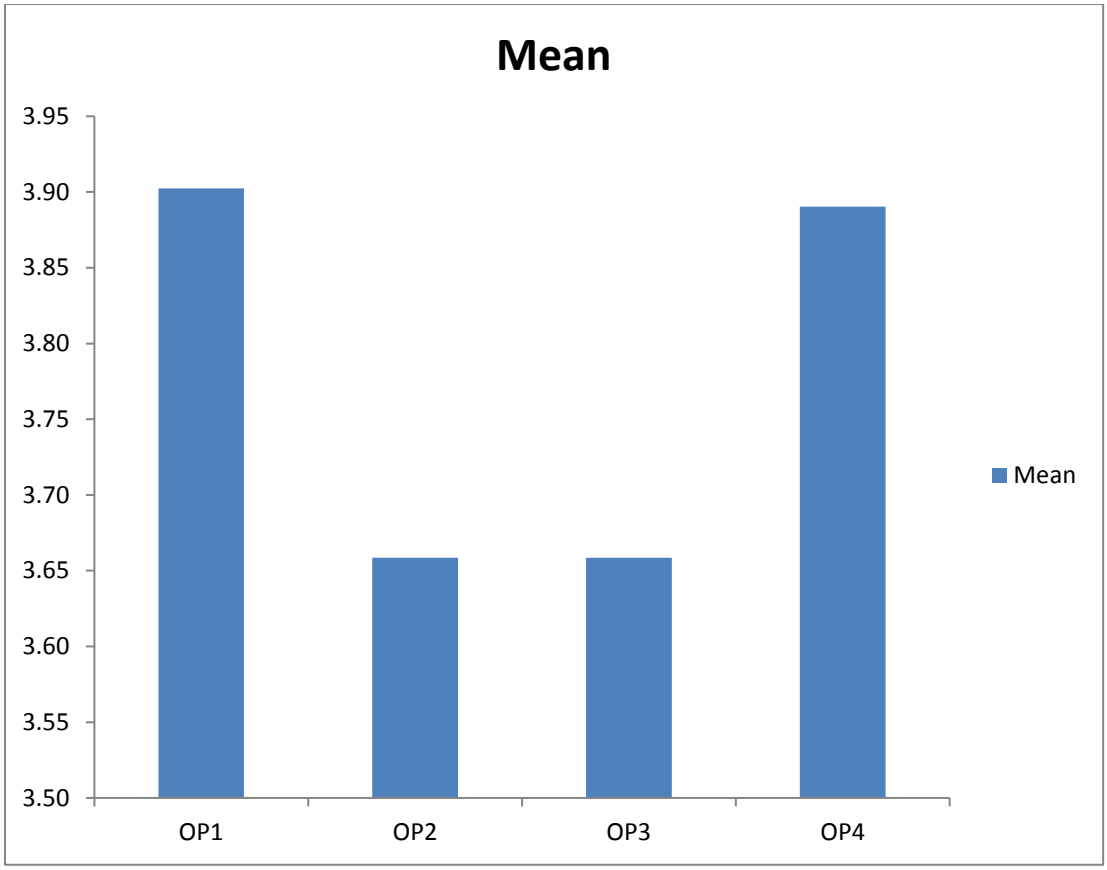

Figure: 4.10 Mean scores of Organizational Performance

From the Table 4.9 and Figure 4.9, it is clear that the overall mean of the dependent variable Organizational Performance is **3.7** which shows that all the stakeholders agree that the Organizational performance of healthcare industry depends on supply chain practices. Further, OP1 scored the highest mean value of 3.89 which shows that customer satisfaction is a major concern for healthcare performance.

4.7 RELATIONSHIP BETWEEN SUPPLY CHAIN

Chi-square analysis shows a significant association between supply chain practices clusters with different groups of respondent categorizes based on the type of organization, nature of supply chain partner, number of employees, year of experience, type of business organization, familiar with performance measurement system. The forthcoming sections shall discuss at length, the relationship between the clusters formed based on supply chain practices.

4.7.1 Association between supply chain partner and familiarity with performance measurement system

Table 4.10 Association between type of Supply chain partner and familiarity with performance measurement system

Familiarity with performance measurement system				
		Does your Organization use Supply chain Performance Measurement System?		Total
		Yes	No	
Type of Supply Chain partner.	Customer	40	21	61
		24.39%	12.80%	37.20%
	Distributor	13	18	31
		7.93%	10.98%	18.90%
	Manufacturer	24	9	33
		14.63%	5.49%	20.12%
	Supplier	10	29	39
		6.10%	17.68%	23.78%
Total		87	77	164
		53.05%	46.95%	100.00%

Table 4.11 Chi-square test results for Association between type of Supply chain partner and familiarity with supply chain performance

Chi-Square Tests			
	Value	Degree of freedom	Significance
Pearson Chi-Square	22.272	3	.000
N of valid cases	164		

It is evident from the Table 4.10 that overall 53.04% of the supply chain partner is familiar with supply chain performance in healthcare supply chain. To investigate the relationship chi-square test has been carried out and it is clear from the result that the relation between the type of supply chain partner and the familiarity of performance measurement is significant. Thus healthcare supply chain partners are conscious about supply chain performance.

4.8 FACTOR ANALYSIS FOR EXTRACTION OF RESEARCH CONSTRUCTS

4.8.1 Research constructs for Supply chain practices

Factor Analysis (FA) enables to tell which group of distinct items measures a specific construct (reasonably impartial from other items). In other words, items that are sufficiently correlated with other items, but at the same time are distinct from each other, are grouped into one factor. This test aims to describe a set of variables in a smaller quantity of hypothesized variables. Therefore, in this research factor analysis is done to identify the research constructs related to supply chain practices, supply chain performance, and organizational performance.

In this study, factor analysis was first carried out on the 16 items from the construct supply chain practices. Before performing factor analysis, the suitability of data was also assessed for sample adequacy through Kaiser-Mayer-Olkin (KMO) measures and Bartlett's test of sphericity. Field (2009), recommends that the value of KMO quantity should be 0.60 or higher for factor examination. As shown in the Table: 4.12 the KMO measure of selection adequacy reported is 0.698. In this study Bartlett's test of sphericity was significant (0.000) thus, rejects to null hypotheses that correlation matrix is relative to an identity matrix and the data is appropriate for factor examination.

Table 4.12 KMO & Bartlett's test for SC

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.698
Bartlett's Test of Sphericity	Approx. Chi-Square	2548.577
	Degree of freedom	120
	Significance	.000

Further, the principal component analysis (PCA) with varimax rotation was carried out on the 16 items. It was argued in the chapter that, varimax rotation maximized the extent of variance explained by the factors. It further minimizes the correlation amongst the factors as well. Communality values reported being above the 0.50 benchmark set. PCA resulted in a simple structure with four factors, which explained 76.70% of the total variance. This was also confirmed by the eigen value criteria illustrated in the figure, in which only components with eigenvalues exceeding 1.00 were extracted.

4.8.2 Eigenvalue

As explained, PCA identifies the linear relationships amongst variables in a covariance matrix. Mathematically, the PCA of the correlation matrix produces orthonormal "eigenvalues" for the space of the experiential data. Eigenvalues are the sum of the square values of aspect loadings relating to aspects. The highest eigenvalues characterize the principal components with the highest covariability between the experiential data. Whereas the low Eigenvalue represents that the factor has little relation with the variables and may be ignored. Based on this approach factors having Eigenvalues greater than one were selected for common factors.

4.8.3 Data Rotation and Factor Loading

Rotation is used to maximize high item loadings on factors and reduce low loadings, to generate an interpretable and simplified factor explanation. The two common rotation methods used by academics are orthogonal rotation and oblique rotation. Orthogonal varimax rotation creates uncorrelated aspect structures, while oblique rotation creates aspects that are correlated (Kline, 2005). According to (Hair et al., 2006) the items with factor loading greater than 0.4 were acceptable for further analysis.

Table 4.13 Varimax Rotation for Supply Chain Practices

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.021	31.380	31.380	5.021	31.380	31.380	3.473	21.706	21.706
2	3.161	19.755	51.135	3.161	19.755	51.135	3.108	19.425	41.132
3	2.222	13.887	65.022	2.222	13.887	65.022	2.942	18.385	59.517
4	1.869	11.681	76.702	1.869	11.681	76.702	2.750	17.186	76.702
5	.881	5.504	82.207						
6	.619	3.868	86.075						
7	.476	2.973	89.048						
8	.439	2.744	91.791						
9	.418	2.612	94.403						
10	.310	1.940	96.343						
11	.220	1.376	97.719						
12	.163	1.017	98.736						
13	.099	.618	99.354						
14	.053	.332	99.686						
15	.037	.234	99.920						
16	.013	.080	100.000						

Further on an inspection of the scree plot (Figure: 4.10) revealed a break after the fourth component. This further confirms that a four-factor structure could best explain the conceptual framework under investigation.

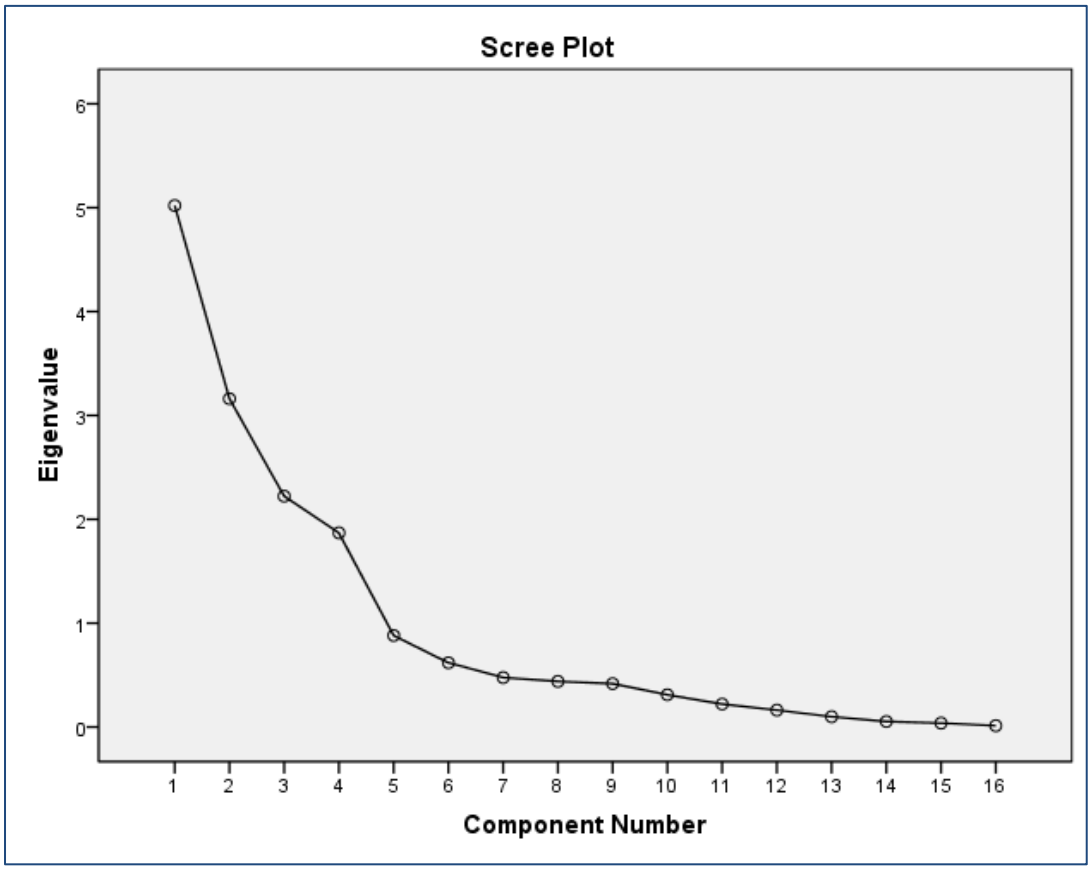

Figure 4.11 Scree Plot for SC

Table 4.14 Varimax factor rotated component matrix for supply chain practices

Item no.	Questionnaire	SCF1-SI	SCF2 TMC	SCF3-LP	SCF4-IV
SC6	Acceptance of strategic changes in the supply chain.	0.89			
SC13	Our company and our key suppliers keep each other informed	0.967			
SC15	Promotes little or no expediting.	0.908			
SC16	Promotes supplier to manage inventory on their behalf. (VMI system).	0.929			
SC1	Promotes small number of high quality suppliers.		0.476		
SC2	Establishes a long-term relationship with our suppliers.		0.675		
SC3	Top management is committed to supplying chain performance.		0.743		
SC4	Our company works for continuous commitment to providing high-quality products and services.		0.915		
SC9	Top management is proactive and systematic in the supply chain management		0.919		
SC5	Strives to maintain a high level of emergency supplies of critical items.			0.847	
SC7	Strive for eliminating duplicate processes and unnecessary procedures			0.863	
SC11	Emphasis on improving the utilization of available equipment and facilities			0.803	
SC12	Promotes right product at the right time.			0.798	
SC8	Keep track on actual and accurate inventory levels.				0.937
SC10	Provides excellence in reducing the frequent use of inventory.				0.91
SC14	Forecast demand and provides this information to our key suppliers.				0.94
	Eigenvalue	3.473	3.108	2.942	2.75
	% of variance	21.706	19.425	18.385	17.186
	Cumulative % of variance	21.706	41.132	59.517	76.702

Table 4.14 illustrates the factor loadings based on the rotated component matrix for each component of supply chain practices; only factor loadings of above 0.4 are reported with no cross loading of factors. The rotated component matrix under this study illustrates a four-factor solution.

Since the Table 4.14 shows that supply chain practices SC 1, 2,3,4,9 are loaded on one single factor thus combining these practices a new construct *Top management commitment* has been formed, again since supply chain practices SC 6,13,15,16 are loaded on one single factor thus combining these practices a new construct *Supplier Integration* has been formed, Further supply chain practices SC 5, 7, 11, 12 are loaded on one single factor thus combining these practices a new construct *Lean Practices* has been formed and from supply chain practices SC 8,10,14 formed *Inventory Visibility* as a new construct. Thus the conceptual model for supply chain practices have **four factors namely SCF1- *Supplier Integration (SI), SCF2- Top management commitment (TMC), SCF3- Lean Practices (LP) and SCF4- Inventory Visibility (IV)***

4.8.4 Research constructs for Supply chain performance

Further, in this study aspect examination was carried out on the seven objects from the construct supply chain presentation. Before execution factor analysis, the appropriateness of data was also considered for sample suitability through Kaiser-Mayer-Olkin (KMO) measures and Bartlett's test of sphericity. Field (2009), recommends that the value of KMO measure should be 0.60 or higher for factor analysis. As shown in the Table: 4.15 the KMO measure of sampling adequacy reported is 0.870. In this study Bartlett's test of sphericity was significant (0.000) thus, rejects to null hypotheses that correlation matrix is proportional to an identity matrix and the data is suitable for factor analysis.

Table 4.15 KMO & Bartlett's test for SCP

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.870
Bartlett's Test of Sphericity	Approx. Chi-Square	402.911
	df	21
	Sig.	.000

Further, the principal element analysis (PEA) with varimax rotation was carried out on the seven objects. It was argued in the chapter that, varimax rotation maximized the extent of variance explained by the factors. It further minimizes the correlation amongst the factors as well. Communality values reported being above the 0.50 benchmark set. PCA resulted in a simple structure with only one factor, which explained 51.522% of the total variance. It was also confirmed by the eigenvalue criteria illustrated in the Table: 4.16, in which only components with eigenvalues exceeding 1.00 were extracted.

4.8.5 Data Rotation and Factor Loading

Rotation is used to maximize high item loadings on factors and reduce low loadings, to generate an interpretable and simplified factor explanation. The two common rotation techniques used by academics are orthogonal rotation and oblique rotation. Orthogonal varimax rotation creates uncorrelated factor constructions, while oblique rotation creates elements that are correlated (Kline, 2005). According to (Hair et al., 2006) the items with factor loading greater than 0.4 were acceptable for further analysis.

Table 4.16 Varimax Rotation for Supply Chain Performance

Total Variance Explained							
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	3.607	51.522	51.522	3.607	51.522	51.522
	2	.943	13.474	64.995			
	3	.672	9.599	74.595			
	4	.573	8.190	82.784			
	5	.478	6.830	89.614			
	6	.425	6.074	95.688			
	7	.302	4.312	100.000			

Further on an inspection of the scree plot (Figure: 4.12) revealed a break after the first component. This further confirms that a single factor structure could best explain the conceptual framework under investigation.

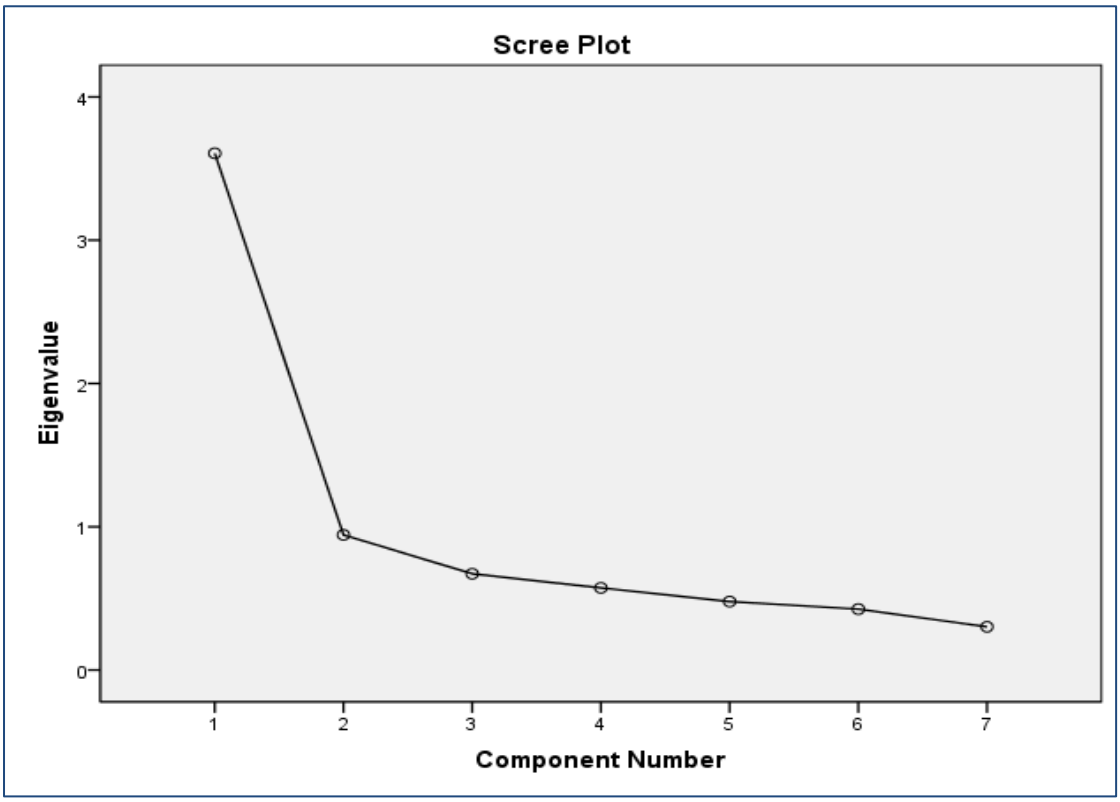

Figure 4.12 Scree Plot for SCP

Table 4.17 Varimax factor rotated component matrix for supply chain performance

Item no.	Questionnaire	Component SCP
SCP1	Increased Overall product quality.	0.74
SCP2	Increased Responsiveness to customer request.	0.76
SCP3	Reduced Reliability in the delivery of materials.	0.32
SCP4	Smaller Order fulfillment lead times.	0.75
SCP5	Increased Flexibility of service to meet customer need.	0.85
SCP6	Acceptance of strategic changes in the supply chain.	0.69
SCP7	Improved Accessibility to product supply.	0.76
	Eigenvalue	3.6
	% of variance	51.52
	Cumulative % of variance	51.52

Table: 4.16 exemplifies the factor loadings constructed on the rotated element matrix for each element of supply chain practices; only factor loadings of above 0.4 are

reported with no cross loading of factors. The rotated component matrix under this study illustrates a single factor solution.

Since the Table: 4.17 shows that supply chain performance SCP 1 to SCP 7 are loaded on one single factor thus combining these practices a new construct Supply Chain Performance has been formed.

4.8.6 Research Constructs for Organizational Performance

Further, in this study factor analysis was carried out on the four items from the construct organizational performance. Before performing factor analysis, the suitability of data was also assessed for sample adequacy through Kaiser-Mayer-Olkin (KMO) measures and Bartlett's test of sphericity. Field (2009), recommends that the value of KMO measure should be 0.60 or higher for factor analysis. As shown in the figure the KMO measure of sampling adequacy reported is 0.685. In this study Bartlett's test of sphericity was significant (0.000) thus, rejects to null hypotheses that correlation matrix is proportional to an identity matrix and the data is suitable for factor analysis.

Table 4.18 KMO & Bartlett's test for OP

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.685
Bartlett's Test of Sphericity	Approx. Chi-Square	130.968
	df	6
	Sig.	.000

Further, the principle component analysis (PCA) with varimax rotation was carried out on the seven items. It was argued in the chapter that, varimax rotation maximized the extent of variance explained by the factors. It further minimizes the correlation

amongst the factors as well. Communality values reported being above the 0.50 benchmark set. PCA resulted in a simple structure with one factor, which explained 52.012% of the total variance. It was also confirmed by the eigenvalue criteria illustrated in the figure, in which only components with eigenvalues exceeding 1.00 were extracted.

4.8.7 Data Rotation and Factor Loading

Rotation is used to maximize high item loadings on factors and reduce low loadings, to generate an interpretable and simplified factor solution. The two common rotation techniques used by researchers are orthogonal rotation and oblique rotation. Orthogonal varimax rotation produces uncorrelated factor structures, while oblique rotation produces factors that are correlated (Kline, 2005). According to (Hair et al., 2006) the items with factor loading greater than 0.4 were acceptable for further analysis.

Table 4.19 Total Variance Explained (PCA with Varimax Rotation) for OP

Total Variance Explained							
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
	1	2.080	52.012	52.012	2.080	52.012	52.012
	2	.954	23.854	75.867			
	3	.582	14.546	90.413			
	4	.383	9.587	100.000			

Further on an inspection of the scree plot (Figure: 4.13) break after the first component. This further confirms that a single factor structure could best explain the conceptual framework under investigation.

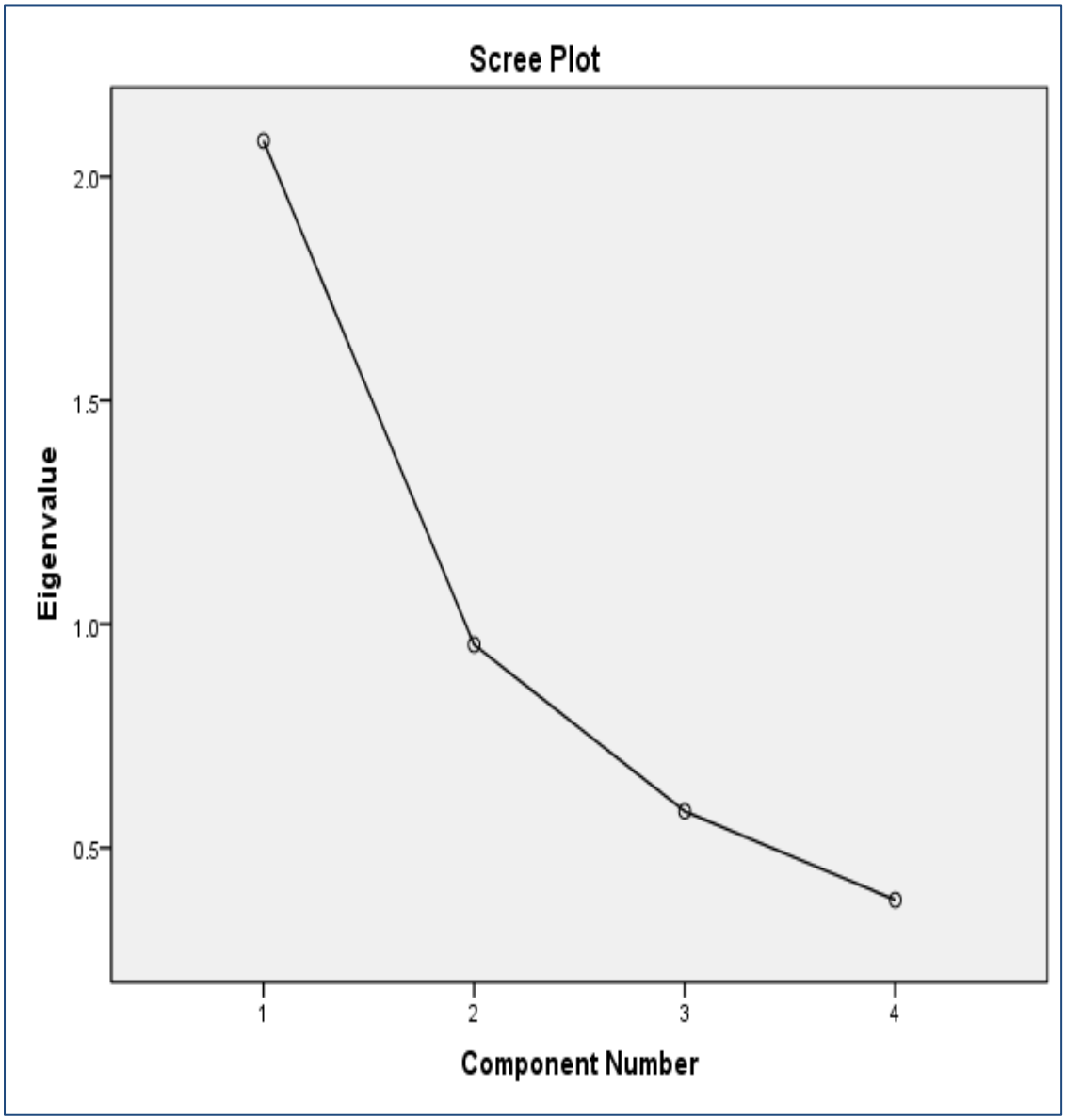

Figure 4.13 Scree Plot for OP

Table 4.20 Varimax factor rotated component matrix for Organizational Performance

Item no.	Questionnaire	Component SCP
OP1	Customer Satisfaction	.828
OP2	Return on investment	.763
OP3	Improved Resource Utilization	.852
OP4	Improved cost of service	.294
	Eigenvalue	2.080
	% of variance	52.012

Table 4.20 illustrates the factor loadings based on the rotated component matrix for each component of supply chain practices; only factor loadings of above 0.4 are reported with no cross loading of factors. The rotated component matrix under this study illustrates a single factor solution.

Since the Table 4.20 shows that supply chain performance OP 1 to OP 4 is loaded on one single factor thus combining these practices a new construct ***Organizational Performance*** has been formed.

4.9 DESCRIPTIVE ANALYSIS OF FACTORS

Table 4.21 Descriptive Analysis of Supply Chain Factors

Descriptive		
Factors/Variables	**Mean**	**SD**
SCF1(Supplier Integration)	3.86	.68
SCF2 (Top Management Commitment)	3.94	.65
SCF3(Lean practices)	2.98	.97
SCF4(Inventory Visibility)	3.30	.97
SCPF(Supply chain performance)	3.54	.74
OPF(Organizational Performance	3.77	.69

Table 4.21, shows the means of the four variables of SC practices. The correlation coefficient among the variables revealed that the Indian healthcare industry emphasized more on Top management commitment (mean=3.94), followed by Supplier Integration (mean=3.86). The mean of all the four variables is 3.52 concluded that Indian healthcare industry strongly practiced SC practices towards their performance.

Further, the mean for Organizational performance 3.77, indicated that the Indian healthcare industry was concern about their Organizational performance through SCM practices. Further, the correlation matrix table shows the relationship between the organization performance and SC practices along with the mediating effect of supply chain performance mean 3.54.

4.10 CORRELATION RESULTS FOR HEALTH CARE INDUSTRY IN INDIA

The correlation analysis was carried out between the variables of the study using Pearson correlation coefficient. It was to test whether independent variables were interdependent and also to examine if there exists a significant relationship between the independent variables (Top Management commitment, Supplier Integration, Lean Practices and Inventory Visibility) and the dependent variable that is Healthcare Supply chain performance and Healthcare Organizational Performance.

4.10.1 Test of Multicollinearity of Independent Variables

Table 4.22: Correlation Matrix of Independent variables

Correlations									
			Mean	SCF1	SCF2	SCF3	SCF4	SCPF	OPF
Spearman's rho	SCF1	Correlation Coefficient	3.86	1					
	SCF2		3.94	0.4**	1				
	SCF3		2.98	0.163**	0.137**	1			
	SCF4		3.3	0.309**	0.27**	0.146**	1		
	SCPF		3.54	0.666**	0.408**	0.371**	0.316**	1	
	OPF		3.77	0.624**	0.307**	0.209**	0.301**	0.715**	1

**Correlation is significant at the 0.01 level (2-tailed), Sig= .000, N=164

According to (Norusis, 2009) When there is multicollinearity among independent variables, the analysis cannot distinguish the effects of one variable over the other. A general rule of thumb is that correlations between the free variables should be a lesser amount of 0.70 to remove the difficulties in regression analysis (Lind *et al.*, 2011). From Table 4.22, the correlation among variables is less than $r < 0.6$, and hence the problem of multicollinearity was minimized.

From the table 4.22 the correlation analysis is performed to check the association between supply chain practices and the moderating effect of supply chain performance and the following inference can be made:

- The Spearman's correlation coefficient between Supply Chain Management practice F1 ***Supplier Integration (SI)*** and the supply chain performance is ($r = 0.666$, $p < 0.01$); this shows that the correlation between Supply Chain Management practice F1 ***Supplier Integration (SI) and*** the supply chain performance of Healthcare industry in India are positive.

- Supply Chain practice as ***Top Management Commitment (TMC)*** F2 and the supply chain performance of Healthcare industry in India ($r = 0.408$, $p < 0.01$);

This outcome indicates that here is a moderate, constructive relationship among Top management commitment and supply chain performance

- ***Lean Practices (LP) F3*** and the supply chain performance of Healthcare industry in India are positively correlated with Spearman's correlation coefficient (r =0.371, $p < 0.01$).

- Lastly, the correlation between ***Inventory Visibility (IV)*** practice F4 and the supply chain performance of Healthcare industry in India are positively correlated with (r =0.316, $p < 0.01$).

Further, a correlation analysis was run as shown in the Table 4.22 to predict the relationship between supply chain practices and the performance of Healthcare industry in India regarding customer satisfaction along with the moderating result of supply chain performance. The analysis revealed that there is a significant and a moderate positive correlation between Supply Chain practice as ***Top Management Commitment (TMC)*** F2 and the performance of Healthcare industry in India (r =0.624, $p < 0.01$). Supply Chain Management practice F1 ***Supplier Integration (SI)*** and the performance of Healthcare industry in India regarding Customer satisfaction are positively correlated with (r =0.307, $p < 0.01$). Also (Tracey and Tan, 2001) in his learning highlighted that supplier incorporation relates to the customer fulfillment level and firm's performance.

Lean Practices (LP) ***F***3 and the performance of Healthcare industry in India regarding Customer satisfaction are positively correlated (r =0.279, $p < 0.01$). Lastly, the correlation between ***Inventory Visibility (IV)*** practice F4 and the performance of Healthcare industry in India regarding Customer satisfaction is significant and a moderate positive with (r =0.301, $p < 0.01$).

As suggested by (Lee.D., 2015; Berberoglu, A. et.al., 2015; Yusuf et al., 2014) Correlation coefficient reveals that there is positive link between the four supply chain practices with supply chain performance with SI (t= 11.364, 162), TMC (t= 5.688, df =162), LP (t= 5.085, df=162), IV (t= 4.239, df= 162). Further, it is observed that there is a significant positive correlation between supply chain practices and organizational performance with a value of r=0.624 and the correlation results also shows a strong

positive relation between supply chain performance and organizational performance with R value=0.715. The Positive results thus pointed out the mediating effect of supply chain performance showing that as the level of supply chain practices increases, the level of organizational performance also increases with a significant increase in supply chain performance. As the level of supply chain performance decreases, the level of organizational performance also decreases with the decrease in supply chain performance.

4.11 REGRESSION ANALYSIS

To recognize the nature of the association between supply chain practices and organizational concert with supply chain performance as mediating effect. Supply chain practices and SCP are considered as the independent variable and organizational performance as the dependent variable, as stated in hypothesis for the study. Multiple Linear Regression tests were applied to the collected data. Multiple regression analysis is used for predicting the percentage of the total variation of a continuous dependent variable by the independent variables and this is assessed using the coefficient of determination (R^2) which is used for judging the explanatory power of the linear regression of dependent variable on independent variables. The regression coefficient shows the precision and measures the ability of the model to explain the variation in the dependent variable. R^2 is a measure of the goodness of fit of the regression line to the observed sample values of dependent and independent variables. The R2 can range from 0.0 to 1.0, with 1.0 showing a perfect fit that indicates that each point is on the line (Carver et al., 2009). The larger the R^2, the improved the model clarifies the difference in the reliant variable.

Adjusted R Square (R^2) adjusts the worth of R^2 when the example size is small since the estimation of R^2 obtained when the example size is small tends to be higher than the real R^2 in the population. The rule of thumb is to report adjusted R2 when it substantially differs from R^2 (Green & Salkind, 2010).

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where,

Y = Supply Chain Performance of healthcare industry

β_0, β_1, β_3, β_4, = Coefficient of Performance

X_1 = ***Supplier Integration (SI)***

X2 =***Top Management Commitment (TMC)***

X_3 = ***Lean Practices (LP)***

X_4 = ***Inventory Visibility (IV)***

4.11.1 Multiple Regression Results for the Contributions of Supply chain Practices on Healthcare supply chain performance in Indian healthcare

To understand the nature of the association among supply chain practices and supply chain performance, Multiple Regression tests were applied to the gather data. Supply chain practices are considered as the independent variable and supply chain performance was assumed as the dependent variable. To be able to use multiple regressions the following assumptions should be fulfilled: Normality, linearity, and independence of errors.

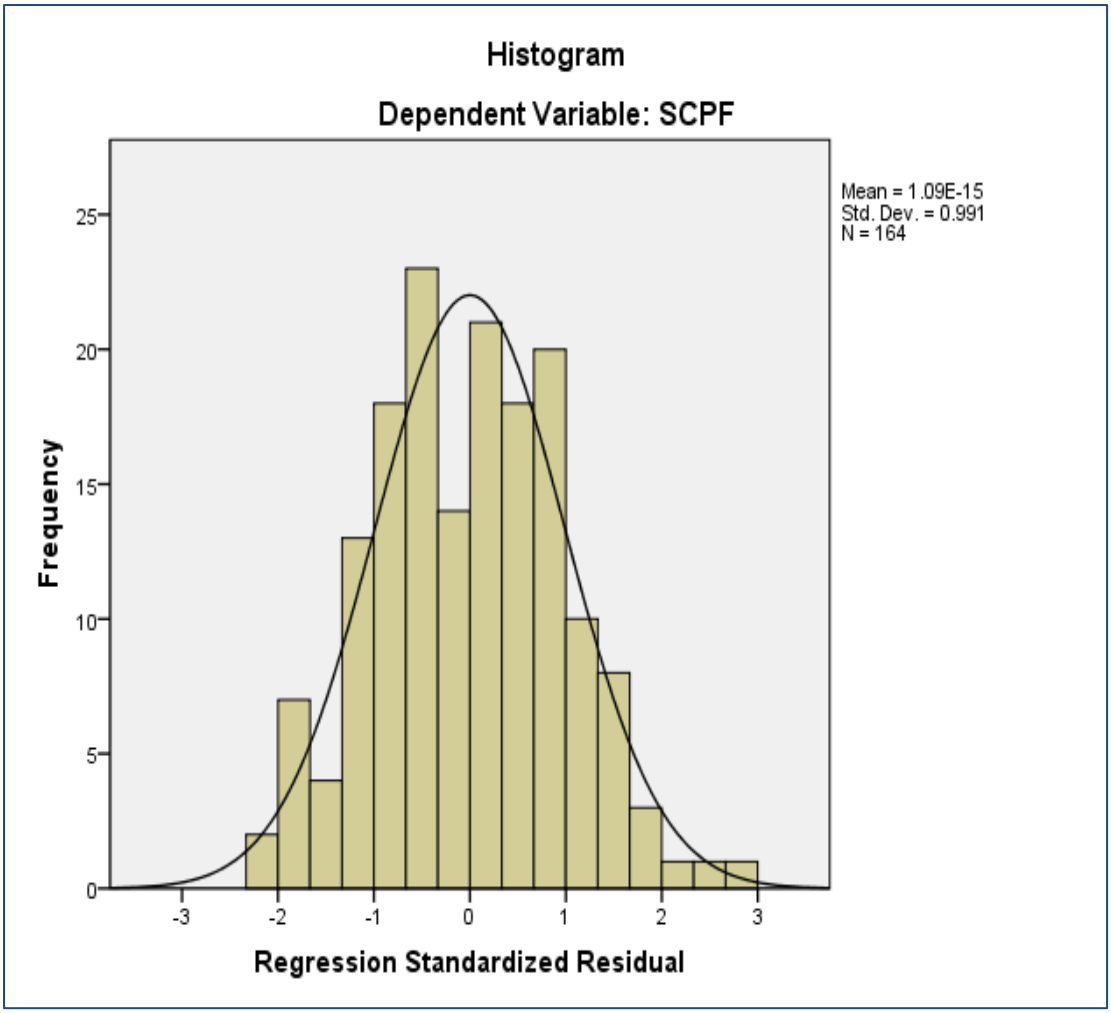

Figure 4.14: Normality Histogram between supply chain practices and supply chain performance.

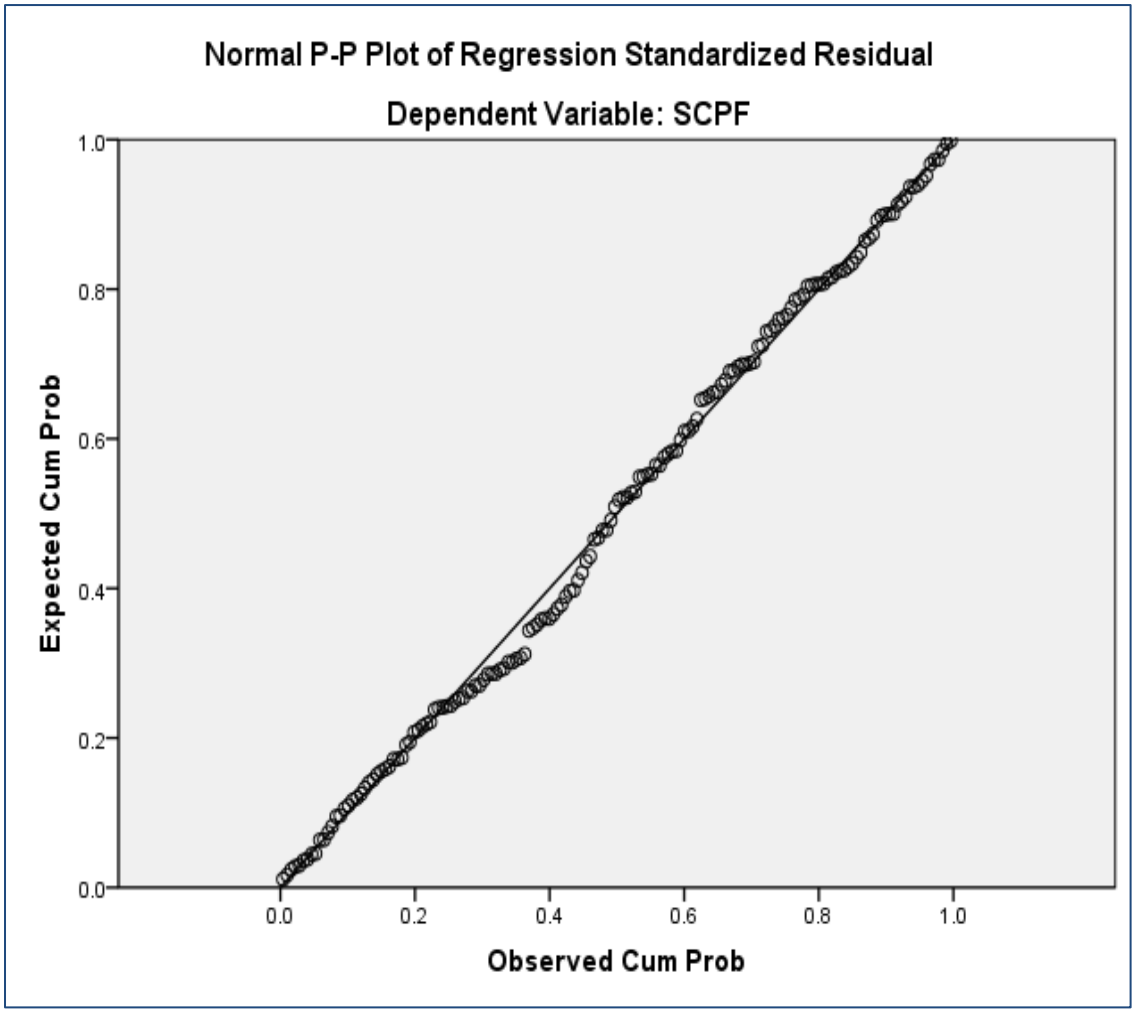

Figure: 4.15 Linearity Test between supply chain practices and supply chain performance

Table 4.23 Model summary for Supply Chain performance

Model Summary	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.755[a]	0.57	0.562	.49022

a. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Top management commitment, X3= Lean practices, X4= Inventory visibility

Table 4.23 presents a summary of regression model result. The value of R and R^2 are 0.755 and 0.57 respectively. The R-value of 0.755 represents the strong positive relationship between supply chain practices and the Healthcare Supply Chain Performance in Indian healthcare industries.

The R^2 specifies that descriptive power of the independent variable supply chain practices is 0.57. This means that about 57% of the variation in Healthcare Supply Chain Performance in Indian healthcare industries is explained by the model hence about 43% of the variation in the dependent variable is unsolved. It suggests that the reliant on a variable is influenced by other separate variables. Thus, According to the result of R square, it is possible to comment that 57% of the supply chain performance of health care industry is affected by their supply chain practices (R=0.57).

Table 4.24 ANOVA (F Test) Analysis for SC practices

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	50.924	3	16.975	70.635	.000[b]
	Residual	**38.450**	**160**	**.240**		
	Total	**89.374**	**163**			

a. Dependent variable: Healthcare Supply Chain Performance

b. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Top management commitment, X3= Lean practices, X4= Inventory visibility

Further, Table 4.24 shows the results of ANOVA test which reveals that the variable Supply Chain practices will significantly predict the performance of Healthcare Supply Chain in Indian healthcare industries, $F(3,160) = 70.635$, $p < .05$, $R^2 = .57$. One way ANOVA test also supported that there is a statistically meaningful relationship between the dependent and independent variable (Sig.=0.000). Also, coefficients table of the regression supported the significant positive relationship between the two concepts.

Table 4.25 Coefficients for SC practices

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.237	.282		-.840	.402
	SCF1	.628	.062	.577	10.165	.000
	SCF2	.186	.063	.166	2.939	.004
	SCF3	.209	.040	.275	5.240	.000

Table 4.25 shows the significance effect of each independent variable on the dependent variable.

The linear regression model for Supply Chain practice,

$$\mathbf{Y = \beta 0 + \beta 1 x1 + \beta 2 x2 + \beta 3 x3 + \mathcal{E}}$$

Healthcare supply chain performance Y= 0.237 + 0.628 x1+ .186 x2 + .209 x3 Supply chain practices.

Y= 0.237 + 0.628 x1+ .186 x2 + .209 x3

The Y-Intercept (β0 = 0.237), predict that the Healthcare supply chain performance of Indian healthcare industries will be 0.237 when all other variables are zero, implying that without the independent variables that include; Top Management Commitment, Supplier integration, and Lean practices.

The regression results shows that, a unit increase in Supplier integration resulted in increase of 62.8% change in Healthcare supply chain performance, while a unit increase in Top management commitment resulted in increase of 18.6% change in Healthcare supply chain performance and a unit growth in Lean practices resulted in increase of 20.9% change in Healthcare supply chain performance.

The general regression model will be

Y= 0.237 + 0.628 x1+ .186 x2 + .209 x3

Further, the beta (β) values allow us to compare the relative strength of each independent variable's relationship with the dependent variable. From the Table 4.25 it is depicted that there is a positive direct impact of supplier integration on operational performance with (Beta= 0.577, t=10.165, sig. 0.000, $p<0.05$) followed by positive direct impact of Lean practices on supply chain performance with (Beta= 0.275, t=5.240, sig. 0.000, $p<0.05$) and Top management commitment with (Beta= 0.166, t=2.939, sig. 0.000, $p<0.05$) Therefore, the hypothesis is accepted, which indicates that the supply chain practices have an impact on supply chain performance at ($\alpha \leq 0.05$).

4.11.2 Multiple Regression Results for the Contributions of Supply chain Practices on Healthcare Organizational Performance in Indian healthcare industry

To understand the nature of the relationship between supply chain practices and healthcare organizational performance, Multiple Regression tests were applied to the collected data. Supply chain practices are considered as the independent variable, and organizational performance was assumed as the dependent variable. To be able to use multiple regressions the following assumptions should be fulfilled: Normality, linearity, and independence of errors.

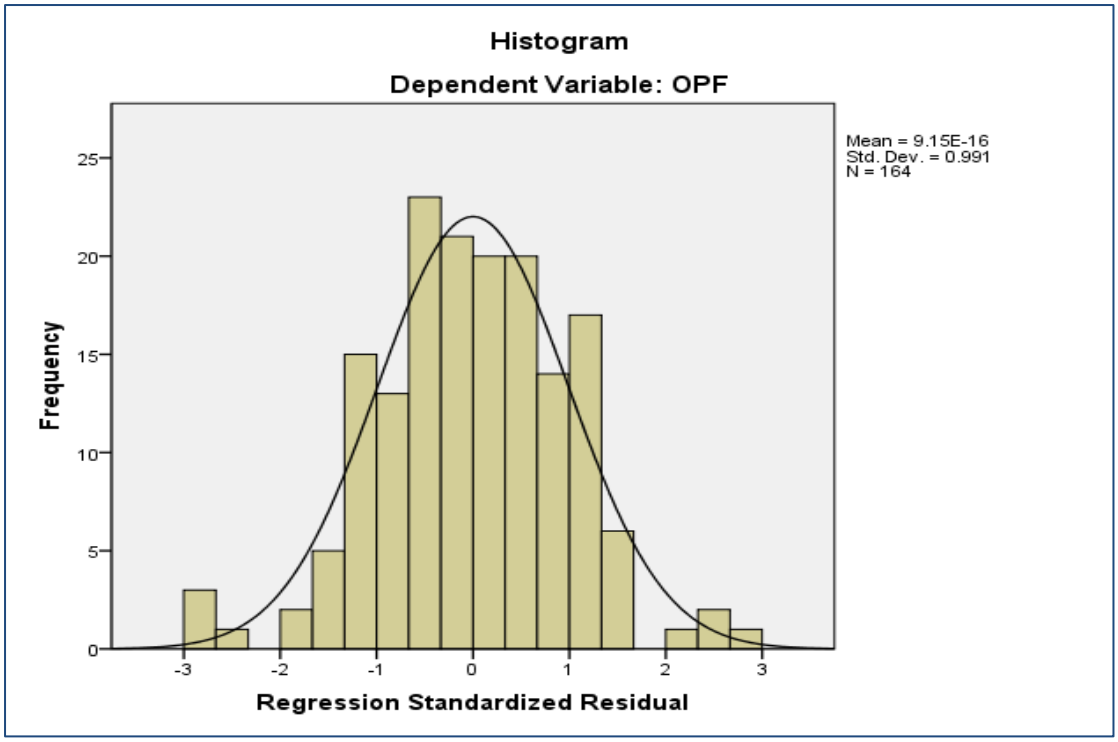

Figure: 4.16 Normality Histogram between supply chain practices and organizational performance

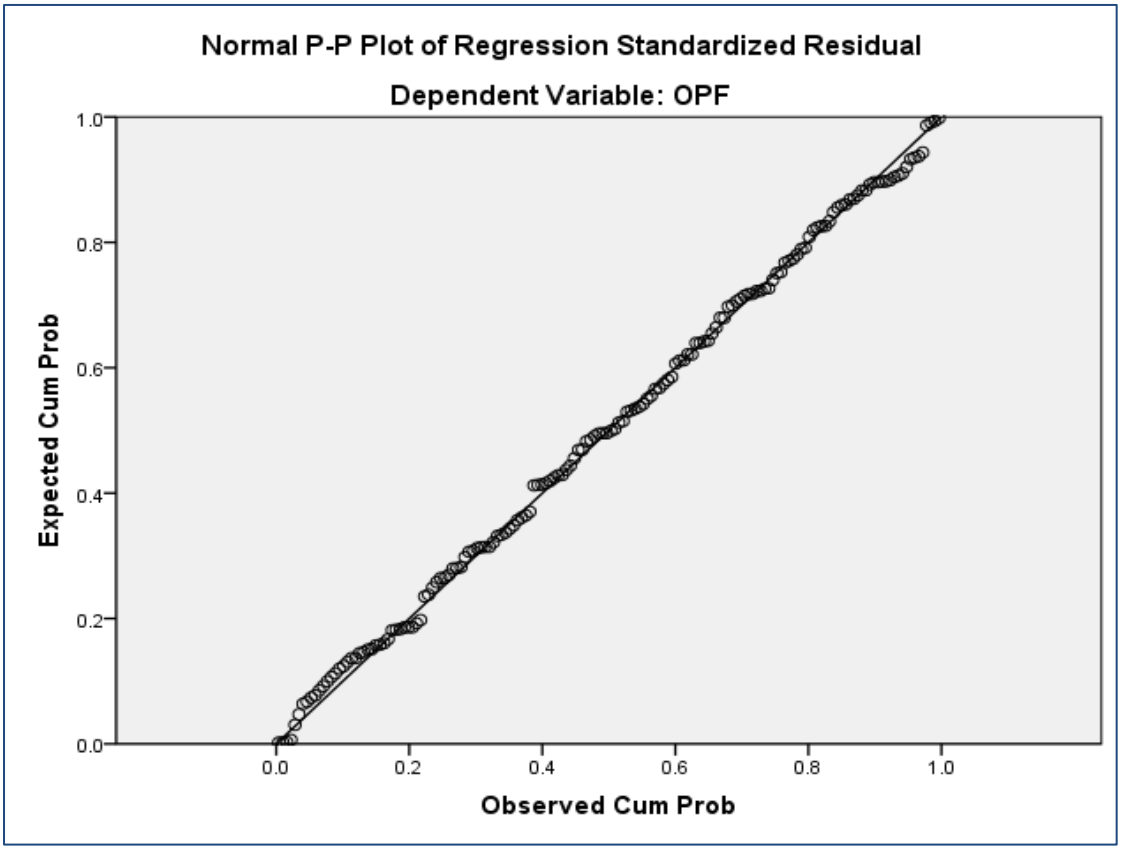

Figure: 4.17 Linearity Test between supply chain practices and organizational performance

Table 4.26 Model summary for Organizational Performance

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.637	.406	.395	.54187

a. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Top management commitment, X3= Lean practices, X4= Inventory visibility

Table 4.26 presents a summary of regression model result. The value of R and R^2 are 0.637 and 0.406 respectively. The R-value of 0.637 represents the moderate positive relationship between supply chain practices and the Healthcare Organizational Performance in Indian healthcare industries.

The R^2 indicates that explanatory power of the independent variable supply chain practices is 0.406. This means that about 40.6% of the variation in Healthcare organizational Performance in Indian healthcare industries is explained by the model hence about 59.4% of the variation in the dependent variable is unexplained. It implies that the dependent variable is influenced by other independent variables. Thus, According to the result of R square, it is possible to comment that 40.6 % of the Organizational performance of health care industry is affected by their supply chain practices (R=0.406).

Table 4.27 ANOVA (F TEST) ANALYSIS for SCP

ANOVA						
Model		Sum of Squares	Degree of Freedom	Mean Square	F	Sig.
1	Regression	32.147	3	10.716	36.495	.000
	Residual	46.979	160	.294		
	Total	79.127	163			

a. Dependent variable: Healthcare Organizational Performance

b. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Top management commitment, X3= Lean practices, X4= Inventory visibility

Further, Table 4.27 shows the results of ANOVA test which reveals that the variable Supply Chain practices will significantly predict the Organizational Performance of Indian healthcare industries, F (3,160) =36.495, p< .05, R^2 = .406. One way ANOVA test also supported that there is a statistically meaningful relationship between the dependent and independent variable (Sig.=0.000). Also, coefficients table of the regression supported the significant positive relationship between the two concepts.

Table 4.28 Coefficients for Organizational Performance

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	1.017	.272		3.739	.000
	SCF1	.570	.065	.557	8.706	.000
	SCF3	.077	.044	.107	1.736	.084
	SCF4	.100	.045	.140	2.200	.029

Table: 4.28 show the significance effect of each independent variable on the dependent variable.

The linear regression model for Supply Chain practice,

$$Y = \beta 0 + \beta 1x1 + \beta 2x2 + \beta 3x3 + \varepsilon$$

Healthcare Organizational performance Y= 1.017 + 0.570 x1+ 0.077 x3 + .1 x4 Supply chain practices.

The Y-Intercept ($\beta 0 = 1.017$), predict that the Healthcare supply chain performance of Indian healthcare industries will be 0.237 when all other variables are zero, implying that without the independent variables that include; Supplier integration, Lean practices, and Inventory Visibility.

The regression results shows that, a unit increase in Supplier integration resulted in increase of 57% change in Healthcare supply chain performance, while a unit increase in Inventory Visibility resulted in increase of 10% change in Healthcare supply chain performance and a unit increase in Lean practices resulted in increase of 7.7% change in Healthcare supply chain performance.

The general regression model will be

Y= 1.017 + 0.570 x1+ 0.077 x3 + .1 x4

Further, the beta (β) values allow us to compare the relative strength of each independent variable's relationship with the dependent variable. From the Table 4.28 it is depicted that there is a positive direct impact of supplier integration on Organizational performance with (Beta= 0.557, t=8.706, sig. 0.000, $p<0.05$) followed by positive direct impact of Lean Practices on Organizational performance with (Beta= 0.140, t=2.200, sig. 0.000, $p<0.05$) and Inventory Visibility with (Beta= 0.107, t=1.736, sig. 0.000, $p<0.05$). Therefore, the hypothesis is accepted, which indicates that the supply chain practices have an impact on Organizational performance at ($\alpha \leq 0.05$).

4.11.3 Multiple Regression Results for the Contributions of Supply chain Practices on Healthcare Organizational Performance with mediate effect of Supply Chain Performance in Indian healthcare industry

Again, to understand the nature of the relationship between supply chain practices and organizational performance with supply chain performance as mediating effect, Multiple Linear Regression tests were applied to the collected data. Supply chain practices and supply chain performance are considered as the independent variable and organizational performance as the dependent variable. To be able to use multiple regressions the following assumptions should be fulfilled: Normality, linearity, and independence of errors.

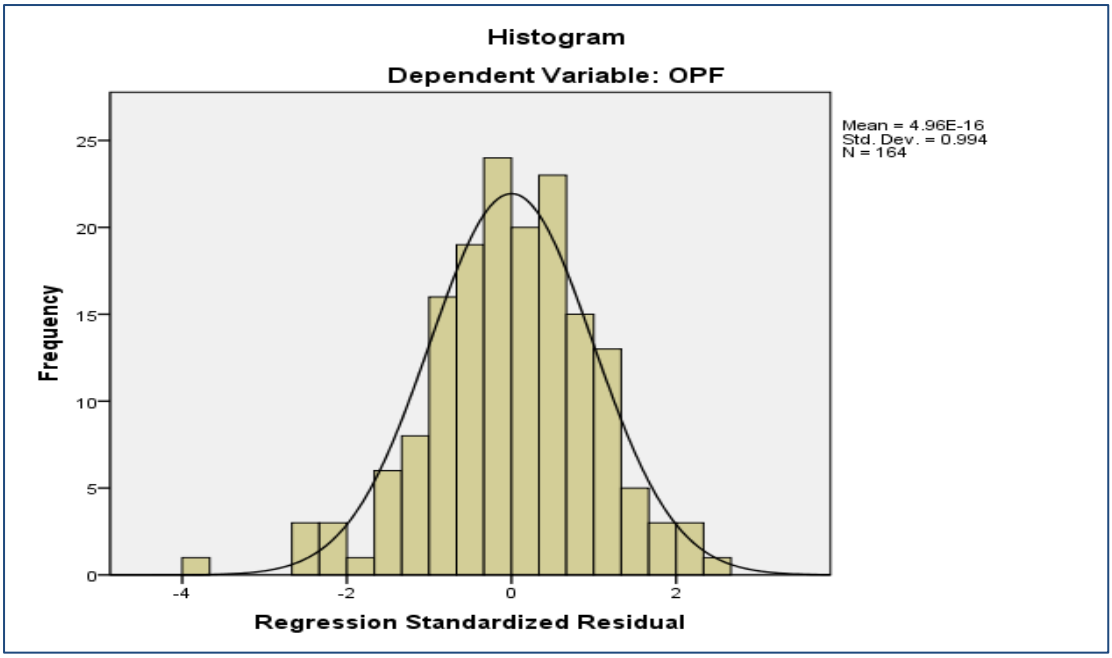

Figure: 4.18 Normality Histogram between supply chain practices and organizational performance with mediating effect of Supply Chain performance

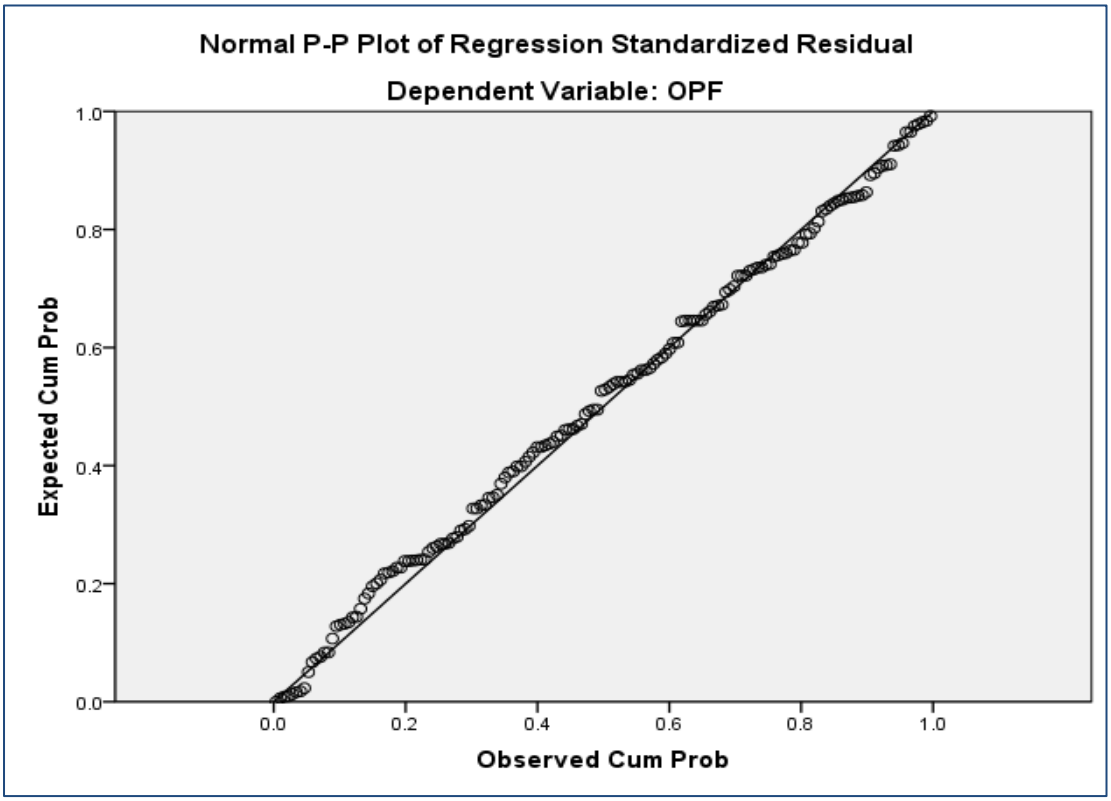

Figure: 4.19 Linearity Test between supply chain practices and organizational performance with mediating effect of Supply Chain Performance.

Table 4.29 Model summary for Organizational Performance

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	**.749**	**.562**	**.556**	**.46421**

a. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Supply Chain Performance

Table 4.29 presents a summary of regression model result. The regression coefficient shows the precision and measures the ability of the model to explain the variation in the dependent variable. The greater the R^2, the better the model explains the variation in the dependent variable. The value of R and R^2 are 0.749 and 0.562 respectively. The R-value of 0.749 represents the strong positive relationship between supply chain practices and the Healthcare Organizational Performance with supply chain performance as mediating effect in Indian healthcare industries.

The R^2 indicates that explanatory power of the independent variable supply chain practices with supply chain performance as mediating effect is 0.562. This means that about 56.2% of the variation in Healthcare organizational Performance in Indian healthcare industries is explained by the model hence about 43.8% of the variation in the dependent variable is unexplained. It implies that the dependent variable is influenced by other independent variables. Thus, According to the result of R square, it is possible to comment that 56.2 % of the Organizational performance of health care industry is affected by their supply chain practices with supply chain performance as mediating effect (R=0.406).

Table 4.30 ANOVA (F TEST) ANALYSIS for SC with mediating effect of SCP

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.433	2	22.217	103.099	.000
	Residual	34.693	161	.215		
	Total	79.127	163			

a. Dependent variable: Healthcare Organizational Performance

b. Predictors: (Constant), Supply Chain, Practices X1= Supplier Integration, X2= Supply Chain Performance

Further, Table 4.30 shows the results of ANOVA test which reveals that the variable Supply Chain practices will significantly predict the Organizational Performance of Indian healthcare industries with supply chain performance as mediating effect, F (3,160) =103.099, $p < .05$, $R^2 = .562$. One way ANOVA test also supported that there is a statistically meaningful relationship between the dependent and independent variable (Sig.=0.000). Also, coefficients table of the regression supported the significant positive relationship between the two concepts.

Table 4.31 Coefficients for Organizational Performance

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.980	.214		4.571	.000
	SCF1	.212	.073	.207	2.899	.004
	SCPF	.557	.067	.592	8.281	.000

Table 4.31 shows the significance effect of each independent variable on the dependent variable.

The linear regression model for Supply Chain practice,

$Y = \beta 0 + \beta 1x1 + \beta 2x2 + Ɛ$

Healthcare Organizational performance Y= .980 + 0.212x1+ 0.557 x2 Supply chain practices.

The Y-Intercept ($\beta 0 = .980$), predict that the Healthcare supply chain performance of Indian healthcare industries will be 0.980 when all other variables are zero, implying that without the independent variables that include; Supply chain practice and supply chain performance.

The regression results show that a unit increase in Supplier integration increased only 21.2% change in Healthcare supply chain performance, whereas a unit increase in Supplier integration along with the mediating effect of supply chain performance will increase 55.7% change in Healthcare supply chain performance.

The general regression model will be

Y= .980 + 0.212 x1+ 0.557 x2

Further, the beta (β) values allow us to compare the relative strength of each independent variable's relationship with the dependent variable. From the Table 4.31 it is depicted that there is a positive direct impact of supplier integration on Organizational performance with (Beta= 0.207, t=2.899, sig. 0.000, $p<0.05$) whereas Supplier Integration with mediating effect of supply chain performance will have strong positive impact on Organizational performance with (Beta= 0.592, t=8.281, sig. 0.000, $p<0.05$). Therefore, the hypothesis is accepted, which indicates that the supply chain practices have an impact on Organizational performance with a mediating effect of supply chain performance at ($\alpha \leq 0.05$).

The results of the proposed regression analysis are also presented in Table 5.1 indicating support for the hypotheses developed. The results support Hypothesis 5, which states that healthcare organizations with high levels of SC practices have high levels of organizational performance. The standardized coefficient is .207 which is statistically significant at P <.05 (t = 2.899). The statistical implication of Hypothesis 5 confirms that SCM practice can affect the organizational concert. The implementation of Supplier Integration may directly improve an organizational performance of Indian healthcare industry in the long run.

Hypothesis 6 is also sustained which indicates that SC practices have an optimistic impact on supply chain performance. The standardized coefficient is .557 which is statistically significant at P <.05(t = 10.165). The results designate that advanced levels of SC practices have great levels of supply chain concert that lead to upgraded organizational performance.

Hypothesis 7 is also sustained which designates that SC outcome has a transitional impact on organizational development. The standardized coefficient is .592 which is statistically significant at P <.05(t = 8.28). The results indicate that advanced levels of SC practices have great levels of supply chain performance that focused on the improved organizational presentation.

Table 4.32 Result of Regression Analysis

Hypothesis	Relationship	Effect	Hypothesis
H5	SC ⟶ OP	.207(2.899)	Supported
H6	SC ⟶ SCP	.557(10.165)	Supported
H7	SCP ⟶ OP	.592(8.28)	Supported

Significant at <.05, *t*-values are in parentheses

4.13 SUMMARY

This chapter presents data collection from different stakeholders of healthcare supply chain management particularly for medical devices and equipment, and the statistical tools were aligned with the objectives of the research. Data was collected from 164 usable responses from a survey sample of 718. The analysis of includes demographic analysis, descriptive analysis, missing value analysis, comparative analysis, Factor analysis of variables and finally multiple regression analysis. The major partners in the supply chain of medical equipment and devices in healthcare industries include manufacturers, distributors, suppliers, and customers. Majority of the respondents (37.2%) were falling in the customer category, 18.9% in the manufacturer category, (23.8%) in the supplier category while (20.1%) respondents are under the category of medical equipment or devices manufacturer.

Further, Chi-square analysis was carried to investigate association between supply chain practices clusters with different groups of respondent categorizes based on type of organization, nature of supply chain partner, number of employees, year of experience, type of business organization, familiar with performance measurement system and it is clear from the result that the relation between type of supply chain partner and the familiarity of performance measurement is significant. Thus healthcare supply chain partners are conscious about supply chain performance.

Factor analysis is mostly used just for dimension bargain and factor abstraction to describe a set of variables in a lesser amount of hypothesized variables. In this study, Factor analysis is done to identify the research constructs related to supply chain practices, supply chain performance, and organizational performance. Varimax rotation was conducted on 16 items of supply chain practices which were loaded on 4 factors namely Supplier Integration (SI), Top management commitment (TMC), Lean practices (LP) and Inventory Visibility (IV). 7 items loaded on one single factor of supply chain performance and 4 items loaded on one single factor of organizational performance.

The correlation analysis was carried out between the variables of the study using Pearson correlation coefficient to test whether there existed interdependency between independent variables and dependent variables. It is observed that there is a strong

positive correlation between supply chain practices and organizational performance with a value of r=0.624 and the correlation results also shows a strong positive relation between supply chain performance and organizational performance with R value=0.715. The Positive results thus pointed out the mediating effect of supply chain performance showing that as the level of supply chain practices increases, the level of organizational performance also increases with a significant increase in supply chain performance, and as the level of supply chain performance decreases, the level of organizational performance also decreases with the decrease in supply chain performance. Further, As suggested by (*Lee.D., 2015; Berberoglu, A. et.al., 2015; Yusuf et al., 2014)* Correlation coefficient reveals that there is positive link between the four supply chain practices with supply chain performance with SI (t= 11.364, 162), TMC (t= 5.688, df =162), LP (t= 5.085, df=162), IV (t= 4.239, df= 162).

Finally, Multiple Linear Regression tests were applied to the composed data. Multiple regression analysis is used for forecasting the percentage of the total dissimilarity of an unceasing dependent variable by the independent variables, and this is assessed using the coefficient of determination (R^2) which is used for judging the explanatory power of the linear regression of dependent variable on independent variables. The regression coefficient shows the precision and measures the ability of the model to explain the variation in the dependent variable. R^2 is a measure of the goodness of fit of the regression line to the observed sample values of dependent and independent variables. Finally Table: 4.33 shows the results of

Table: 4.33 Result of Hypothesis

Hypothesis	Relationship	Test value	Result
H1	Supplier Integration practices have association with Supply Chain Performance	(r =0.666, p < 0.01)	**H1: accepted**
H2	Top Management commitment practices have association with Supply Chain Performance	(r =0.408, p < 0.01)	**H2: accepted**
H3	Lean practices have association with Supply Chain Performance.	(r =0.371, p < 0.01)	**H3: accepted**
H4	Inventory visibility practices association with Supply Chain Performance	(r =0.316, p < 0.01)	**H4: accepted**
H5	There is a positive relation between Supply Chain Practices (SCs) and Supply chain Performance (SCP).	F (3,160) = 70.635, p< .05, R^2 = .57	**H5: accepted**
H6	There is a positive relation between Supply Chain Practices (SCs) and Healthcare Organizational performance (OP).	F (3,160) =36.495, p< .05, R^2 = .406.	**H6: accepted**
H7	Healthcare SC practices are positively associated with Healthcare Organizational Performance with Healthcare supply chain performance as mediating effect.	F (3,160) =103.099, p< .05, R^2 = .562	**H7: accepted**

The results indicate that advanced levels of SC practices have great levels of supply chain performance that lead to enhanced organizational performance. The study reveals that the Indian healthcare industries are adopting supply chain practices but are still a gap which is needed to be explored. Next chapter will further study the comparative analysis of supply chain practices, supply chain performance, and organizational performance.

CHAPTER-5 COMPARATIVE STUDY OF SUPPLY CHAIN PRACTICES FACTORS

5.1 INTRODUCTION

In this chapter, the stakeholder wise comparative analysis of healthcare supply chain practices and its dimensions such as Top Management Commitment (TMC), Supplier Integration (SI), Lean Practices (LP) and Inventory visibility (IV) has been examined. Various analysis tools such as F-test, T-test, and ANOVA analysis has been applied.

5.2 STAKEHOLDER WISE COMPARATIVE ANALYSIS

The sample is divided into four stakeholders of healthcare supply chain, i.e., Manufacturers, Distributors, Suppliers, and Customers. A set of supply chain practices related to Top management commitment, Supplier integration, Lean practices and inventory visibility have been analyzed. Detailed analysis of Supply chain practices, Healthcare supply chain performance and Healthcare Organizational performance concerning various healthcare supply chain stakeholders have shown below in Table: 5.1

Table 5.1 Descriptive statistics of Supply chain performance.

	Stakeholders / Constructs	Customers (N=61)		Distributors (N=31)		Manufacturers (N=33)		Suppliers (N=39)		Overall (N=164)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	**SD**
SC	**SI**	4.04	0.63	3.83	0.76	**3.75**	0.70	3.73	0.64	3.87	0.68
	TMC	**4.16**	0.64	**3.90**	0.67	3.72	0.61	**3.85**	0.65	**3.95**	0.66
	LP	3.02	1.01	3.32	0.82	2.62	0.95	2.96	0.98	2.98	0.98
	IV	3.33	0.98	3.43	1.02	3.08	0.94	3.35	0.98	3.30	0.98

From the Figure 5.1 it is clear that all the stakeholders of healthcare supply chain are most conscious about Top Management Commitment practice with mean value of **3.95** however the manufacturers of healthcare equipment and devices in the healthcare supply chain are more conscious about practicing supplier integration as a significant supply chain practice with mean value of **3.75** as compared to other stakeholders.

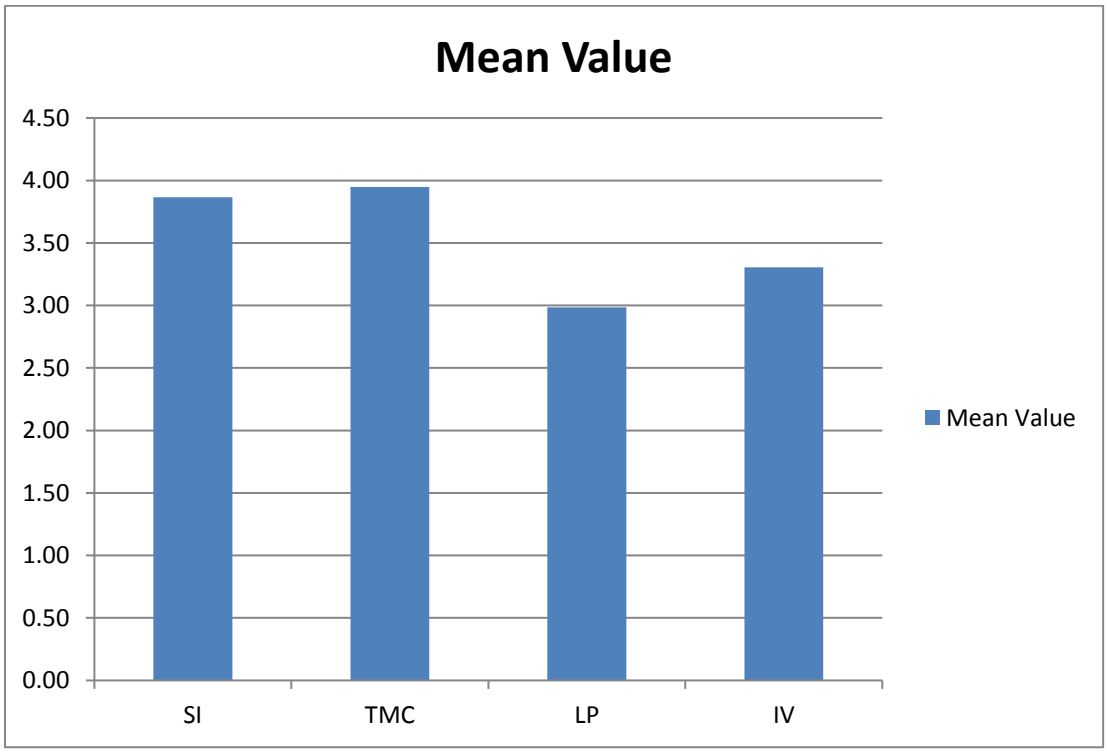

Figure 5.1 Practices of Healthcare Supply chain

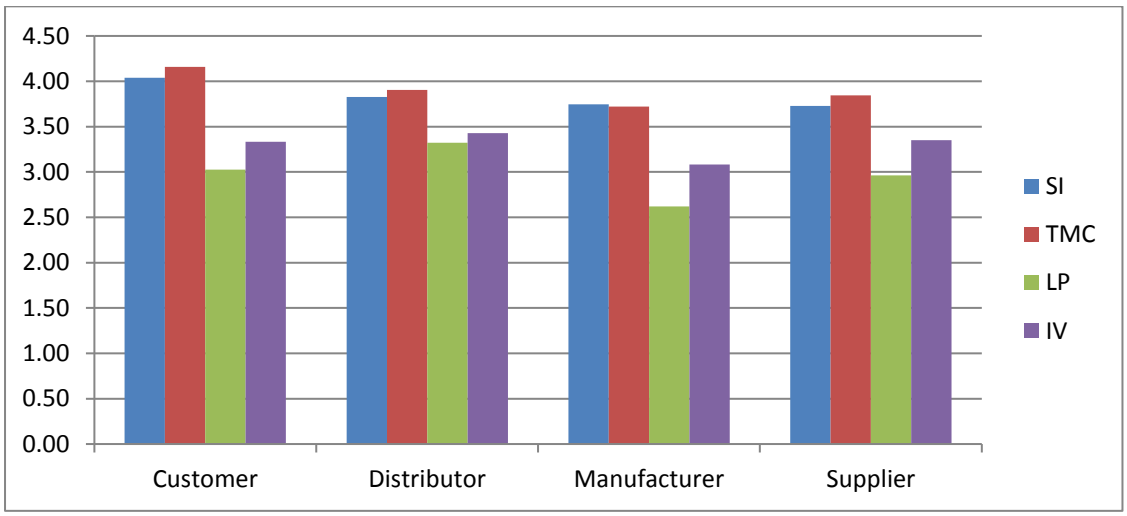

Figure 5.2 Mean score for practices of different stakeholders of healthcare supply chain

Further, from Figure 5.2, it is clear that Customers prefer Top Management Commitment as most significant practice to improve Healthcare supply chain performance with a mean value of 4.16 followed by Supplier Integration with a mean value of 4..04. It is also clear that Customers are more conscious about Supplier Integration (SI) and Top Management Commitment (TMC) as compared to other stakeholders.

Similarly, Distributors and Suppliers also prefer Top management Commitment practices as most preferred supply chain practice. However, Manufacturers are more concern about Supplier Integration practices top management Commitment with a mean value of 3.75 as compared to Supplier integration with a mean value of 3.72. Thus, it may be concluded from the above table that Supplier Integration and Top Management practices are of major concern in healthcare supply chain.
However, Customers, Distributors, and Suppliers also focus and implement Supplier integration practice with a mean value of 4.04, 3.83 & 3.73 respectively. Thus, it may be concluded from the above table that Supplier Integration and Top Management practices are of major concern in healthcare supply chain.

5.2.1 Supplier Integration

Based on the literature (Li et al., 2005; Li and Lin, 2006; Monczka et al., 1998; Li et al., 2006; Mohr and Spekman, 1994; Claycomb et al., 1999; Tan et al., 1998), various supply chain practices in which the Supplier Integration is explored are identified such as easy acceptance for strategic changes, key suppliers keep each other informed about events or changes related to financial, service design, strategy and research, no expediting and Promotes supplier to manage inventory on their behalf. (VMI system). Respondents were requested about the level of acceptance of practice in their association on five points Likert scale with 1- strongly disagree and 5- strongly agree. Table 5.2 shows the stakeholder wise mean and standard deviation of Supplier Integration.

Table 5.2 Descriptive statistics of Supplier Integration

Item/variables	Customer (N=61)		Distributor (N=31)		Manufacturer (N=33)		Supplier (N=39)		Overall (N=164)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SI1(SC6)	2.80	1.00	2.84	1.07	2.21	0.78	2.54	0.97	2.63	0.99
SI2(SC13)	3.03	1.06	3.32	0.79	2.67	1.02	3.00	0.97	3.01	1.00
SI3(SC15)	**3.23**	1.15	**3.68**	0.94	**3.00**	1.30	**3.36**	1.20	3.30	1.17
SI4(SC16)	3.03	1.03	3.45	0.99	2.61	1.03	2.95	1.05	3.01	1.05
SI	**4.04**	**0.63**	**3.83**	**0.76**	**3.75**	**0.70**	**3.73**	**0.64**	**3.87**	**0.68**

SC6	Acceptance of strategic changes in the supply chain.
SC13	Our company and our key suppliers keep each other informed
SC15	Promotes little or no expediting.
SC16	Promotes supplier to manage inventory on their behalf. (VMI system).

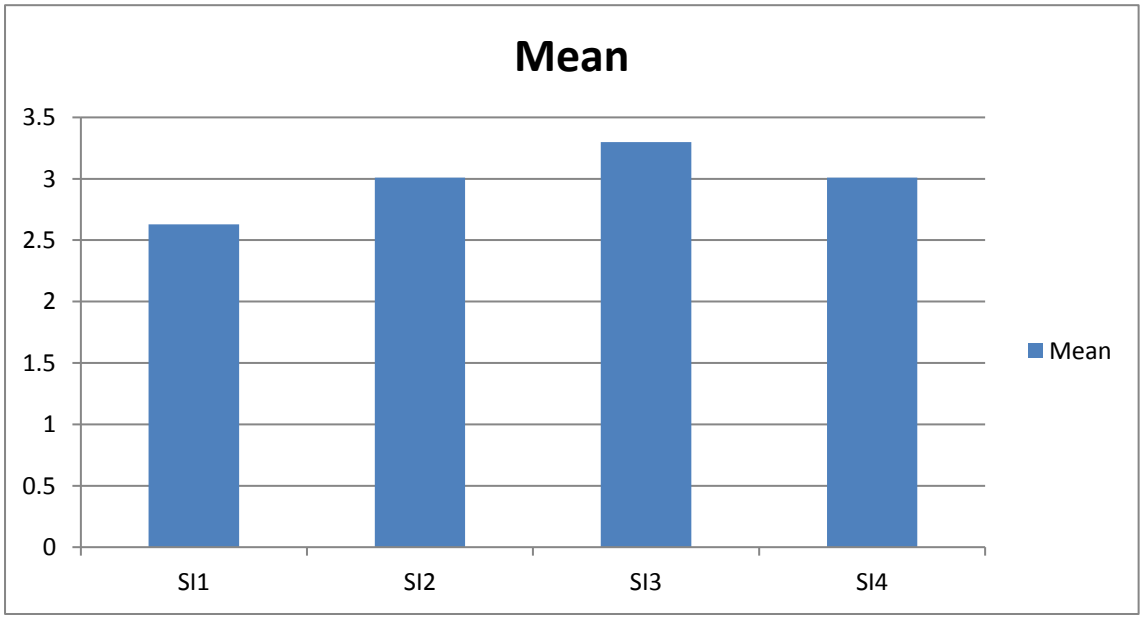

Figure 5.3 Practices of Supplier Integration (SI)

It is clear from the Table 5.2 that level of Supplier Integration is based on the quality of the supply with little or no expediting, as the result, indicates highest mean to SI3 of 3.30 as shown in the Figure 5.3. Separately from this it is represented from Figure 5.4 that in Healthcare industries all the stakeholders (Manufacturers, Distributors, Suppliers, and Customers), are highly interested in the quality of the supply with little or no expediting practice (SI3) as an integral part of healthcare organizational performance.

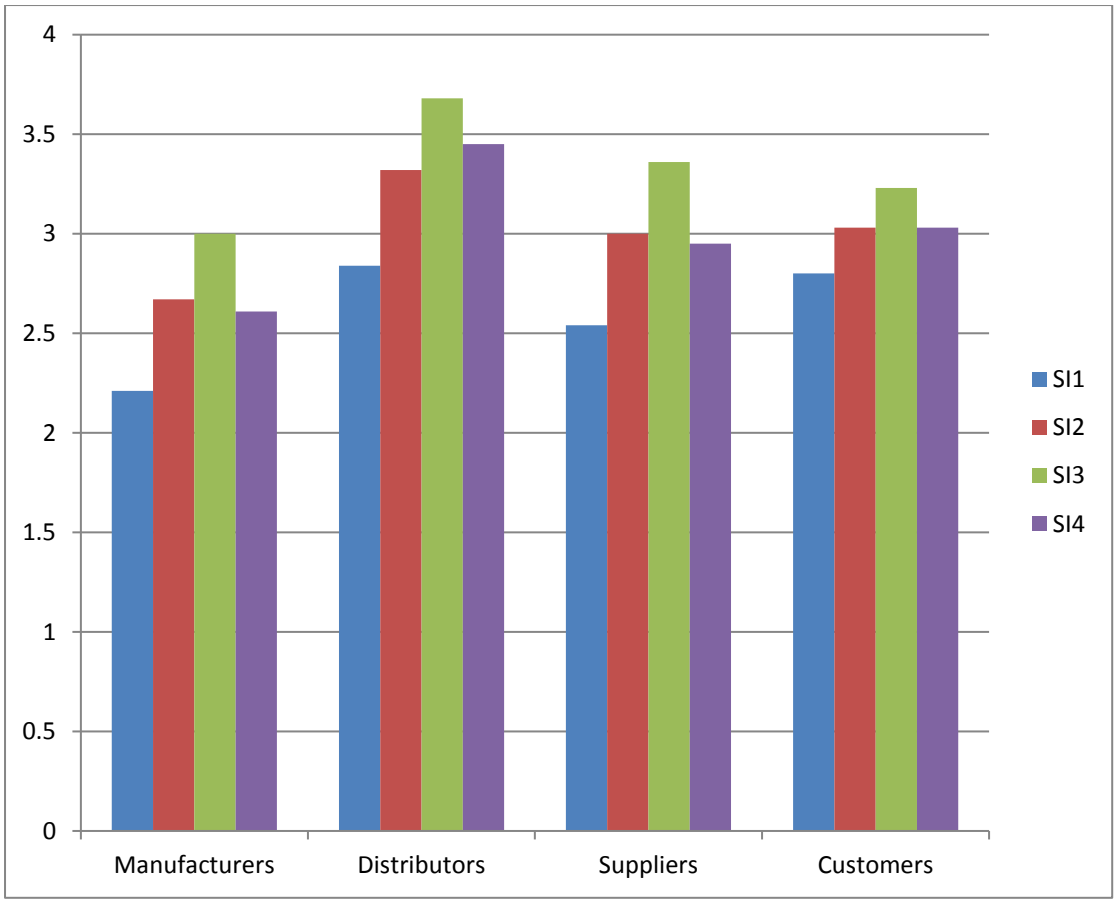

Figure 5.4 Mean score of stakeholder's choice of practice of Supplier Integration

Table 5.3 One- sample T-Test for Supplier Integration Practice for Healthcare Organizational Performance

One-Sample Test						
Item	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
SI1	-4.833	163	.000	-.372	-.52	-.22
SI2	.078	163	.938	.006	-.15	.16
SI3	3.276	163	.001	.299	.12	.48
SI4	.074	163	.941	.006	-.16	.17

From the Table 5.3 by one sample T-test analysis, it can be clearly observed that the p-value of SI1 and SI3 is .000 and .001 respectively, which is less than the level of significance 0.05. It indicates that these practices have a significant difference in Supplier Integration practice for healthcare organizational performance in Indian healthcare industry. However, the p-value of SI2 and SI4 is .938 and .941 respectively, which is greater than the level of significance 0.05. It indicates that these practices do not have a significant difference in Supplier Integration for healthcare organizational performance in Indian healthcare industry hence does not have much focus on stakeholders. Further, from the results, it is observed that quality of product supply is strictly adhered with little or no expediting practice (SI3) (t=3.276) and are a significant variable of Supplier Integration in Indian healthcare industry.

Table 5.4 ANOVA Test for supply chain practices for Supply chain performance.

ANOVA							
Supply Chain Practice	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Supplier Integration	Customer	61	4.115	0.755	0.097	2.11	0.10
	Distributor	31	3.806	0.910	0.163		
	Manufacturer	33	3.758	0.792	0.138		
	Supplier	39	3.795	0.833	0.133		
	Total	164	3.909	0.820	0.064		

Table 5.4 illustrates that F statistics associated p-value. The result shows that the value of F=2.11 at a p-value of 0.10. It is clearly observed that the p value= 0.10, which is greater than the level of significance 0.05. It designated that there is no substantial difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for Supplier Incorporation. Hence, it is concluded that Supplier Integration practice for all the stakeholders of Indian healthcare supply chain is significantly same due to improving quality of products with little or no expediting.

5.2.2 Top Management Commitment

Based on the literature (Singh and Kant, 2008; Sit et al.,2009; Sandberg and Abrahamsson, 2010; Qureshi et al., 2011; Singh, 2011; Morgan et al., 2000; Kiplagat J., 2015), various supply chain practices in which the Top management commitment is explored are identified such as Promotes small number of high quality suppliers, Establishes long term relationship with our suppliers, Top management is committed to supplying chain performance, Our company work for continuous commitment to providing high-quality products and services and Top management is proactive and systematic in the supply chain management. Respondents were asked about the level of acceptance of practice in their organization on five points Likert scale with 1- strongly disagree and 5- strongly agree. Table 5.5 shows the stakeholder wise mean and standard deviation of Top Management Commitment.

Table 5.5 Descriptive statistics of Top Management Commitment

Item	Customer (N=61)		Distributor (N=31)		Manufacturer (N=33)		Supplier (N=39)		Overall (N=164)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
TMC1(SC1)	**4.11**	0.75	3.81	0.91	3.76	0.79	3.79	0.83	3.91	0.82
TMC2(SC2)	4.10	0.94	**3.97**	0.87	3.61	1.27	3.62	1.21	3.86	1.08
TMC3(SC3)	4.05	0.83	3.87	0.99	**3.79**	0.89	**3.90**	0.82	**3.93**	0.87
TMC4(SC4)	3.97	0.75	3.74	0.93	**3.79**	0.78	3.69	0.80	3.82	0.81
TMC5(SC9)	3.97	0.75	3.74	0.93	**3.79**	0.78	3.64	0.78	3.81	0.80
TMC	**4.16**	**0.64**	**3.90**	**0.67**	**3.72**	**0.61**	**3.85**	**0.65**	**3.95**	**0.66**

SC1	Promotes a small number of high-quality suppliers.
SC2	Establishes a long-term relationship with our suppliers.
SC3	Top management is committed to supplying chain performance.
SC4	Our company works for continuous commitment to providing high-quality products and services.
SC9	Top management is proactive and systematic in the supply chain management

It is depicted from the Table 5.5 and Figure 5.5 that Indian healthcare industries emphasize more on the commitment of Top management for supply chain performance with a maximum overall mean of 3.93. The overall and stakeholder wise mean and standard deviation score is given in Table 5.5.

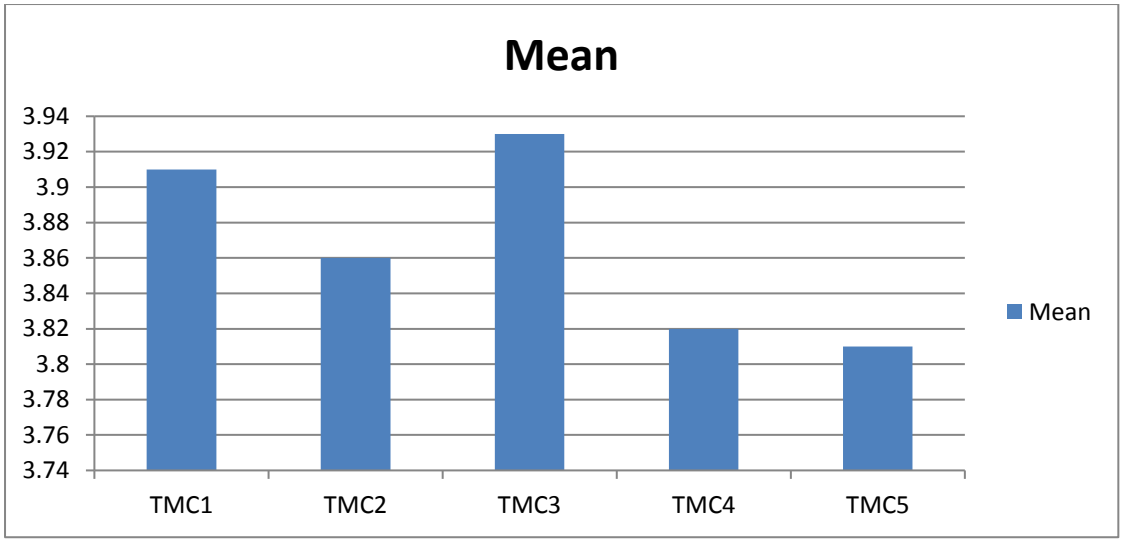

Figure 5.5 Practices of Top Management Commitment (TMC)

From Table 5.5 and Figure 5.6 it is depicted that apart from all the stakeholders of Healthcare supply chain (Manufacturers, Distributors, Suppliers, and Customers), Manufacturers and Suppliers are interested in continuous commitment in providing high-quality products and services (TMC4). Whereas, Customers are focused on promoting a small number of high-quality suppliers (TMC1) and Distributors in establishing a long-term relationship with our suppliers (TMC2) as an integral part of supply chain practices for health care organizational performance.

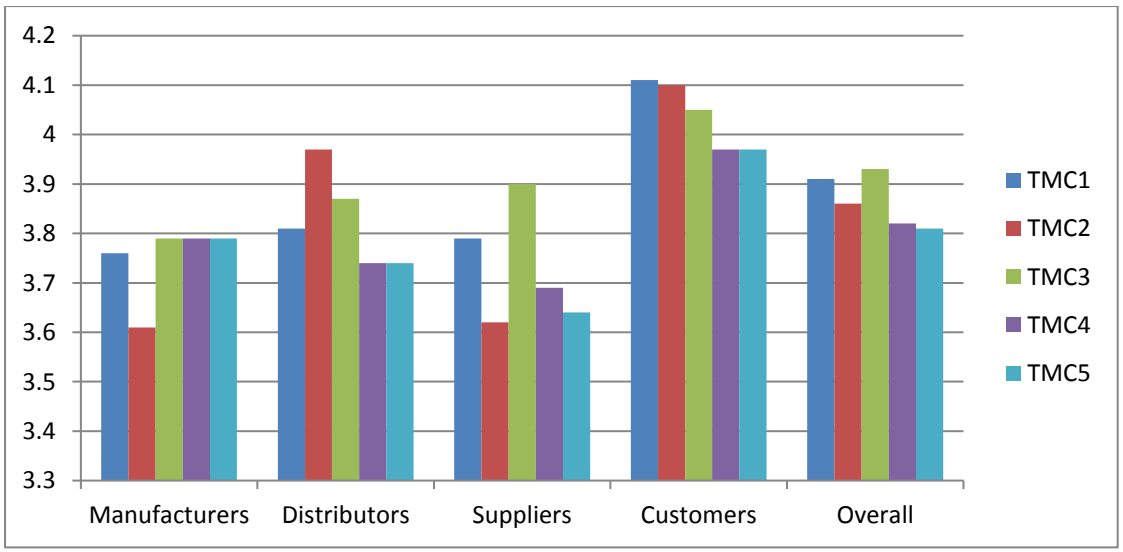

Figure 5.6 Mean score of stakeholder's choice of practice of TMC

Table 5.6 One-sample T-Test for TMC Practice for Healthcare Organizational Performance

One-Sample Test						
	Test Value = 3					
					95% Confidence Interval of the Difference	
Item	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
TMC1	**14.187**	163	0.000	0.909	0.78	1.03
TMC2	10.151	163	0.000	0.86	0.69	1.03
TMC3	13.657	163	0.000	0.927	0.79	1.06
TMC4	13.08	163	0.000	0.823	0.7	0.95
TMC5	12.931	163	0.000	0.811	0.69	0.93

From the Table 5.6 by one sample T-test analysis, it can be observed that the p-value of the test is 0.000, which is less than the level of significance 0.05. It indicates that there is a significant difference in Top Management Commitment to healthcare organizational performance in Indian healthcare industry. Further, from the results, it is observed that a small number of high-quality suppliers are strictly adhered (TMC1) (t=14.187) and is a highly significant variable of Top Management Commitment in Indian healthcare industry. Further, unceasing assurance to providing high-quality products and services (TMC4) (t=13.08) is also a significant variable of Top Management Commitment in Indian healthcare industry

Table 5.7 ANOVA Test for supply chain practices for Supply chain performance.

						ANOVA	
Supply Chain Practice	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Top Management Commitment	Customer	61	4.098	0.943	0.121	2.409	0.069
	Distributor	31	3.968	0.875	0.157		
	Manufacturer	33	3.606	1.273	0.222		
	Supplier	39	3.615	1.206	0.193		
	Total	164	3.860	1.085	0.085		

Table 5.7 illustrates that F statistics associated p-value. The result shows that the value of F=2.409 at a p-value of 0.069. It is clearly observed that the p value= 0.069, which is greater than the level of significance 0.05. It indicated that there is no significant difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for Supplier Integration. Hence, it is concluded that Supplier Integration practice is significant for all the stakeholders of Indian healthcare supply chain.

5.2.3. Lean Practices

Based on the literature (Li et al., 2006; Li et al., 2005; Handfield and Nichols, 1999; Mason-Jones and Towill, 1997; McIvor, 2001; Taylor, 1999; Womack and Jones, 1996; Shah et al., 2008; Alvarado & Kotzab, 2001) three relevant practices of Lean Practice were identified for Indian healthcare industries which improve the supply chain of Indian healthcare industry. These practices are a High level of emergency supplies of critical items, Eliminating duplicate processes and unnecessary procedures, Utilization of available equipment and facilities and Right product at the right time. Respondents were asked about the level of acceptance of practice in their organization on five points Likert scale with 1- strongly disagree and 5- strongly agree. Table 5.8 shows the stakeholder wise mean and standard deviation of Supplier Integration.

Table 5.8 Descriptive statistics of Lean practices

Items	Item/variables	Customer (N=61)		Distributor (N=31)		Manufacturer (N=33)		Supplier (N=39)		Overall (N=164)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
LP1(SP5)	SC5	4.05	0.76	3.74	0.86	3.55	0.75	3.64	0.84	3.79	0.82
LP2(SP7)	SC7	**4.28**	0.71	**4.13**	0.85	3.82	0.77	**3.97**	0.78	**4.09**	0.78
LP3(SP11)	SC11	4.18	0.74	4.00	0.77	**3.91**	0.72	**3.97**	0.67	4.04	0.73
LP4(SP12)	SC12	4.13	0.69	3.74	0.82	3.61	0.79	3.79	0.73	3.87	0.77
LP	**SCF3**	**3.02**	**1.01**	**3.32**	**0.82**	**2.62**	**0.95**	**2.96**	**0.98**	**2.98**	**0.98**

SC5	Strives to maintain a high level of emergency supplies of critical items.
SC7	Strive for eliminating duplicate processes and unnecessary procedures
SC11	Emphasis on improving the utilization of available equipment and facilities
SC12	Promotes right product at the right time.

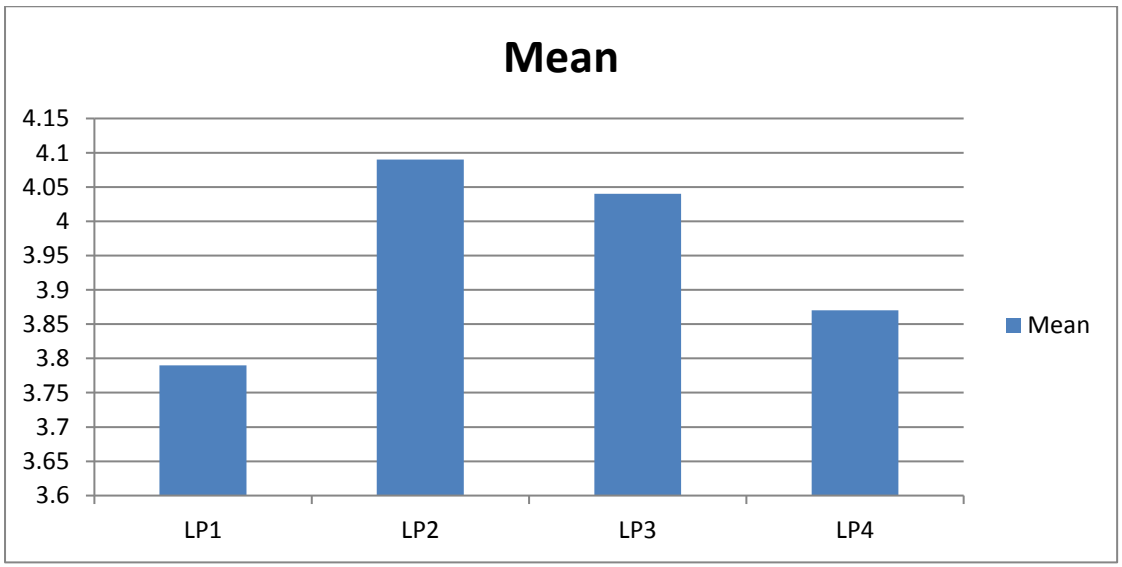

Figure 5.7 Lean Practices

It is clear from the Table 5.8 that Lean Practices are more focused on eliminating duplicate processes and unnecessary procedures. As a result, indicate highest mean to (LP2) of 4.09 as shown in the Figure 5.7. Apart from this it is depicted from the Table 5.7 and Figure 5.8 that among all the stakeholders of healthcare supply chain the Customers, Distributors, and Suppliers are highly interested in eliminating duplicate processes and unnecessary procedures (LP2) as preferred lean practice. Whereas, Manufacturers preferred lean practice is Utilization of available equipment and facilities for improving health care organizational performance.

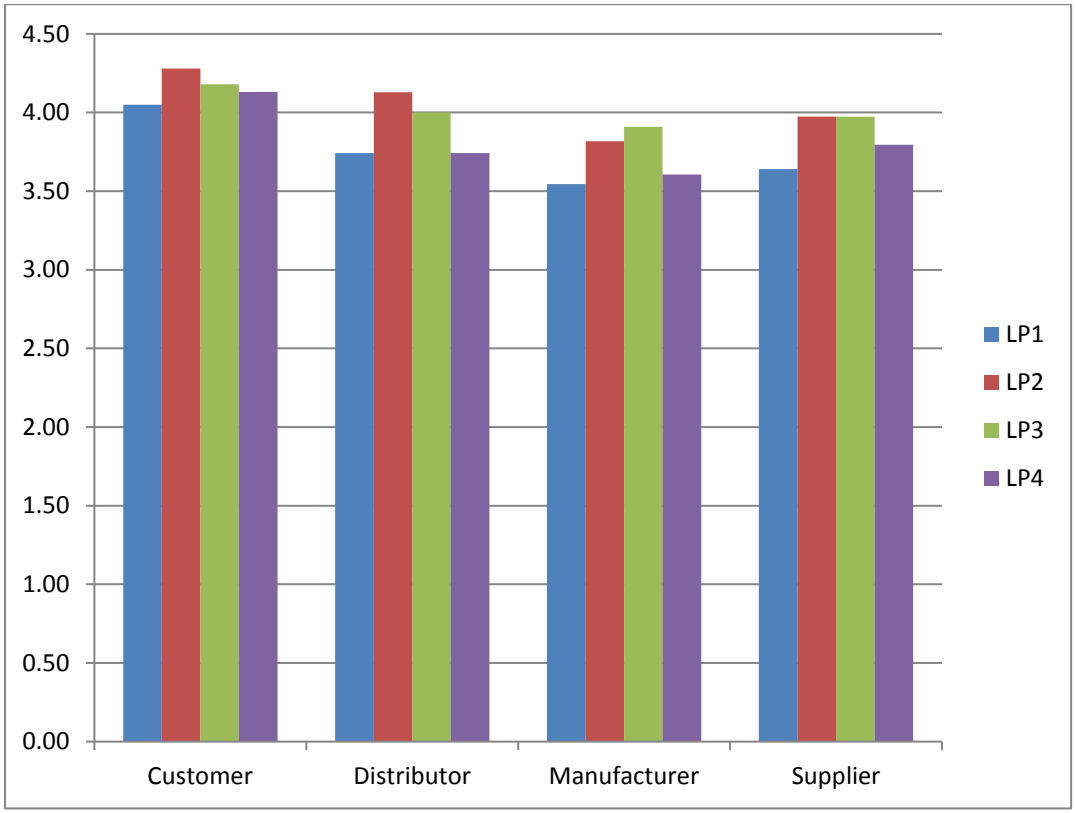

Figure 5.8 Mean score of stakeholder's choice of practice of Lean Practices

Further, from the Table 5.9 by one sample T-test analysis, it is observed that the p-value of the test is 0.000, which is less than the level of significance 0.05. It indicates that there is a significant difference in Lean Practices. The value of T statistics and its level of significance for LP1 (12.416; 0.000), LP2 (17.853; 0.000), LP3 (18.309; 0.000) and LP4 (14.527; 0.000) confirms that Utilization of available equipment and

facilities LP3 (18.309; 0.000). Eliminating duplicate processes and unnecessary procedures LP2 (17.853; 0.000) are the most significant Lean Practice in Indian healthcare industry.

Table 5.9 One- sample T-Test for Lean Practice for Healthcare Organizational Performance

One-Sample Test						
Item	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
LP1	12.416	163	.000	.793	.67	.92
LP2	17.853	163	.000	1.085	.97	1.21
LP3	18.309	163	.000	1.043	.93	1.16
LP4	14.527	163	.000	.872	.75	.99

Table 5.10 ANOVA Test for supply chain practices for Supply chain performance.

ANOVA							
Supply Chain Practice	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Top Management Commitment	Customer	61	3.025	1.012	0.130	2.907	0.036
	Distributor	31	3.323	0.822	0.148		
	Manufacturer	33	2.621	0.948	0.165		
	Supplier	39	2.962	0.981	0.157		
	Total	164	2.985	0.975	0.076		

Table 5.10 illustrates that F statistics and associated p-value. The result shows that the value of F=2.907 at a p-value of 0.036. It is clearly observed that the p value= 0.036, is less than the level of significance 0.05. It indicated that there is a significant difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for implementation of Lean practices. Hence, it is concluded that

implementation of Lean practices is significantly not same for all the stakeholders of Indian healthcare supply chain.

To find out the significant difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for implementation of Lean practices, post hoc test (multiple comparisons) is conducted. From the post hoc test result as shown in Table 5.11, it is found that there is a significant difference in the means of distributors and manufacturers of medical equipment and devices of healthcare supply chain. It is due to invisibility of requirements from customers.

Table 5.11 Post hoc test for Lean practices (LP)

Variable	(I) Type of Supply Chain partner.	(J) Type of Supply Chain partner.	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
SCF3	Customer	Distributor	-.29799	.21147	.496	-.8470	.2510
		Manufacturer	.40338	.20718	.213	-.1345	.9413
		Supplier	.06305	.19656	.989	-.4473	.5734
	Distributor	Customer	.29799	.21147	.496	-.2510	.8470
		Manufacturer	.70137	.23980	.020	.0788	1.3240
		Supplier	.36104	.23069	.402	-.2379	.9600
	Manufacturer	Customer	-.40338	.20718	.213	-.9413	.1345
		Distributor	-.70137	.23980	.020	-1.3240	-.0788
		Supplier	-.34033	.22677	.439	-.9291	.2484
	Supplier	Customer	-.06305	.19656	.989	-.5734	.4473
		Distributor	-.36104	.23069	.402	-.9600	.2379
		Manufacturer	.34033	.22677	.439	-.2484	.9291

5.2.4 Inventory Visibility

Based on the literature (Li et al., 2006; Li et al., 2005; Naylor et al.,1999; van Hoek et al., 1999; Beamon, 1998; Carlos Callender, 2007), three relevant practices of Inventory visibility were identified for Indian healthcare industries which improve the supply chain of Indian healthcare industry. These practices are Track on actual and accurate inventory levels, Reducing frequent use of inventory, Forecast demand and provide actual information. Respondents were asked about the level of acceptance of practice in their organization on five points Likert scale with 1- strongly disagree and 5- strongly agree. Table 5.12 shows the stakeholder wise mean and standard deviation of Inventory visibility which shows that stakeholders of Indian healthcare industries are committed to

Table 5.12 Descriptive statistics of Inventory Visibility

Items	Customer (N=61)		Distributor (N=31)		Manufacturer (N=33)		Supplier (N=39)		Overall (N=164)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
IV1(SC8)	**3.38**	1.07	3.48	1.12	3.06	0.93	3.38	1.02	3.34	1.04
IV2(SC10)	3.25	0.92	3.23	0.92	2.97	0.88	3.23	1.01	3.18	0.94
IV3(SC14)	**3.38**	1.05	**3.58**	1.18	**3.21**	1.11	**3.44**	1.21	**3.40**	1.12
IV	**3.33**	**0.98**	**3.43**	**1.02**	**3.08**	**0.94**	**3.35**	**0.98**	**3.30**	**0.98**

SC8	Keep track on actual and accurate inventory levels.
SC10	Provides excellence in reducing the frequent use of inventory.
SC14	Forecast demand and provides this information to our key suppliers.

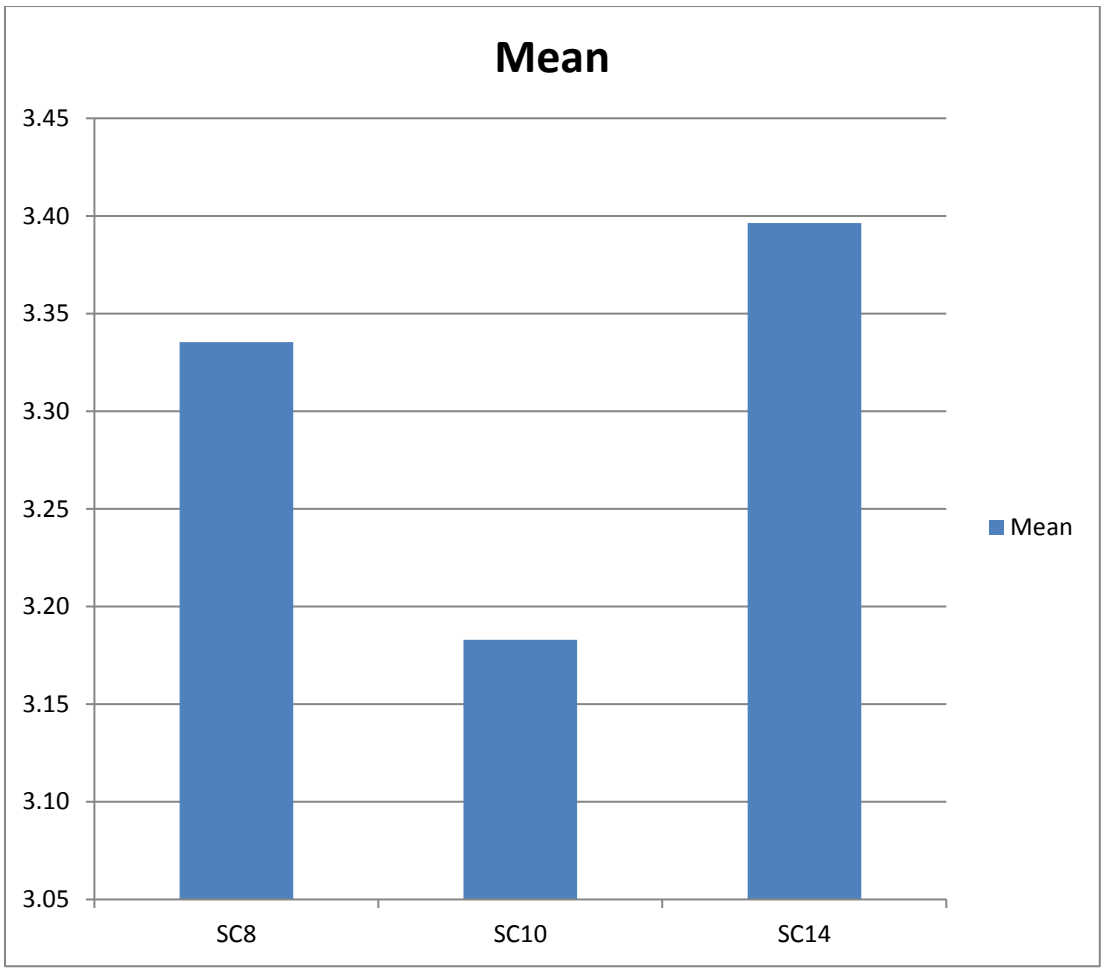

Figure 5.9 Practices of Inventory Visibility (IV)

It is clear from the Table 5.12 that Inventory Visibility is more focused on forecasting demand and providing information to key suppliers as a result indicate highest mean to IV3 of 3.40 as shown in the Figure 5.9. Apart from this, it is depicted from the Table 5.12 and Figure 5.10 that all the stakeholders (Manufacturers, Distributors, Suppliers, and Customers), are highly interested in forecasting demands and providing information to key suppliers (IV3) as an essential part of healthcare organizational development. However, Customers preferred to keep track on actual and accurate inventory levels (IV1) for improving health care organizational performance.

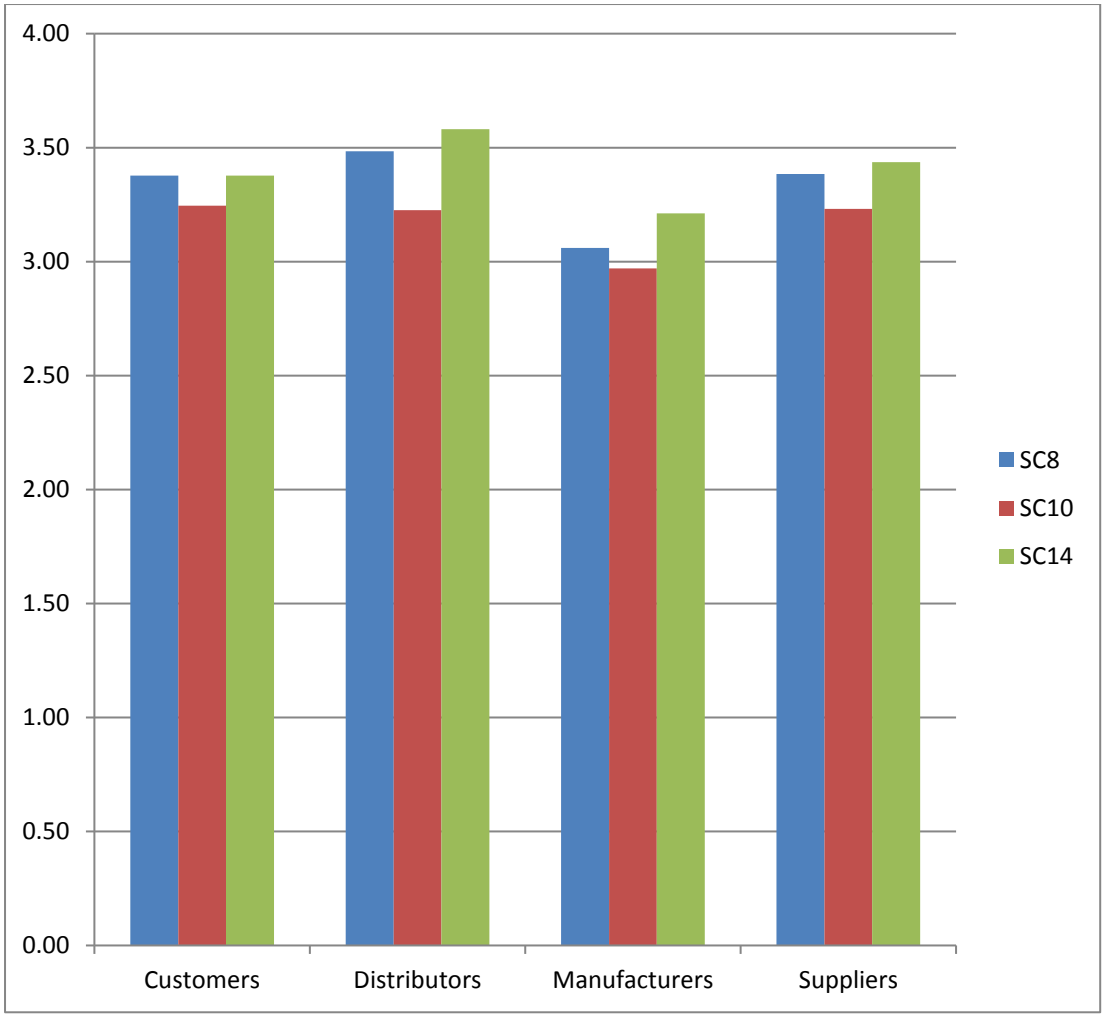

Figure: 5.10 Mean score of stakeholder's choice of practice of Inventory Visibility

Further, from the Table 5.13 by one sample T-test analysis, it is observed that the p-value of the test is 0.000 for IV1 and IV3 whereas the p-value of the test IV3 is 0.013, that is less than the near of significance 0.05. It specifies that there is a substantial difference in Inventory visibility practice. Further, from the results, it is observed that forecasting demands and providing information to key suppliers (IV3) (t=4.523) are the most significant Inventory Visibility Practice in Indian healthcare industry.

Table 5.13 One- sample T-Test for Inventory Visibility for Healthcare Organizational Performance

One-Sample Test						
Item	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
IV1	4.127	163	.000	.335	.17	.50
IV2	2.505	163	.013	.183	.04	.33
IV3	4.523	163	.000	.396	.22	.57

Table 5.14 ANOVA Test for supply chain practices for Supply chain performance.

ANOVA							
Supply Chain Practice	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Inventory Visibility	Customer	61	3.333	0.982	0.126	0.787	0.503
	Distributor	31	3.430	1.023	0.184		
	Manufacturer	33	3.081	0.936	0.163		
	Supplier	39	3.350	0.981	0.157		
	Total	164	3.305	0.979	0.076		

Table 5.14 illustrates that F statistics and associated p-value. The result shows that the value of F=2.907 at a p-value of 0.503. It is clearly observed that the p value= 0.503, is greater than the level of significance 0.05. It indicated that there is no significant difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for implementation of Inventory visibility practices. Hence, it is concluded that implementation of Inventory Visibility practices is significantly same for all the stakeholders of Indian healthcare supply chain.

5.2.5 Healthcare Supply Chain Performance

Based on the literature (Gunasekaran et al., 2004; Shepherd and Gunter, 2005; Sukati et al., 2012; Bhagwat and Sharma, 2007; Gunasekaran et al., 2003; Bhatnagar and Sohal, 2008; Vijayasarathy, 2010; Trkman et al., 2010; Deshpande, 2012; Olugu and Wong, 2009; Ou et al., 2010; Chantanapokul. et.al, 2015; Dobrzykowski et.al, 2014; Lenin.K,2014;Dobrzykowski et.al, 2009; Ozdamar& Zhang, 2008; Samuel et. al., 2009; Schneider et. al, 2012; Zheng et.al, 2006; Alain Beerens,2005; Matinelly et. al,2006; Aptel & Pourjalli, 2001; Dobrzykowski et.al, 2014; Devar, Krajewski & Wei,2007) seven relevant dimensions of performance measures were identified for Indian healthcare industries which improve the supply chain of Indian healthcare industry. These practices are Increased Overall product quality, Increased Responsiveness to customer request, Reduced Reliability in the delivery of materials, Smaller Order fulfillment lead times, Increased Flexibility of service to meet customer need, Acceptance for strategic changes in supply chain and Improved Accessibility to product supply. Respondents were asked about the level of acceptance of practice in their organization on five points Likert scale with 1- Very low and 5- very high. Table 5.15 shows the stakeholder wise mean and standard deviation of Supplier Integration.

Table 5.15 Descriptive statistics of Healthcare supply Chain performance

Items	Customer (N=61)		Distributor (N=31)		Manufacturer (N=33)		Supplier (N=39)		Overall (N=164)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SCP1	**4.03**	0.89	**4.19**	0.91	**3.85**	1.00	**3.85**	0.99	**3.98**	0.94
SCP2	3.87	1.09	3.65	1.08	3.33	1.29	3.31	1.13	3.59	1.16
SCP3	3.31	0.99	3.06	1.18	2.91	1.28	3.46	1.00	3.22	1.10
SCP4	3.44	1.27	3.42	0.96	3.00	1.20	3.31	1.20	3.32	1.19
SCP5	3.77	0.96	3.48	1.12	3.48	1.03	3.28	1.00	3.54	1.02
SCP6	3.80	0.89	3.58	1.09	3.52	1.09	3.05	1.02	3.52	1.04
SCP7	3.80	0.89	3.61	0.92	3.52	0.91	3.64	1.04	3.67	0.93
SCPF	**3.72**	**0.73**	**3.57**	**0.68**	**3.37**	**0.79**	**3.41**	**0.72**	**3.55**	**0.74**

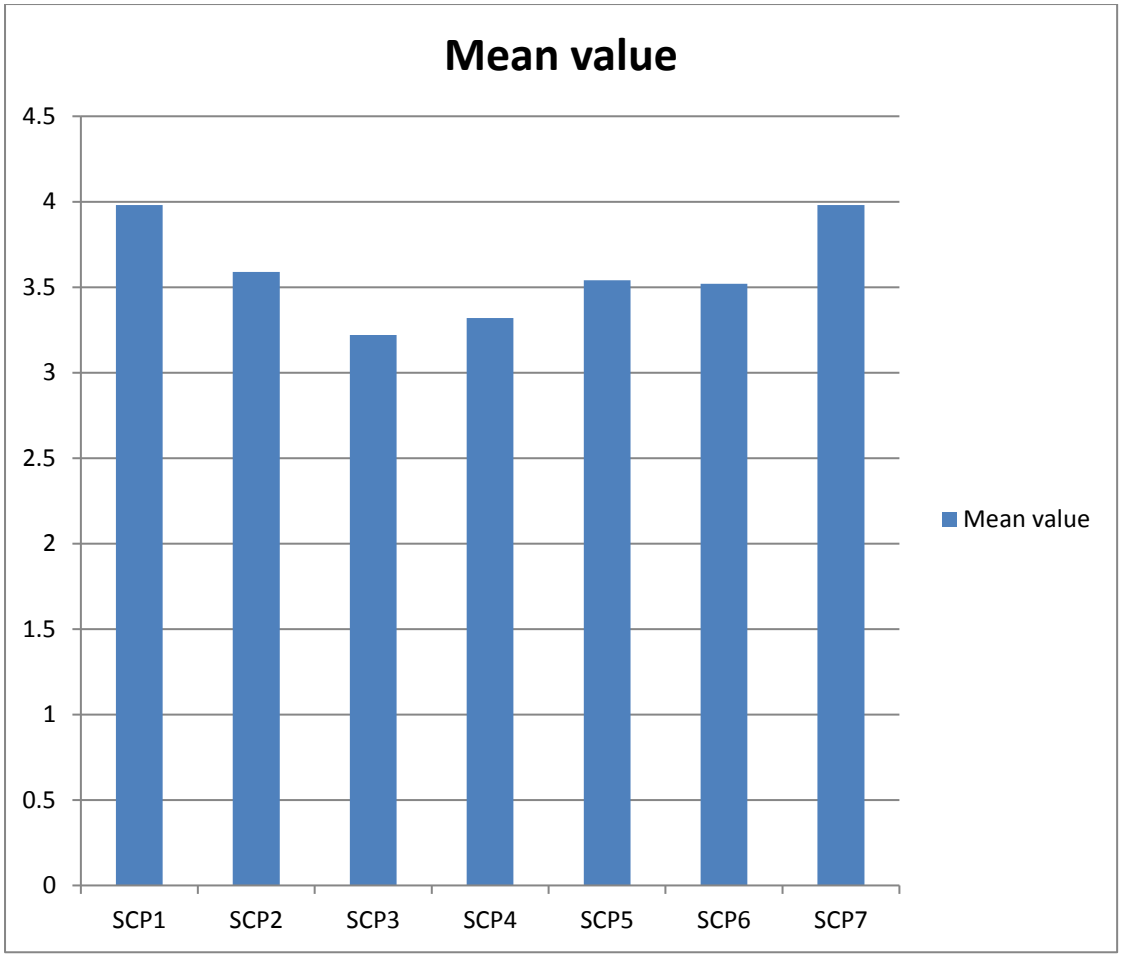

Figure: 5.11 Measures of Supply Chain Performance

It is clear from the Table 5.15 that the Healthcare supply chain performance is more focused on quality of the supply with easy accessibility of the product supply as a result indicate highest mean with SCP1 as shown in the Figure 5.10. Apart from this it is depicted from the Table 5.15 and Figure 5.12 that all the stakeholders (Manufacturers, Distributors, Suppliers, and Customers), respondents are highly interested in overall product quality (SCP1) as an integral performance dimension of health care organizational performance.

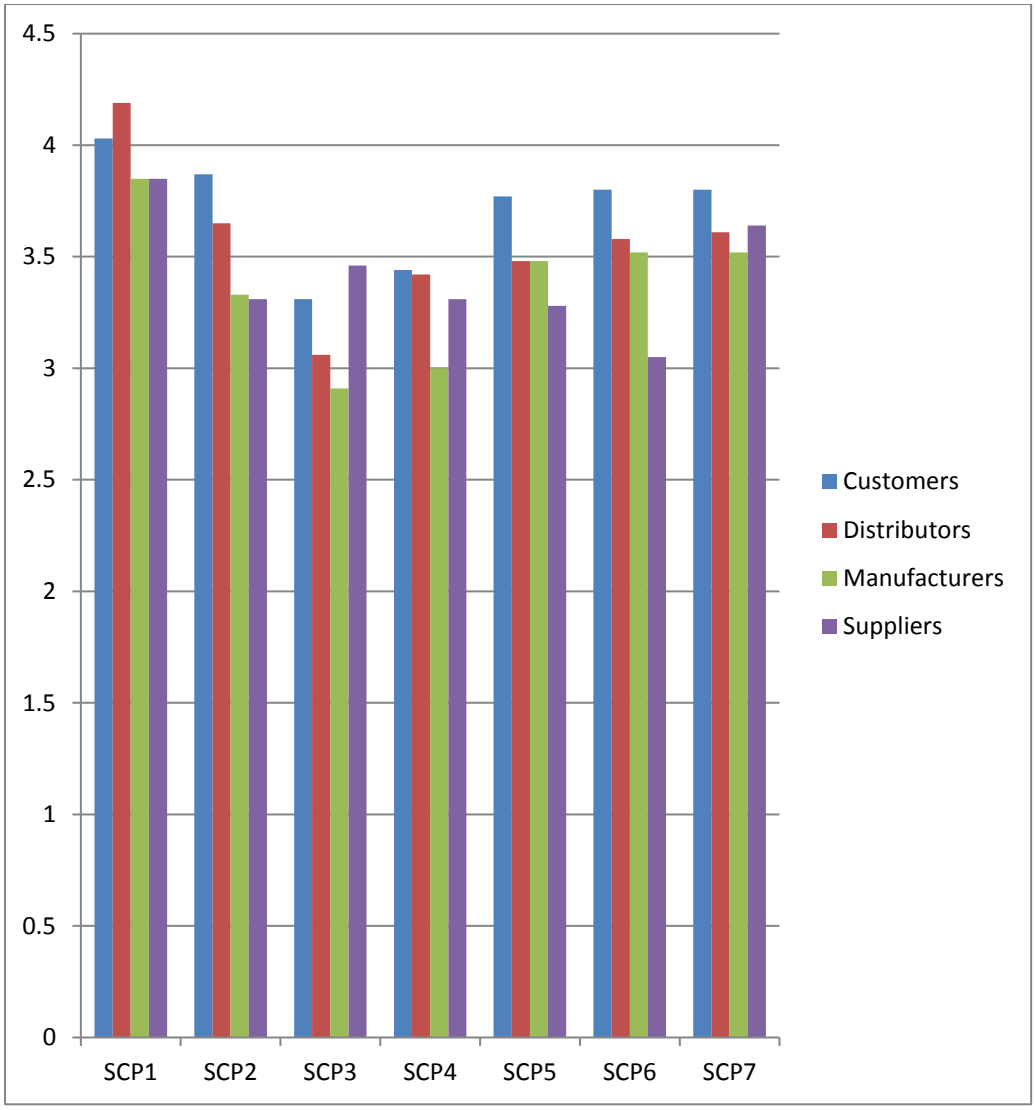

Figure: 5.12 Mean score of stakeholder's choice of Supply Chain Performance

Further, from the Table 5.16 by one sample T-test examination, it is detected that the p-value of the test is less than the level of significance 0.05. It shows that there is a significant change in Supply Chain Performance. Further, from the results, it is observed that Increased Overall product quality (SCP1) (t=13.332) is the most significant dimension of Supply Chain Performance for Indian healthcare industry.

Table 5.16 One- sample T-Test for Supply Chain Performance

One-Sample Test						
Item	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
SCP1	13.332	163	.000	.982	.84	1.13
SCP2	6.485	163	.000	.585	.41	.76
SCP3	2.550	163	.012	.220	.05	.39
SCP4	3.422	163	.001	.317	.13	.50
SCP5	6.791	163	.000	.543	.38	.70
SCP6	6.483	163	.000	.524	.36	.68
SCP7	9.196	163	.000	.671	.53	.81

Table 5.17 ANOVA Test for supply chain practices for Supply chain performance.

ANOVA							
Dimension	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Supply Chain Performance	Customer	61	3.719	0.734	0.094	**2.190**	**0.091**
	Distributor	31	3.572	0.677	0.122		
	Manufacturer	33	3.372	0.791	0.138		
	Supplier	39	3.414	0.721	0.115		
	Total	164	3.549	0.740	0.058		

Table 5.17 illustrates that F statistics and associated p-value. The result shows that the value of F=2.190 at a p-value of 0.091. It is clearly observed that the p value= 0.091, is greater than the level of significance 0.05. It indicated that there is no significant difference between the stakeholders (Manufacturers, Distributors, Suppliers, and Customers) for Supply Chain Performance. Hence, it is concluded that Supply Chain Performance measures are significantly same for all the stakeholders of Indian healthcare supply chain.

5.2.6 Healthcare Organizational Performance

Based on the literature, (Ou et al., 2010; Hsu et al., 2007; Lin et al., 2004; Li et al., 2006; Kristal et al., 2010; Deshpande, 2012; Kannana and Tan, 2004; Tan et al., 1998; Hsu et al., 2009; Yang and Su, 2009; Tan 2002; Cook et al., 2010; Ellinger et al., 2012; Koh et al., 2007; Qrunfleh and Tarafdar 2012) four relevant dimensions of organizational performance were identified for Indian healthcare industries which improve the supply chain effectiveness of Indian healthcare industry. These practices are Customer Satisfaction, Return on investment, Improved Resource Utilization & Improved cost of service. Respondents were asked about the level of acceptance of practice in their organization on five points Likert scale with 1- Very low and 5- very high. Table 5.18 shows the stakeholder wise mean and standard deviation score.

Table 5.18 Descriptive statistics of Healthcare Organizational Performance

Descriptives: Type of Supply Chain partner										
Item/variables	Customers (N=61)		Distributors (N=31)		Manufacturers (N=33)		Suppliers (N=39)		Overall (N=164)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
OP1	**4.11**	1.03	3.87	1.02	3.76	1.06	**3.72**	1.02	**3.90**	1.04
OP2	3.79	0.97	3.81	1.05	3.36	1.06	3.59	0.97	3.66	1.01
OP3	3.80	0.95	3.74	0.93	3.55	1.12	3.46	0.88	3.66	0.97
OP4	3.98	0.97	**4.03**	0.84	**3.88**	0.78	3.64	1.06	3.89	0.94
OPF	**3.92**	**0.66**	**3.86**	**0.66**	**3.64**	**0.67**	**3.60**	**0.76**	**3.78**	**0.70**

OP1	Customer Satisfaction
OP2	Return on investment
OP3	Improved Resource Utilization
OP4	Improved cost of service

It is clear from the Table 5.18 that Healthcare Organizational Performance is focused on Customer Satisfaction as a result indicate highest mean to OP1 of 3.90 as shown in the Figure 5.13. Apart from this it is depicted from the Table 5.18 and Figure 5.13 that in all the stakeholders (Manufacturers, Distributors, Suppliers, and Customers),

Customers and Suppliers are highly interested in Customer Satisfaction (OP1) as an integral part for achievement of healthcare organizational performance whereas Manufacturers and Distributors are interested in Improved cost to service (OP4) as an integral part of achievement of healthcare organizational performance.

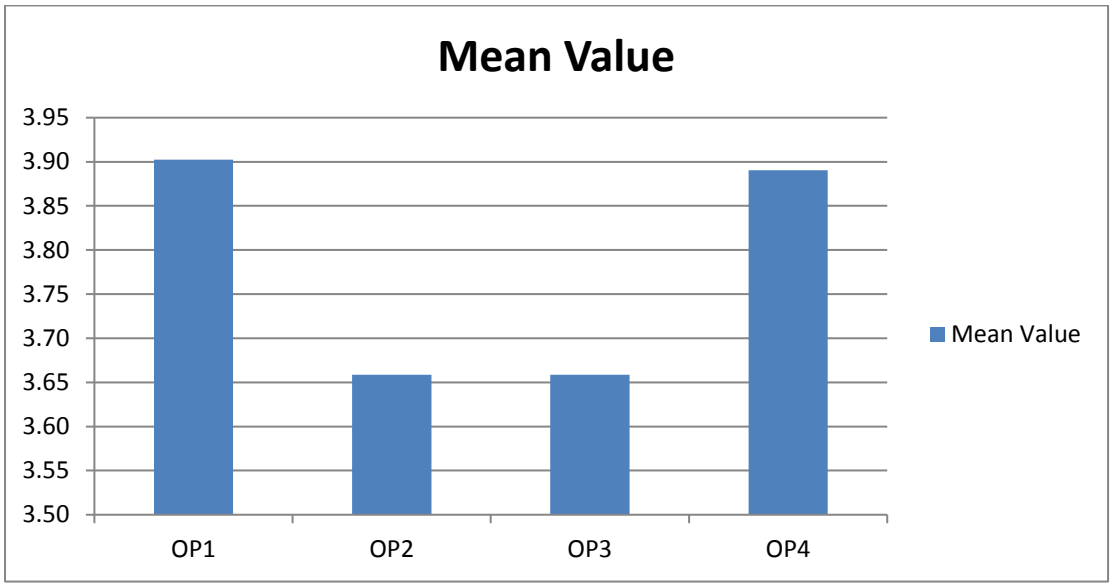

Figure: 5.13 Measures of Organizational Performance

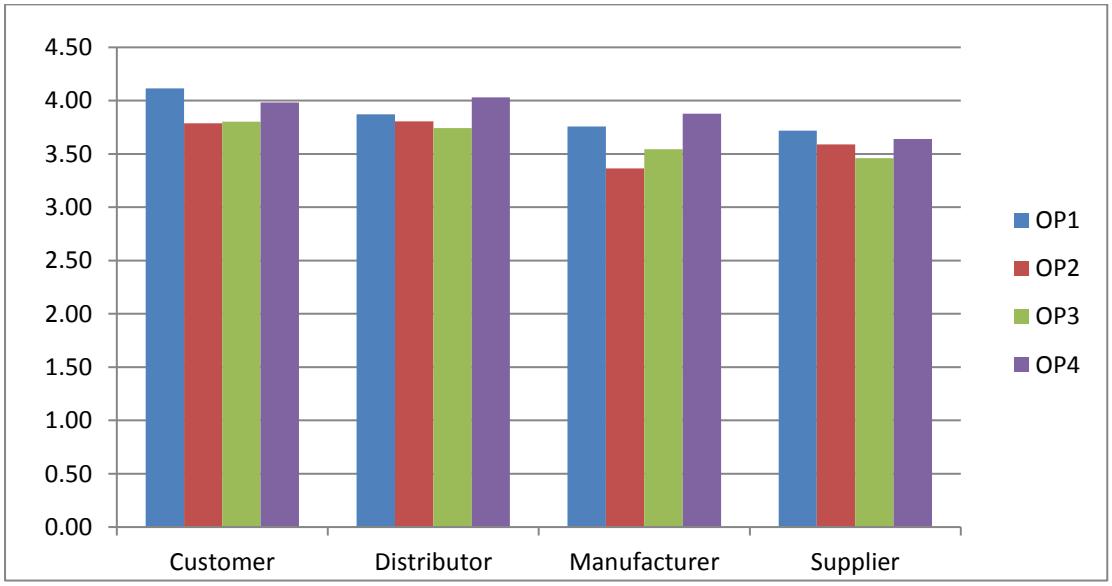

Figure 5.14 Mean score of stakeholder's choice of Organizational Performance

Further, from the Table 5.19 by one sample T-test analysis, it is observed that the p-value of the examination is 0.000, which is less than the level of significance 0.05. It indicates that there is a significant difference in Inventory visibility practice. Further, from the results, it is observed that forecasting demands and providing information to key suppliers (OP4) (t=12.128) and OP1 (11.108) are the most significant measure for Organizational Performance in Indian healthcare industry.

Table 5.19 One- sample T-Test for Supply Chain Performance

One-Sample Test						
Item	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
OP1	11.108	163	.000	.902	.74	1.06
OP2	8.385	163	.000	.659	.50	.81
OP3	8.708	163	.000	.659	.51	.81
OP4	12.128	163	.000	.890	.75	1.04

Table 5.19 illustrates that F statistics and associated p-value. The result shows that the value of F=2.360 at a p-value of 0.074. It is clearly observed that the p value= 0.074, is greater than the level of significance 0.05. It indicated that there is no significant change between the investors (Manufacturers, Distributors, Suppliers, and Customers) for Supply Chain Performance. Hence, it is concluded that Organizational Performance measures are significantly same for all the stakeholders of Indian healthcare supply chain.

Table 5.20 ANOVA Test for Organizational performance

ANOVA							
Dimension	Stakeholders	N	Mean	SD	Standard Error	F Value	P Value
Organizational Performance	Customer	61	3.922	0.661	0.085	2.360	0.074
	Distributor	31	3.863	0.664	0.119		
	Manufacturer	33	3.636	0.671	0.117		
	Supplier	39	3.603	0.760	0.122		
	Total	164	3.777	0.697	0.054		

5.3 SUMMARY

This chapter discussed the stakeholder wise comparative analysis of supply chain practices, supply chain performance measures, and healthcare organizational performance measures. The study found significant Supply chain practices, supply chain performance measures and organizational performance in Indian healthcare industries. The result suggests that the customers or end users are highly aware of supply chain practices to improve healthcare organizational performance regarding customer satisfaction.

Indian healthcare industries have initiated certain practices of healthcare organizational performance including SI, TMC, LP, and IV but from the results, it is found that Supplier Integration practices are highly adapted by the Indian healthcare industries. From the Figure 5.1 it is clear that all the stakeholders of healthcare supply chain are most conscious about Top Management Commitment practice with mean value of **3.95** however the manufacturers of healthcare equipment and devices in the healthcare supply chain are more conscious about practicing supplier integration as a significant supply chain practice with mean value of **3.75** as compared to other stakeholders. Further, from Table: 5.1 it is clear that Customers, Distributors, and Suppliers also focus and implement Supplier integration practice with a mean value of 4.04, 3.83 & 3.73 respectively. Thus, it may be concluded from the above table that Supplier Integration and Top Management practices are of major concern in healthcare supply chain.

This is because that one of the informal and most operative ways to maximize quality, decrease costs and less time to market of medical device supply chain which could be achieve by integrating and stabling various suppliers.

The next chapter provides in-depth study of medical devices and equipment supply chain of Indian healthcare industries through case studies. Case studies for this research have been taken from two renowned hospitals and are discussed in the next chapter.

6.1 INTRODUCTION

To develop and improve the conceptual framework discussed in previous chapters, a case study approach was employed. Case study method enables a researcher to intimately examine the data within a specific context. In this chapter two hospitals are taken for case studies with the aim that they will lead to a better understanding of the implementation of supply chain practices in Indian Healthcare Industries and will help to answer research questions of the study. The selection of case hospitals were based on two criteria. Firstly, permission from hospital management for detailed study and secondly the geographical location of the case hospitals. The two selected case hospitals were located in the close proximity of the researcher.

From past literature, Case study research is used as an exploration and understanding of complex issues in the more comprehensive way (Dangayach & Deshmukh, 2001; Bartlett & Trifilova, 2010; Wang et al., 2015). Further, Case study is documented as a tool in many social science studies, the role of case study method in research becomes more significant when issues about education Gulsecen & Kubat, (2006). Case study approach uses both qualitative and quantitative methods with an aim to understand the developed hypothesis. Also, Eisenhardt (1989) suggested various advantages of Case study research as:

- Case study method is responsible for the intensive study of a unit. It is the investigation and exploration of an event thoroughly and deeply.
- Case study method is precious in constantly analyzing the life of a social unit to dig out the facts.
- Case study method provides grounds for generalization of data for illustrating statistical findings.

- Case study approach helps to find the deviant cases which behave against the proposed hypothesis.
- It provides a broad, holistic pattern of the phenomenon in real-world settings.

Apart from some advantages, some researchers discussed some limitations of Case study method. A Hamel (1993) observes that the application of case study approach is restricted because of its lack of representativeness and its lack of firmness in the collection, construction, and analysis of the empirical materials. Further limitations engage the issues of dependability, validity, and generalizability. Case study research is also subjected to multiple methods, tools, lack of control and conceptual complicacies.

6.2 CASE STUDY METHODOLOGY

A case study is a complete study of a societal unit, be it a person, a group of persons, an institution, society or a family. It is a method of exploring and analyzing the life of a social unit. In this research, two cases were developed from two hospitals. These hospitals are studied for various supply chain practices such as Supplier Integration, Top Management Commitment, Lean Practices and Inventory Visibility and some performance measures such as Supply Chain Performance Measures and OP.

For a Case Study to be effective and useful the stepwise case development methodology is proposed as shown in Figure 6.1. There are seven major steps in a case study. These steps are categorized as:

1. Background
2. Problem
3. Vision/Objective
4. Proposed Solution
5. Implementation
6. Results
7. Learning

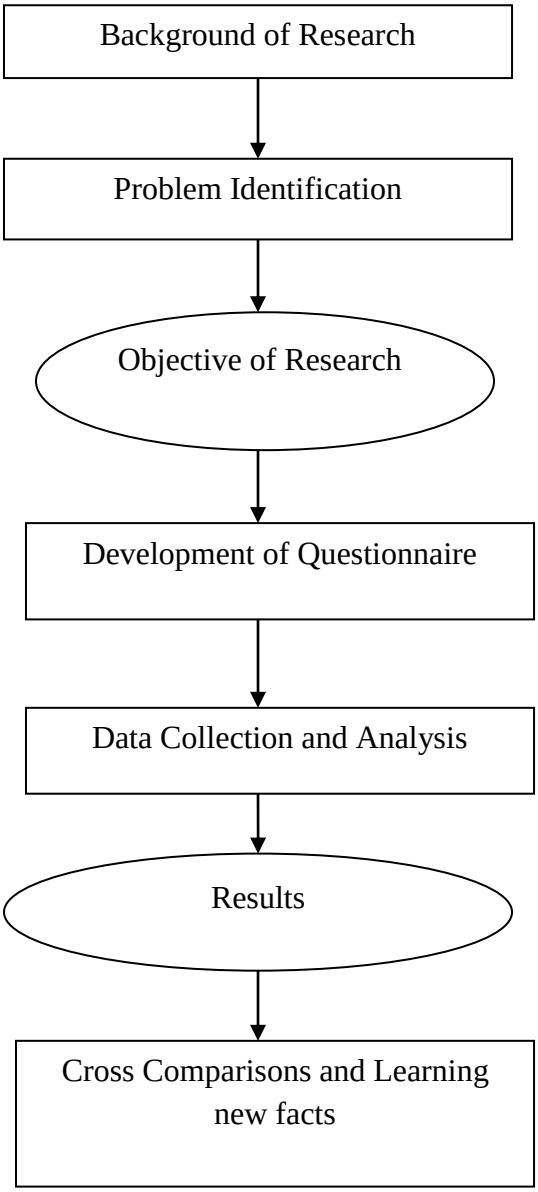

Figure 6.1 Case Methodology

In first step brief explanation describing the situation of the organization is analyzed enough for anyone to understand the case study in the right context. It clearly articulates the problem identified in the research. The objective of this stage is to get an in-depth understanding of supply chain, various supply practices in various hospitals. The second step of the methodology is to identify the problem and selection of cases. In this study, two hospitals are selected for a better explanation of the hypothesis through cross-case analysis. The third step the basic objective of the study

is formulated based on the assessment of real practice. The next step includes proposed solution by framing case questionnaire. The implementation of the solution is made by a questionnaire which includes measured supply chain practices and performance measures to obtain best responses. The sixth step includes results through data collection and evaluation process. For data collection author visited both the case hospitals twice or thrice to understand the supply chain, various suppliers, and implementation process of supply chain practices of the hospital management. The data collection process involved interviews with Directors, Chief Medical officer, Hospital Superintendent, doctors, Store In-charges. The analysis for this study started with processing and analyzing interview data. The findings of the case studies were discussed, and observations were made. Finally, a cross-comparison was conducted among the selected hospitals to assure the generalizability of the findings. For better understanding, the results of survey and case studies were also compared with the earlier studies.

6.3 CASE HOSPITALS

6.3.1 CASE 1: ABC Hospital

Hospital ABC is a leading hospital in Jaipur, Rajasthan. Hospital ABC is a part of an integrated world-class healthcare facility. We endeavor to go beyond the expected and deliver the most positive experience to each of our patients. In this attempt of ours, we are backed by most recent equipment, skilled and extremely qualified medical professionals, who manage the best-available medical services across all major disciplines of medicine and surgery.

This hospital was recognized in December-1990 to fulfill the growing need for the private sector. The hospital has clean, green and hygienic surroundings. The hospital provides healthcare from the smallest to the most complex medical problems-services that are curative and preventive, to both national and international patients.

Hospital is supported by extremely qualified and expert specialists, super specialists, nursing staff of paramedics with all supportive services like laboratory, X-ray,

Ultrasound, Ambulances (Critical Care) and facilities such as: Intensive Neonatal Care Unit, Advanced Transfusion, Plasma Pheresis, Management of Acute Renal Failure, Cancer Surgery & Chemotherapy, Rigid bronchoscopy for removal of foreign body etc.

6.3.1.1 Vision and Mission

To be the most dependable health care supplier in society with best medical skills carried with state of the art for ornamental the quality of life of present and upcoming generations.

To deliver quality care with Highest Concern, Greatest Compassion, Latest technology by the finest team.

6.3.2 CASE 2: XYZ Hospital

XYZ Hospital & Research Institute is a State of the art proposed 300 bedded, super specialty hospital located at prime location of Jaipur, India, spread over more than 12,500 Sq. Meter area with an aim to provide Best possible healthcare solutions at reasonable price. Tagore Hospital was inaugurated on 31st March 2006. The hospital has a well-equipped Intensive Care Unit (ICU). It is air-conditioned with Ventilators, Latest monitors, Infusion pumps, Pulse oximeter, the Centralized supply of oxygen, etc. The hospital also has most modern Neonatal Intensive Care Unit (NICU). There are well-equipped modular Operation Theatres, Suction lines, Compressed air, and nitrous oxide lines round the clock supply.

XYZ hospital has well-furnished wards and rooms with all supportive facilities. The hospital has other auxiliary services like High tech laboratory and diagnostic center, CT Scan, Digital X-ray, Critical care and emergency facilities. The hospital has major super specialties departments such as Orthopedic, Neurology, Plastic & Cosmetics, Dermatology, etc.

Hospital believes in providing international standards of medical care at an affordable cost with an emphasis on making the patient a partner in treatment.

6.3.2.1 Vision and Mission

- To be the principal healthcare organization providing competent and cost-effective healthcare solutions with a compassionate approach.
- To deliver high quality & cost efficient medical service to all with a personal touch.

6.4 CASE ASSESSMENT

An assessment of supply chain practices and its impact on healthcare organizational performance is discussed in this section. The discussion was made during a hospital visit with different stakeholders of the supply chain of the hospital ABC and hospital XYZ such as prominent suppliers, Doctors, Store in charge, Nurses and staff, Technicians. It is concluded that partial adoption of supply chain practices is done, and major concern is to make a long-term relationship with their suppliers. Further, the results of discussions are shown in next sections.

6.4.1 Supplier Integration

The assessment of Supplier integration for healthcare supply chain in the ABC and XYZ hospitals is illustrated in Table 6.1. The perceptions of different stakeholders of the company for various practices of supplier Integration is collected on five points Likert scale.

The Table 6.1 depicts that the topmost implemented Supplier Integration practices for hospital ABC and hospital XYZ is that both hospitals promote little or no expediting (SI3) and emphasis on updating and informing their key suppliers about events or changes related to financial, research, design, and strategy (SI2). The case hospital ABC and case hospital XYZ validate the survey results. The overall mean of survey and case hospitals ABC and XYZ for Supplier Integration practices can be very clearly seen in Radar chart in Figure 6.2.

Table 6.1 Assessment of Supplier Integration

SI		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
SI1	Improved information sharing with suppliers and customers.	2.63	3.45	3.06
SI2	Our company and our key suppliers keep each other informed about events or changes related to financial, research, design, strategy, etc.	3.01	3.26	3.17
SI3	Promotes little or no expediting.	3.30	3.45	3.51
SI4	Promotes supplier to manage inventory on their behalf. (VMI system)	3.01	3.16	2.94

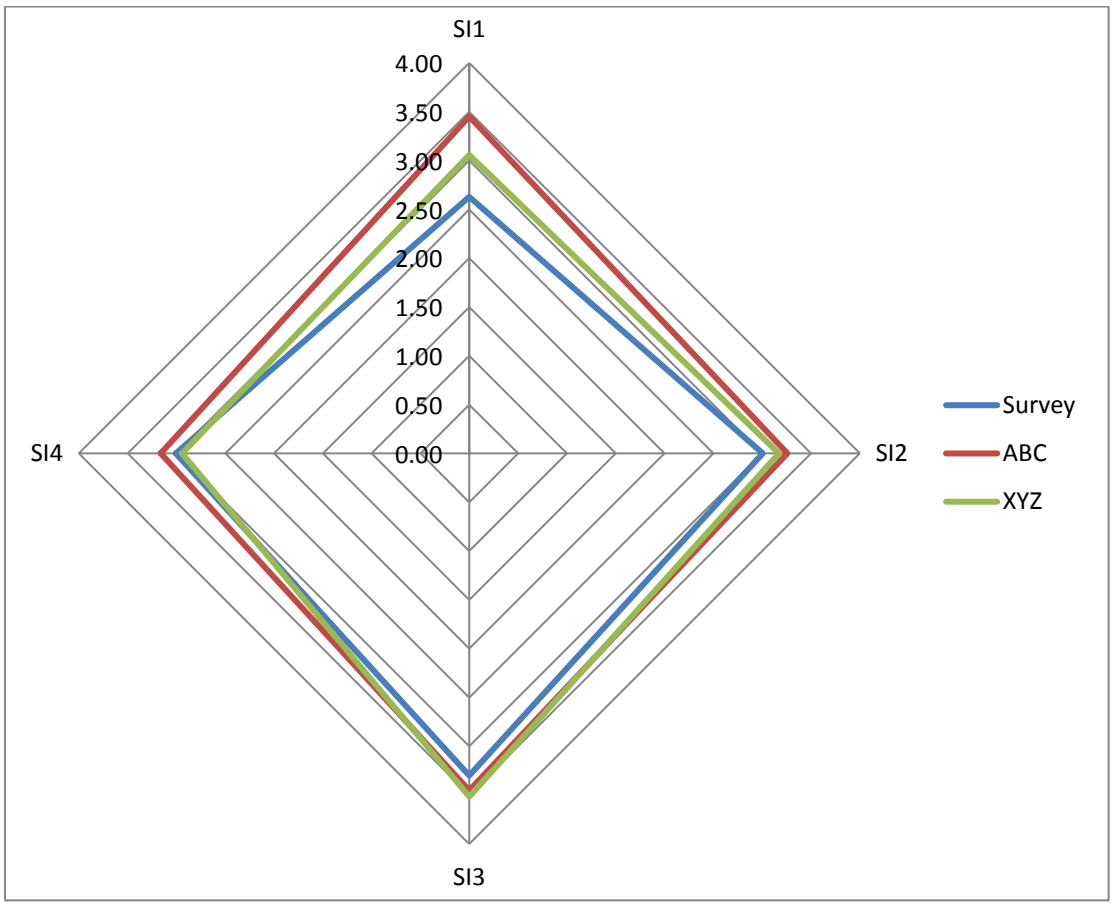

Figure 6.2 Assessment of Supplier Integration

6.4.2 Top Management Commitment

The assessment of Top management commitment for healthcare supply chain in the ABC and XYZ hospitals is illustrated in Table 6.2. The perceptions of leaders of the hospitals for various practices of top management commitment are collated in five-point Likert scale.

Table 6.2 Assessment of Top Management Commitment

TMC		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
TMC1	Promotes a small number of high-quality suppliers.	3.91	3.77	3.94
TMC2	Establishes long-term relationship with our suppliers.	3.86	3.74	4.00
TMC3	Top management is committed to supplying chain performance.	3.93	3.81	3.91
TMC4	Continuous commitment to providing high-quality products and services.	3.82	3.94	3.71
TMC5	Top management is proactive and systematic in the supply chain management.	3.81	3.48	3.86

The Table 6.2 depicts that the topmost Top management commitment practices for the survey stakeholders is the commitment of top management for supply chain performance (TMC3), and promotion for a small number of high-quality suppliers (TMC1). It is also

depicted from the table that the most important practice for case hospital ABC is its continuous commitment in providing high-quality products and services (TMC4) and commitment of top management for supply chain performance (TMC3). Whereas, the most important practice for case hospital XYZ is to establish a long-term relationship with our suppliers (TMC2) and promotion for a small number of high-quality suppliers (TMC1). Thus, the case hospital ABC and case hospital XYZ partially validate the survey results. The overall mean of survey and case hospitals ABC and XYZ for Supplier Integration practices can be very clearly seen in Radar chart in Figure 6.3.

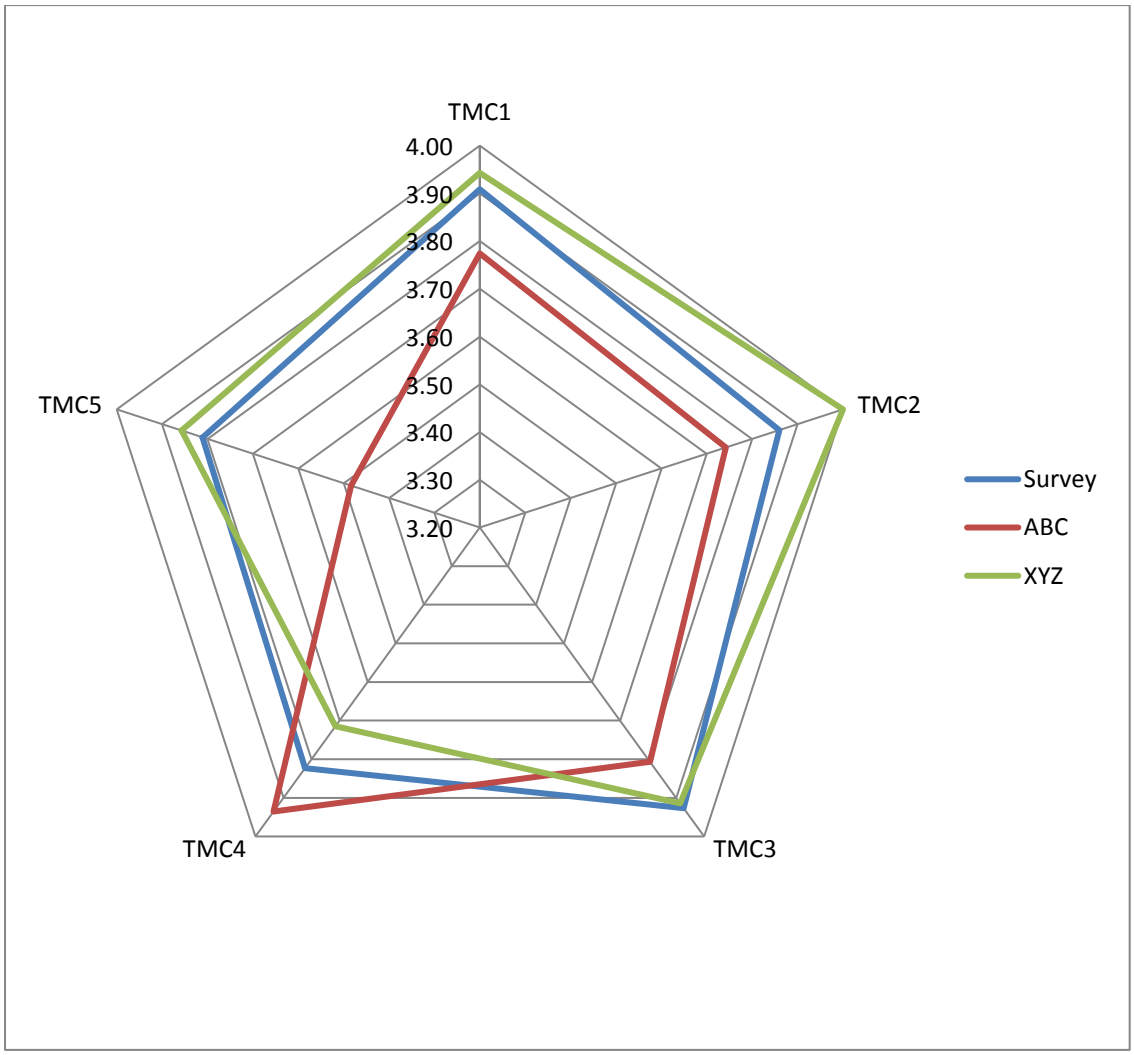

Figure 6.3 Assessment of Top Management Commitment

6.4.3 Lean Practices

The assessment of Lean Practices (LP) in the healthcare industry is illustrated in Table 6.3. The data was collected through the hospital survey and interviews with Purchase managers, major suppliers, Doctors, Store in charges for all the items of Lean Practices on the five-point Likert scale.

Table 6.3 Assessment of Lean Practices

LP		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
LP 1	Strives to maintain a high level of emergency supplies of critical items.	3.79	3.68	3.71
LP 2	Strive for eliminating duplicate processes and unnecessary procedures.	4.09	3.74	4.00
LP 3	Emphasis on improving the utilization of available equipment and facilities.	4.04	3.84	4.31
LP 4	Promotes right product at the right time.	3.87	3.77	3.94

The Table 6.3 depicts that the topmost Lean practices for the survey stakeholders are to strive for eliminating duplicate processes and unnecessary procedures (LP2) and to Emphasis on improving the utilization of available equipment and facilities (LP3).

In case of case hospital ABC the topmost Lean Practice is to Emphasis on improving the utilization of available equipment and facilities (LP3) and to Promote right product at the right time (LP4). This depicts that the case hospital ABC partially validates the survey results. Further, in case of case hospital XYZ the topmost Lean Practice is to

Emphasis on improving the utilization of available equipment and facilities (LP3) and to strive for eliminating duplicate processes and unnecessary procedures (LP2). Thus, the case hospital XYZ validates the survey results. The overall mean of survey and case hospitals ABC and XYZ for Supplier Integration practices can be very clearly seen in Radar chart in Figure 6.4.

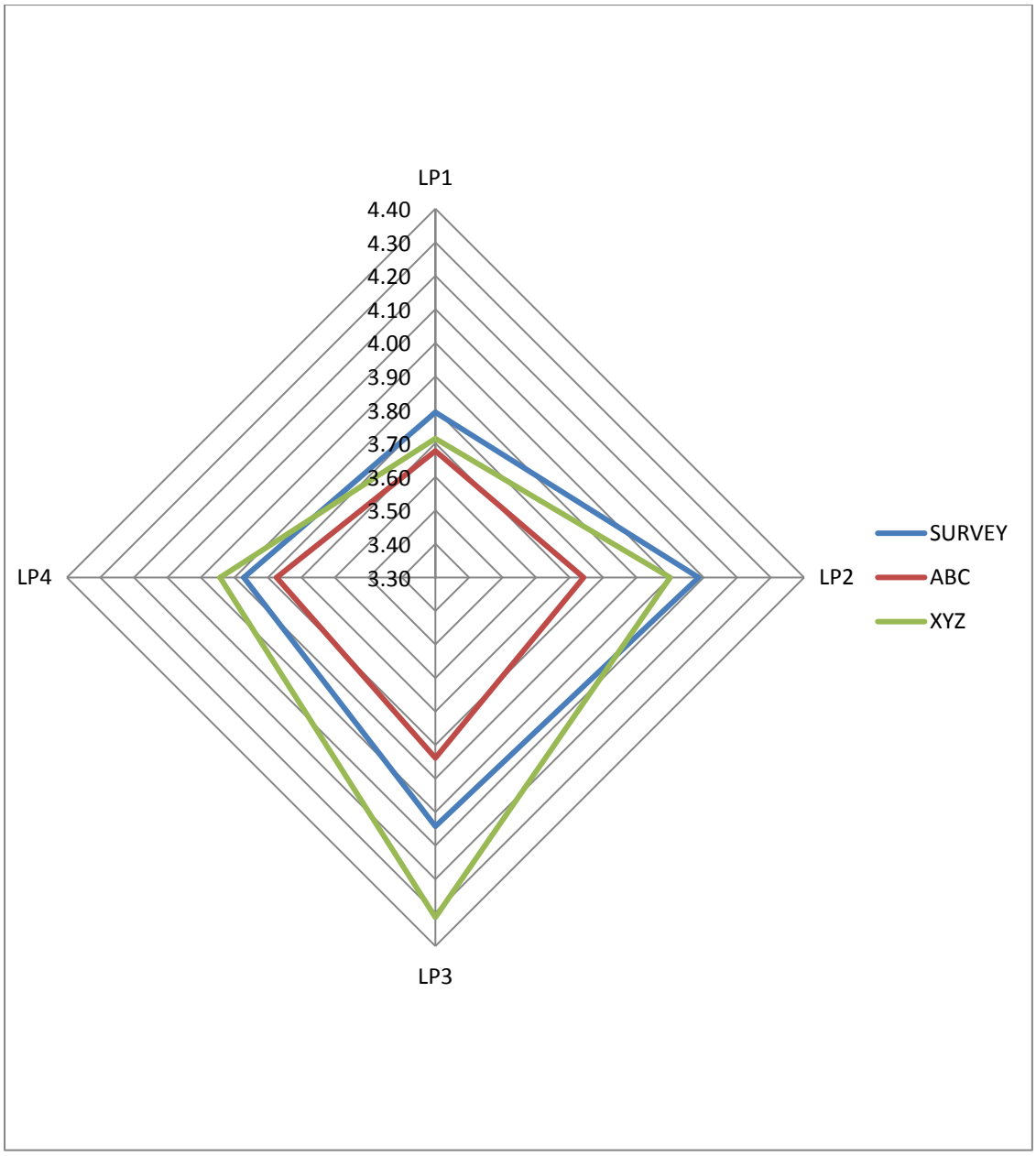

Figure 6.4 Assessments of Lean Practices

6.4.4 Inventory Visibility (IV)

The assessment of Inventory Visibility (IV) in the healthcare industry is illustrated in Table 6.4. The data was collected through the hospital survey and interviews with Purchase managers, major suppliers, Doctors, Store in charges for all the items of Inventory Visibility on the five-point Likert scale.

Table 6.4 Assessment of Inventory Visibility

IV		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
IV 1	Keep track on actual and accurate inventory levels.	3.34	3.18	3.40
IV 2	Provides excellence in reducing the frequent use of inventory.	3.65	3.58	3.23
IV 3	Forecast demand and provide this information to key suppliers.	3.17	3.60	3.49

The Table 6.4 depicts that the topmost Inventory Visibility practices for the survey stakeholders are to strive to provide excellence in reducing the frequent use of inventory (IV1). Whereas, in case of case hospital ABC and case hospital XYZ the topmost Inventory Visibility Practice is to Forecast demand and provide this information to key suppliers (IV3). Thus, the case hospital XYZ validates the survey results. The overall mean of survey and case hospitals ABC and XYZ for Supplier Integration practices can be very clearly seen in Radar chart in Figure 6.5.

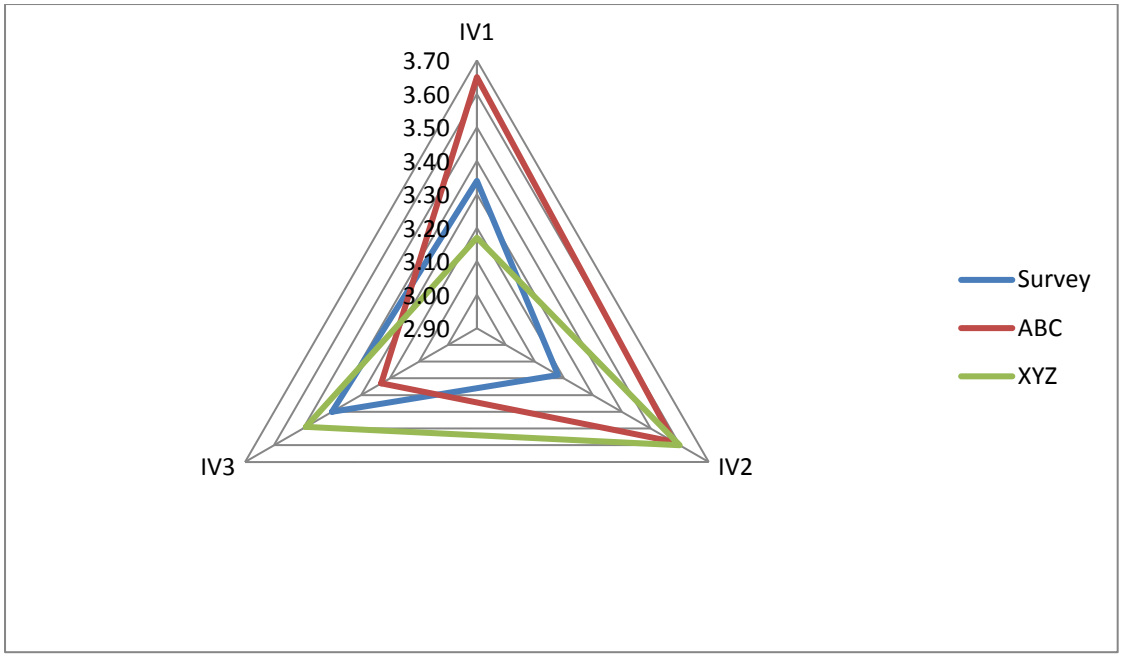

Figure 6.5 Assessment of Inventory Visibility Practices

6.4.5 Supply Chain Performance measures (SCP)

The assessment of Supply Chain Performance measures in hospitals is illustrated in Table 6.5 The data was collected through the hospital survey and interviews of senior managers, distributors, major suppliers, Doctors for all the seven items of supply chain performance on the five-point Likert scale (1-Very Low to 5- Very High).

Table 6.5 depicts that the topmost supply chain performance measures for the survey stakeholders are Increased Overall product quality (SCP1) (3.98), Improved Accessibility of product supply (SCP7) (3.67) and Increased Responsiveness to customer requests (SCP2) (3.58).

In case of case hospital, ABC the topmost supply chain performance measures are Increased Overall product quality (SCP1) (4.48), Increased Responsiveness to customer requests (SCP2) (4.29) and Improved Accessibility of product supply (SCP7) (4.16). This depicts that the case hospital ABC validates the survey results. Further, in case of case hospital XYZ the top most supply chain performance measures is Increased Responsiveness to customer requests (SCP2) (4.29), Increased Overall product quality (SCP1) (4.23) and Increased Flexibility of service to meet customer need (SCP5) (4.11). Thus, the case hospital XYZ partially validates the survey results.

The overall mean of survey and case hospitals ABC and XYZ for Supply Chain Performance (SCP) can be very clearly seen in Radar chart in Figure 6.6.

Table 6.5 Assessment of Supply chain performance (SCP)

SCP		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
SCP 1	Increased Overall product quality.	3.98	4.48	4.23
SCP 2	Increased Responsiveness to customer requests.	3.59	4.29	4.29
SCP 3	ReducedReliability in the delivery of materials.	3.21	3.74	3.74
SCP 4	Smaller Order fulfillment lead times.	3.31	3.94	3.80
SCP 5	Increased Flexibility of service to meet customer need.	3.54	4.03	4.11
SCP 6	Acceptance of strategic changes in the supply chain.	3.52	4.13	3.74
SCP 7	Improved Accessibility of product supply.	3.67	4.16	3.80

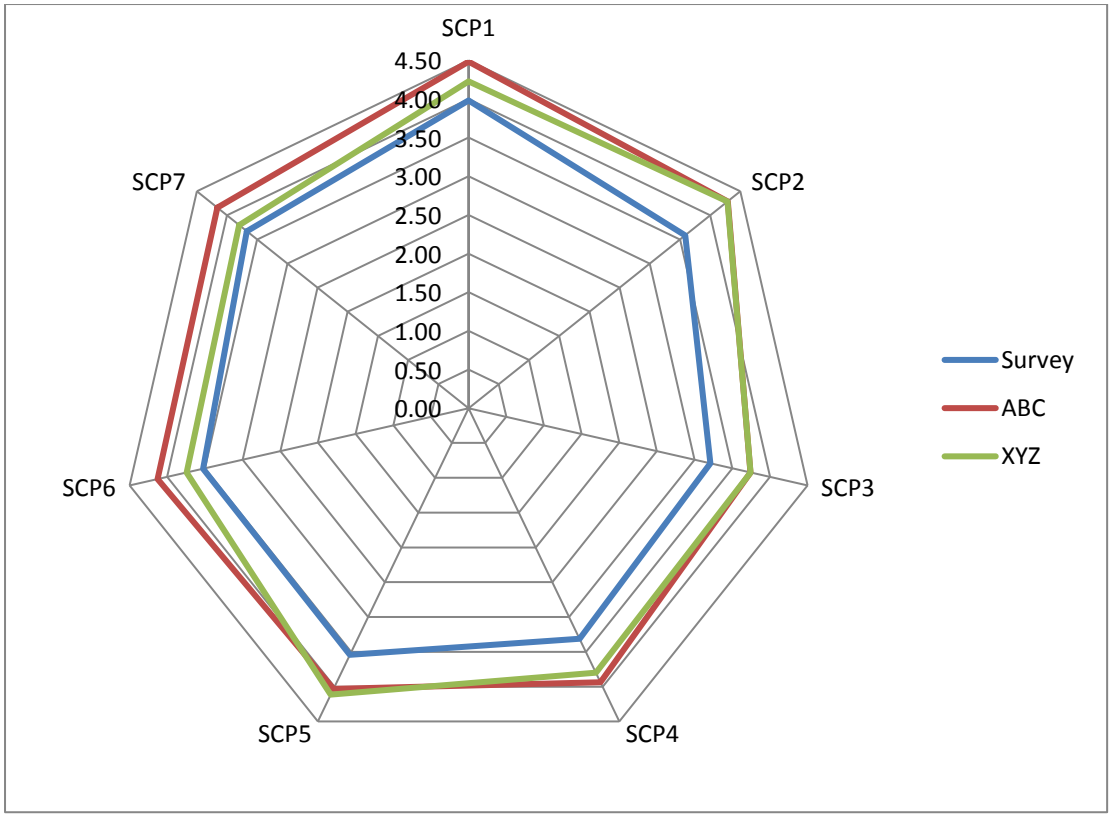

Figure 6.6 Assessments of Supply Chain Performance Measures.

6.4.6 Organizational Performance

The assessment of Organizational Performance for healthcare supply chain in the ABC and XYZ hospitals is illustrated in Table 6.6. The perceptions of leaders of the hospitals, senior managers, directors were collected for various practices of Organizational Performance are collated in five-point Likert scale.

Table 6.6 Assessment of Organizational Performance measures

OP		Survey (Overall Mean)	Hospital ABC (Overall Mean)	Hospital XYZ (Overall Mean)
OP1	Customer Satisfaction	3.90	4.26	4.17
OP2	Return on Investment	3.66	3.94	4.00
OP3	Improvement in Resource Utilization	3.66	4.26	4.03
OP4	Cost to Service	3.89	3.90	4.03

The Table 6.6 depicts that the topmost Organizational Performance measures for the survey stakeholders are Customer satisfaction (OP1) and Cost of Service (OP4).

The top most Organizational Performance measures for the case hospital ABC is Customer satisfaction (OP1) and Improvement in Resource Utilization (OP3). Whereas, the top most Organizational Performance measures for the case hospital XYZ is Customer satisfaction (OP1) and Return on Investment (OP2). Thus the case hospital ABC and case hospital XYZ partially validate the survey results. The overall mean of survey and case hospitals ABC and XYZ for Organizational Performance measures can be very clearly seen in Radar chart in Figure 6.7.

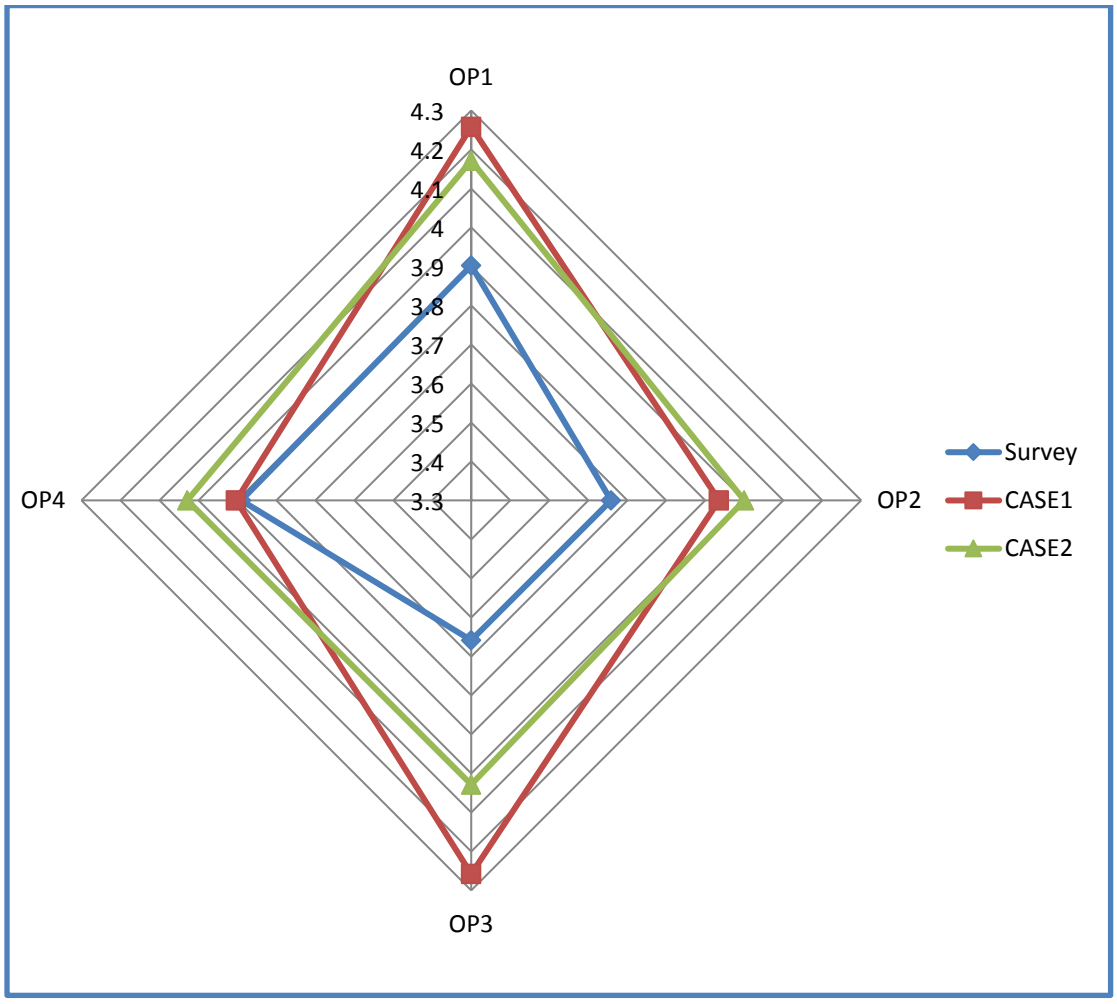

Figure 6.7 Assessment of Organizational Performance measures

6.4.7 Case Observation for Case Hospital ABC

Case Hospital ABC are backed by latest equipments, trained and highly qualified medical professionals, who administer the best-available medical services across all major disciplines of medicine and surgery. The case hospital is one of the leading ***hospitals*** of ***Jaipur***, Rajasthan. The company believes in optimizing the orders placed in order to reduce supply chain cost and improving healthcare services. The hospital has implemented Vendor Managed Inventory (VMI) for inventory control in hospital supply. The hospital uses Radio Frequency Identification (RFID) technology that connects objects to the Internet so that they can be traced, and companies can share data about them. ABC hospital a part from above practices has been committed to adopt, implement and achieve some of the following supply chain practices to improve the Organizational performance:

- JIT approach with the concept of stockless inventory systems.

- Replenishment of the product to be decided by the supplier from provided information to make sure the quantity of the product is optimal.
- The suppliers need to specify the customer demand pattern and inventory level given by the hospitals to ensure the inventory at the wholesaler is used to replenish the hospital with inventory level to overcome issues of out of stock at wholesalers.
- Standardization of medical supplies to reduce the number of contracts and transactions.
- Use of automated ordering process for calculating reorder points and quantities based on demand forecast and safety stock levels.
- Involve end customers and other providers in the product selection process through collaboration and cooperation.

6.4.8 Case Observation for Case Hospital XYZ

Case Hospital XYZ is one of the leading hospitals of Jaipur with an aim to provide better health solutions. It is a Multi-specialty hospital, providing maximum standards of care to a population around Northern India in an inexpensively feasible manner and to facilitate the research work for the newer concept in the field of medicine. The case hospital believes that implementation of integrated Supply Chain solution will provide state-of-the-art capabilities to support critical cost-saving efforts. The case hospital implemented management information system practice for monitoring and complete visibility of available inventory and other essentials in hospitals. The hospital XYZ maintains better information with their suppliers that ensure better use of resources, which are often in short supply. The hospital XYZ has implemented various supply chain practices, such as scheduled delivery networks, integrated supply chains, pay-for-performance systems, or cash-to-cash cycle time management approaches, to one or more channels (e.g., consultants, trainers, educators, change agents. A part of above practices the hospital XYZ has been committed to adopt, implement and achieve some of the following supply chain practices to improve the Organizational performance:

- Implementation of decision support systems to integrate financial, clinical and administrative information.
- Increase training on SC principles such as top management support, internal communication, information, and management system.
- Develop supplier relationship management frameworks and capabilities
- Share demand signals with supplier
- Strategic inventory management to reduce stocks by eliminating waste and reducing the administrative burden on clinical teams from supply chain activities.
- Focus on strategic supplier relationships that enable hospitals to find the right supplier, pay the right price and create partnerships for the right patient outcomes.

6.5 CROSS-CASE ANALYSIS

This study involved two hospitals for case studies to better relate and interpret the findings coming from empirical analysis. The hospitals selected for case studies show diverse characteristics on several important dimensions. Table 6.7 shows the cross-case analysis of hospitals and their respondent's profile. Hospital ABC and Hospital XYZ are privately owned hospitals using some supply chain practices.

From the cross-case analysis, it is found that the hospital XYZ has improved its Organizational Performance by improving its Supply Chain Performance through implementing various supply chain practices. From the study it is found that the hospital XYZ focuses on better information with their suppliers as compared to hospital ABC that ensure better use of resources, which are often in short supply. Therefore, it implies that in context of Indian healthcare industries implementing best supply chain practices has a positive effect on supply chain performance will, in turn, improve organization performance.

Table 6.7 Cross comparison of Hospitals and Respondent Profile

S.No.	Attributes	Hospital ABC	Hospital XYZ
1.	Type of Hospital	Privately Owned	Privately Owned
2.	No. of Beds	200 beds	350 beds
3.	Annual Turnover	approx. 1 crore	Approx 1-2 crore
4.	Major Suppliers	Epsilon, Oricare, Swastik systems, Cura, Phoneix	Respimax, Dentsply, Unique Importer, Thyrocare,
5.	Number Of Employees	>500	>1000
6.	Type of Service Provided	Multi-Specialty	Super -Specialty
7.	Respondents profile	Chief medical officer, Doctors, Directors, Technicians, Store mangers	Senior managers, Hospital In-charge, major suppliers, Doctors, , Directors, Technicians, Store mangers
8.	Existing	Joint Commission International, NABH,	NABL, NABH, ISO

Table 6.8 Cross comparison of implementation of SC practices

S.No.	Supply Chain Dimensions	Hospital ABC	Hospital XYZ
1	Supplier Integration	Improved information sharing with suppliers and customers. Promotes little or no expediting.	Promotes little or no expediting. Company and their key suppliers keep each other informed about events or changes related to financial, research, design, strategy, etc.
2	Top Management Commitment	Continuous commitment to providing high-quality products and services. Top management is committed to supplying chain performance.	Establishes a long-term relationship with their suppliers. Promotes a small number of high-quality suppliers.
3	Lean practices	Emphasis on improving the utilization of available equipment and facilities. Promotes right product at the right time.	Strive for eliminating duplicate processes and unnecessary procedures. Promotes right product at the right time.
4	Inventory Visibility	Forecast demand and provide this information to key suppliers	Forecast demand and provide this information to key suppliers

5	Supply Chain Performance	Increased Overall product quality. Increased Responsiveness to customer requests. Improved Accessibility of product supply.	Increased Responsiveness to customer requests. Increased Overall product quality. Increased Flexibility of service to meet customer need.
6	Organizational Performance	Improvement in Resource Utilization, Customer satisfaction	Improvement in Resource Utilization, Cost to service.

6.6 SUMMARY

In this chapter case studies of two hospitals were considered. The case studies were done to get in-depth knowledge of various supply chain practices and its implementation in hospitals to enhance healthcare supply chain performance which in turn enhance organizational performance. The case hospitals studied showed great awareness about supply chain performance and committed to changing themselves and adopting various supply chain practices. Forecast demand and providing better information to key suppliers and right product at the right time are practices implemented in both hospitals.

Apart from these, hospitals are motivated to implement other supply chain practices to improve supplier integration and better information sharing with their key suppliers thus become supply chain practices imperative. This supplier integration orientation is reflected regarding company's emphasis on supplier collaboration and cooperation, supplier relationship management, continuous improvement strategies, etc. Based on this hospital thorough studies and findings it is validated that with improving accomplishment of supplier integration the supply chain performance can be improved which will, in turn, improve the organizational performance of Indian healthcare industries. The hospitals are motivated for long term relationship with suppliers in terms of emphasis on supplier cooperation, vendor managed inventory, closer supplier relationship, just in time, improved resource utilization etc.

Thus base on the survey of Indian healthcare industries and case studies it can be inferred that supply chain practices is a motivation for improving performance of an organization in terms of improving its Supply chain performance. It enables a healthcare industry to satisfy its wide range of requirements to its customers through various supply chain practices such as SI, TMC, LP and IV and thus provides better service to patients in terms of customer satisfaction, resource utilization, return on investment and cost to service.

CHAPTER-7 CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

This chapter presents a summary of study's findings, conclusions, and recommendations based on the findings. The chapter further summarizes and gives suggestions for further research in the field of Supply Chain. The recommendations will help the Indian healthcare supply chain players on how they can improve the performance of Indian healthcare industries in to compete favorably in the dynamic global market.

The research is aimed at examining supply chain practices in Indian Healthcare industries, through a questionnaire survey. The main objective of this research is to gain insights of the impact of supply chain practices on organizational performance in the context of Indian healthcare industries. The specific objectives of the research were:

- To identify the importance of effective supply chain practices in the context of Indian healthcare industries through a literature survey.
- To develop a theoretical framework showing the relationship between healthcare supply chain practices and its impact on healthcare supply chain performance and ultimately its impact on healthcare organizational performance in Indian healthcare industry.
- To explore the positive link between Supplier Integration (SI) and Supply Chain Performance (SCP).
- To explore the positive link between Top Management Commitment (TMC) and Supply Chain Performance (SCP).
- To explore the positive link between Lean Practices (LP) and Supply Chain Performance (SCP).

- To explore the positive link between Inventory Visibility (IV) and Supply Chain Performance (SCP).
- To explore the relationship between Supply Chain Practices (SPs) and Supply chain Performance (SCP).
- To explore the relationship between Supply Chain Practices (SPs) and Organizational Performance (OP).
- To explore the relationship between Supply Chain Practices (SPs) and Organizational Performance (OP) with Healthcare supply chain performance as mediating effect.
- To study stakeholder wise comparative analysis of healthcare supply chain practices and its dimensions such as Top Management Commitment (TMC), Supplier Integration (SI), Lean Practices (LP) and Inventory visibility (IV).
- To develop the case study in two hospitals to closely examine the data and validate the results within a specific context.

A database of 718 stakeholders has been produced and administered through a structured questionnaire. This collective database is formed from healthcare industries, medical equipment manufacturers, distributors, and suppliers are collected from a directory of Confederation of Indian Industry (CII), (CLAA), Association of Indian Medical Device Industry (AI-MED), Indiamart e-portal, etc. Finally, 164 usable responses from a survey sample of 718 (8 through the post, 52 through the online link, 104 by personal interview) were received yields a response rate of 22.8% which is sufficient number for further analysis. Vital statistics of respondents is given in Table 7.1. Case studies of two hospitals were developed to validate the survey result.

Table 7.1 Critical statistics of respondents

S.No	Respondent Type	Questionnaire Sent	Responses Received (%)
1.	Customer	289	61 (21.1)
2.	Distributor	118	31 (26.2)
3.	Manufacturer	177	33 (18.6)
4.	Supplier	134	39 (29.10)
	Total	718	164 (22.8)

The Conclusion chapter consists of five sections. Section one presents a summary of the work done. The second section presents research findings. The third section presents this study's contribution to the existing theory. In the following section, the realistic implications of the research undertaken are explained and the limitations of the study and suggestions for future research. Finally, the chapter concludes with a brief summary.

7.2 SUMMARY OF WORK DONE

The summary of the work done is highlighted as:

- A literature survey was conducted to identify present-day research and their relevance in the Indian context. As an outcome of the survey, a comprehensive bibliography is prepared. It is expected that this bibliography will be of great use to following researchers in the field of supply chain.
- Based on the literature survey a set of research hypothesis has been developed.
- A detailed questionnaire was prepared to collect the responses of different stakeholders of the supply chain of Indian healthcare industry.

- Through analyzing the collected data various supply chain practices such as Top Management Commitment (TMC), Supplier Integration (SI), Lean Practices (LP) and Inventory visibility (IV) were identified.

- Various measures for supply chain performance such as Overall product quality, Increased Responsiveness, Reduced Reliability, Smaller Order fulfillment lead times, Increased Flexibility of service, Acceptance for strategic changes and Improved Accessibility to product supply. Whereas, various measures of organizational performance such as Customer Satisfaction, Return on investment, Resource utilization and cost of service were identified.

- The correlation analysis was carried out between the variables of the study using Pearson correlation coefficient to test whether there existed interdependency between independent variables and dependent variables.

- Multiple Linear Regression tests were practiced on the collected data. Multiple regression analysis is used for predicting the percentage of the total deviation of a continuous dependent variable by the independent variables. The results show that higher levels of SC practices have high levels of supply chain performance that lead to improved organizational performance.

- To gain inclusive knowledge of supply chain in Indian healthcare industries, two cases are developed. A methodology is proposed for case study and critical case comparison on various dimensions is made. Based on this hospital in-depth studies and findings, it is validated that with improving implementation of supplier integration the supply chain performance can be enhanced which will, in turn, improve the organizational performance of Indian healthcare industries.

7.3 SUMMARY OF FINDINGS

The study required to evaluate the contributions of supply chain management practices on Organizational Performance of Healthcare industries in India. The precise objective of the study was; to determine the contributions of supply chain practices such as Supplier Integration, Top Management Commitment, Lean Practices

and Inventory Visibility on Organizational Performance of Indian healthcare industries with a mediating effect of Supply Chain Performance. The outcomes of the findings can be summarized based on the following research objectives.

7.3.1 To examine the relationship between Supplier Integration practices and supply chain performance in Indian healthcare industry.

H1: Top Management commitment has a positive link with Supply Chain Performance.

Hypothesis H1 were formulated to determine whether there was a relationship between Supplier Integration SCM practices and the supply chain performance. Three key features of such relationship were considered that is, their strength, direction, and level of significance. Nonparametric tests, that is, Spearman correlation coefficients and Kruskal-Wallis were used respectively. Spearman's rank-order correlation coefficient ranges from -1 to +1, whereby when +1 it indicates a perfect association between variables, zero indicates no association between variables and -1 indicates a perfect negative association of variables. Kruskal-Wallis H test was used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. Thus, from the study, Kruskal-Wallis H test was used to make a comparison between responses with the high and low level of SCM practices. This means responses from 1 - "not at all" up to 3 - "to a moderate extent" were considered as the low level of SCM practices while 4 - " to a great extent" and 5 - " to a very great extent" were regarded as a high level of SCM practices.

The Spearman's correlation coefficient between Supply Chain Management practice F1 ***Supplier Integration (SI)*** and the supply chain performance is ($r = 0.666$, $p < 0.01$); this shows that there was strong, positive correlation between Supply Chain Management practice F1 ***Supplier Integration (SI) and*** the supply chain performance of Healthcare industry in India which was statistically significant. Thus

the hypothesis H1: “Supplier Integration has a positive link with Supply Chain Performance” is accepted.

7.3.2 To examine the relationship between Top Management Commitment practices and supply chain performance in Indian healthcare industry.

H2: Top Management Commitment has a positive link with Supply Chain Performance.

The Spearman's correlation coefficient between Supply Chain practice ***Top Management Commitment (TMC)*** F2 and the supply chain performance of Healthcare industry in India ($r = 0.408$, $p < 0.01$); This result indicates that there is a moderate positive relationship between Top management commitment and supply chain performance. Thus the hypothesis H2: “Top Management commitment has a positive link with Supply Chain Performance” is accepted.”

7.3.3 To examine the relationship between Lean practices and supply chain performance in Indian healthcare industry.

H3: Lean Practices have a positive link with Supply Chain Performance.

The Spearman's correlation coefficient between Supply Chain practice ***Lean practices*** F3 and the supply chain performance of Healthcare industry in India ($r = 0.371$, $p < 0.01$); This result indicates that there is a moderate positive relationship between Top management commitment and supply chain performance. Thus the hypothesis H3: “Lean Practices has a positive link with Supply Chain Performance” is accepted.”

7.3.4 To examine the relationship between Inventory Visibility and supply chain performance in Indian healthcare industry.

H4: Inventory Visibility has a positive link with Supply Chain Performance.

The Spearman's correlation coefficient between Supply Chain practice ***Inventory*** F4 and the supply chain performance of Healthcare industry in India ($r = 0.316$, $p < 0.01$); this result indicates that there is a moderate positive relationship between Top management commitment and supply chain performance. Thus the hypothesis H4: "Inventory Visibility Practices has a positive link with Supply Chain Performance" is accepted."

7.3.5 To investigate the contributions of Supply Chain Practices on Supply Chain Performance in Indian Healthcare Industries.

H5: There is a positive relation between Supply Chain Practices (SPs) and Supply chain Performance (SCP).

The results indicate that Supply chain practices significantly contribute to the supply chain performance of Indian healthcare industries. This is shown from Table 4.9.1.2 by the regression analysis value $F(3,160) = 70.635$, $p < .05$, $R^2 = .57$. The results of ANOVA test reveals that the variable Supply Chain practices will significantly predict the performance of Healthcare Supply Chain in Indian healthcare industries. Also, From the Table 4.9.1.3 it is depicted that there is a positive direct impact of supplier integration on supply chain performance with (Beta= 0.577, t=10.165, sig. 0.000, $p<0.05$) followed by positive direct impact of Lean practices on supply chain performance with (Beta= 0.275, t=5.240, sig. 0.000, $p<0.05$) and Top management commitment with (Beta= 0.166, t=2.939, sig. 0.000, $p<0.05$). Therefore, the hypothesis H5 is accepted, which indicates that the supply chain practices have an impact on supply chain performance at ($\alpha \leq 0.05$).

7.3.6 To investigate the contributions of Supply Chain Practices on Healthcare Organizational Performance in Indian Healthcare Industries.

H6: There is a positive relation between Supply Chain Practices (SPs) and Healthcare Organizational performance.

The results indicate that Supply chain practices moderately contribute to the Healthcare Organizational performance of Indian healthcare industries. This is shown from Table 4.9.2.2 by the regression analysis value F (3,160) = 36.495, p< .05, R^2 = .40. The results of ANOVA test reveals that the variable Supply Chain practices will significantly predict the Organizational Performance of Indian healthcare industries. Also, From the Table 4.9.2.3 it is depicted that there is a positive direct impact of supplier integration on Organizational performance with (Beta= 0.557, t=8.706, sig. 0.000, p<0.05) followed by positive direct impact of Lean Practices on Organizational performance with (Beta= 0.140, t=2.200, sig. 0.000, p<0.05) and Inventory Visibility with (Beta= 0.107, t=1.736, sig. 0.000, p<0.05). Therefore, the hypothesis H6 is accepted, which indicates that the supply chain practices have an impact on Organizational performance at ($\alpha \leq 0.05$).

7.3.7 To investigate the contributions of Supply chain Practices on Healthcare Organizational Performance with mediate effect of Supply Chain Performance in Indian healthcare industry

H7: Healthcare SC practices are positively associated with Healthcare Organizational Performance with Healthcare supply chain performance as mediating effect.

Table 4.9.3.1 presents a summary of regression model result with the value of R and R^2 as 0.749 and 0.562 respectively. The R-value of 0.749 represents the strong positive relationship between supply chain practices and the Healthcare Organizational Performance with supply chain performance as mediating effect in Indian healthcare industries. Further, Table 4.9.3.2 shows the results which reveals

that the variable Supply Chain practices will significantly predict the Organizational Performance of Indian healthcare industries with supply chain performance as mediating effect, F (3,160) =103.099, p< .05, R^2 = .562.

Also from the Table 4.9.3.3, it is depicted that there is a positive direct impact of supplier integration on Organizational performance with (Beta= 0.207, t=2.899, sig. 0.000, p<0.05). Whereas Supplier Integration with mediating effect of supply chain performance will have a strong positive impact on Organizational performance with (Beta= 0.592, t=8.281, sig. 0.000, p<0.05). Therefore, the hypothesis H7 is accepted, which indicates that the supply chain practices have an impact on Organizational performance with a mediating effect of supply chain performance at ($\alpha \leq 0.05$).

7.4 RECOMMENDATIONS OF THE RESEARCH

Based on the study findings, it was confirmed that the healthcare industry that implement supply chain practices such as Supplier Integration, Top Management Commitment, Lean Practices and Inventory visibility will enhance their overall organizational performance. Thus the present research may be very helpful for Indian healthcare industries to understand and manage healthcare supply chain particularly supply chain of medical devices and equipments. Hence the researcher provides some recommendations that can easily be applicable to Indian healthcare industries to enhance their organizational performance.

7.4.1 Managerial Recommendations

- Although Top management understands the importance of SCM practices, but much more commitment is needed from senior management for the full potential of SCM practices to be realized. It is also essential for other stakeholders of healthcare supply chain to be trained so that they also understand the usefulness of SCM practices implementation and become committed to it.
- Training programs should also be provided to other staff of the healthcare industry as the way to ensure they can put into consideration the SCM concept in greater

detail to enable them to properly implement it since a poor understanding of the concept can hinder them from fully participating in the SCM practices implementation in their respective companies.

- The present research may help the stakeholders to develop strong norms to promote supply chain practices in Indian healthcare industries. The research may help leaders of healthcare industries about various issues related to the implementation of supply chain practices and how they can be used gainfully to improve the organizational performance.

7.4.2 Recommendations for Academia

This study also provides several implications for academics:

- The questionnaire developed for this research can be further enhanced to examine linkages with other supply chain practices that enhance the OP of Indian healthcare industries.
- A set of Organizational Performance measures can be developed further.
- More case studies can be done taking other stakeholders for better understanding.
- The bibliography on supply chain practices may be used for further research.
- Further studies can be conducted to determine evaluation approaches especially in the healthcare supply chain services sector in government sectors.
- Further studies can be conducted to assess which other supply chain practices can best be handled by the various key sector players and which supply chain practices can be outsourced to others.
- Finally, this research provides the basis for Top management's commitment to enhancing supply chain practices and supply chain performance measures to achieve organizational performance.

7.5 LIMITATIONS AND SCOPE FOR FUTURE WORK

Just like most observed studies, the present study is also subject to certain limitations. The study covers only Indian healthcare industries and does not concentrate on other industries engaged in service sectors. Hence, future research may be undertaken to evaluate the supply chain practices of industries engaged in providing services. Further, although the response rate is 22.84% which comes within the range as suggested by Flynn et al. (1990) for such type of research (between 0-30%) the responses can be increased for better results.

Furthermore, this study has been conducted at a macro level, ignoring the micro aspects of healthcare industries. This study reveals the competence of supply chain practices engaged in healthcare industries. Hence, future research may be undertaken to analyze the supply chain implementation issues related to specific industries. Further, the concept of the supply chain is highly complex and exhaustive. Supply chain practices may vary for different healthcare for different products. Different variables are used to assess the supply chain performance related to different healthcare. It is highly difficult, to include all of such variables in one study. Thus, the scope of study on supply chain can be magnified by including more supply chain practices and variables related to performance.

Apart from these other major limitations of the study, which future researchers can consider is:

- The questionnaire can be further improved so that it can be used for the global market so that the comparisons can be made for Indian healthcare and other global competitors.
- The sample size may be increased for future research; as suggested by Hair et al. (2013).
- As the study has multiple comparisons of several dependent or independent statistical tests performed simultaneously, hence for future research Bonferroni correction can be used for corrected P-values.

- Future research may also adopt other data analysis methods for further research so as to improve design limitations.
- Future studies should consider barriers that hinder effective SC practices implementation in Indian healthcare industries.
- Usually, hospitals with long years of operations are more experienced and competent thus they can efficiently implement SC practices than younger hospitals which are new and inexperienced. Due to time constraints, the study failed to consider these controls variable which could be considered by future researchers.
- In future longitudinal studies can be conducted by considering the other supply chain practices such as supply chain integration, strategic location, order fulfillment management, returns management, logistics integration, supply chain benchmarking, many suppliers, e-procurement, inventory management, etc.
- Finally, a comprehensive software system could be developed to assess supply chain practices, supply chain performance, and organizational performance. This may also be used to assess performance index for healthcare organizational performance in the context of Indian healthcare industries.

7.6 CONCLUDING REMARKS

The general aim of this study was to assess SC practices implementation in Indian healthcare industries and their impact on the overall organizational performance. Critical dimensions of SC practices as well as supply chain performance dimensions were used to investigate the real scenario. Whereas, suitable and dependable instruments for assessing study variables were used with the help of scientific methods such as chi-square test, Spearman's correlation, and Kruskal Wallis test. Thus from such analysis, the study had empirically justified and provided proof to support the conceptual and prescriptive statements made in the previous studies regarding the role of supply chain management practices in enhancing organizational performance. Furthermore, the study noticed some important points regarding SC practices implementation in Indian healthcare industries that is, the level of understanding and implementation of SC practices is not to a very large extent in a way that it could have enabled hospitals to take full advantage of benefits SC concept to offer success of their organizations. This was evidently seen that implementation of some of SC practices was practiced to the very small extent or completely neglected in some of the healthcare, example level of information sharing and outsourcing practices. Nevertheless, the general conclusion emerged in this study was that SCM practices understanding and implementation in Indian healthcare industries could have a direct, positive influence in their respective organizational performance when efficiently and efficiently implemented and vice versa is true.

The study evolved Indian healthcare supply chain practices, which are explored through literature review and discussion with professional experts. The variables on supply chain practices, supply chain performance measures may be useful for academicians and practitioners for their profession. The study has developed four supply chain practices viz. Supplier Integration, Top Management Commitment, Lean Practices and Inventory Visibility. It is further observed from Figure: 5.1 that the Supplier Integration with a mediating effect of supply chain performance plays an important role to improve Organizational Performance in Indian healthcare industries. From the Figure 5.1 it is clear that all the stakeholders of healthcare supply chain are most conscious about Top Management Commitment practice with mean value of **3.95** however the manufacturers of healthcare equipment and devices in the healthcare

supply chain are more conscious about practicing supplier integration as a significant supply chain practice with mean value of **3.75** as compared to other stakeholders.

Further, from the results, it is observed that quality of product supply is strictly adhered with little or no expediting practice (SI3) (t=3.276) and are a significant variable of Supplier Integration in Indian healthcare industry.

Thus a multivariate regression analysis is used to analyze the relationship between supply chain practices, supply chain performance, and organizational performance. Further, a stakeholder wise comparative analysis is performed. Finally, a case study of two hospitals is developed to assess the in-depth knowledge.

Further it is seen from the study that formulation and assessment of supply chain practices involve various stakeholders in healthcare industries (internal and external) such as management, manufacturers, distributors, suppliers, service providers and service receivers. Thus supply chain of healthcare industries is not a static function and needs to review periodically for its effectiveness.

Finally, the implementation and assessment of supply chain practices coherent with supply chain performance is essential to achieve Organizational Performance of healthcare industries. Thus the Indian healthcare industries realized the importance of supply chain performance and started taking a proactive approach towards implementation of supply chain practices. The validated framework and result findings propose that the study can help to improve the organizational performance of Indian healthcare industries through a proper understanding of supply chain practices implementation among Indian healthcare industries.

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APPENDIX 1

PART A:
Demographic Profile

Please provide your Details (Optional)

1. Name of Respondent: ☐
2. Name of Organization: ☐

3. Gender Male ☐ Female ☐

4. Age

(*Tick where appropriate*)

18-24 years ☐ 25-34 years ☐ 35-44 years ☐ 45-54 years ☐ Over 55 years ☐

5. Type of Supply Chain Partner
(*Tick where appropriate*)

Manufacturer ☐ Supplier ☐ Distributor ☐ Customer ☐

6. How many years have you worked for the organization?

(*Tick where appropriate*)

1-5 years ☐ 6-10 years ☐ 11-15 years ☐ Over 16 years ☐

7. Is your Organization?

Private ☐ Society/Trust ☐ Aided Organization ☐

8. No. of employees in the Organization

<50 ☐ 50-500 ☐ 500-1000 ☐ more than 1000 ☐

9. Does your Organization use Performance Measurement System?

☐ Yes

☐ No

Email Id: SIGNATURE

PART B

Instruction: You are requested to rate the degree or extent of practice of each item with reference to the focal firm's (Healthcare Industry) perspective in 1 to 5 scale (5- Strongly Agree, 4- Agree, 3- Average, 2- Disagree, 1- Strongly Disagree)

S. No.	Items	Strongly Agree → Strongly Disagree				
		5	4	3	2	1
1	Promotes small number of high quality suppliers.					
2	Establishes long term relationship with our suppliers.					
3	Top management is committed for supply chain performance.					
4	Our company work for continuous commitment in providing high quality products and services.					
5	Strives to maintain high level of emergency supplies of critical items.					
6	Improved information sharing with suppliers and customers.					
7	Strive for eliminating duplicate processes and unnecessary procedures.					
8	Keep track on actual and accurate inventory levels.					
9	Top management is proactive and systematic in the supply chain management					
10	Provides excellence in reducing frequent use of inventory.					
11	Emphasis on improving the utilization of available equipment and facilities					
12	Promotes right product at right time.					
13	Our company and our key suppliers keep each other informed about events or changes related to financial, service design, strategy, research that may effect to our customers.					
14	Forecast demand and provides this information to our key suppliers.					
15	Promotes little or no expediting.					
16	Promotes supplier to manage inventory on their behalf. (VMI system).					

PART C

Instruction: You are requested to rate the degree or extent of Supply Chain performance with reference to the focal firm's (Healthcare Industry) perspective in 1 to 5 scale (5- Strongly Agree, 4- Agree, 3- Average, 2- Disagree, 1- Strongly Disagree)

S. No.	Items	Strongly Agree → Strongly Disagree				
		5	4	3	2	1
1	Increased Overall product quality.					
2	Increased Responsiveness to customer request.					
3	Reduced Reliability in delivery of materials.					
4	Smaller Order fulfillment lead times.					
5	Increased Flexibility of service to meet customer need.					
6	Acceptance for strategic changes in supply chain.					
7	Improved Accessibility to product supply.					

PART D

Instruction: You are requested to rate the degree or extent of organizational performance with reference to the focal firm's (Healthcare Industry) perspective in 1 to 5 scale (5- Significant Increase, 4- Increase, 3- Same as before, 2-Decrease, 1-Significant Decrease)

S. No.	Items	Significantly Increase → Significantly Decrease				
		5	**4**	**3**	**2**	**1**
1	**Customer Satisfaction**					
2	**Return on investment**					
3	**Improved Resource Utilization**					
4	**Improved cost to service**					

LIST OF PUBLICATIONS

Peer Reviewed International Journal Publications:

- **Mathur, B.,** Gupta, S., Meena, M.L., Dangayach, G.S.,"Healthcare Supply Chain Management: Literature Review & Some Issues" Journal of Advances in Management Research, **https://doi.org/10.1108/JAMR-09-2017-0090. Emerald publishing.**

- **Mathur, B.,** Gupta, S., Meena, M.L., Dangayach, G.S.,"Impact of Supply chain practices on Organizational Performance with Moderating effect of Supply chain performance in Indian Health Care Industry" International Journal of Supply Chain Management (IJSCM), **Excelling Technologies Publications**. **(Scopus indexed) (Accepted).**

International/National Conferences:

- **Mathur, B.,** Dangayach, G.S., "Effect of Supply Chain Management on Industry Performance" presented paper in IWCEM-2016 at Manipal University, Jaipur during 4-6 June, 2016.

- **Mathur, B.,** Dangayach, G.S., "Performance measurement of supply chain management in health care industries" Proceedings of International Conference on Production and Automation(ICPA-2015) during 14-15 April, 2015 at Department of Mechanical Engineering, Global Institute of Technology, Jaipur.

- **Mathur, B.,** Dangayach, G.S., "Performance measurement and improvement frameworks in health Industry: A literature study." presented paper in 7th ISDSI & 5th OSCM International Conference at IMI, New Delhi on December 28-30, 2013 (Paper Id:. 00185)

- **Mathur, B.,** Dangayach, G.S., "Performance Measurement and Management through Balanced Scorecard in Health Care Industry: A Review" (Paper Id: NCPE-087), Presented paper in 28th National Convention of Production

Engineers-2013 (NCPE 2013) on 5th May 2013.

Brief Bio-data of the Author

BHAVANA MATHUR

1979	Born in Bhilai, Chattisgarh, India on 10th August
Academics	
2018	Currently a candidate (registered in July 2012) for the degree of Doctor of Philosophy at MNIT, Jaipur, India.
2009	Post-Graduated from MNIT, jaipur with a Mater of Technology in Mechanical Engineering specialized in Manufacturing System Engineering.
2002	Graduated from University Institute of Technology, Bhopal, Barkatullah University, Bhopal, M.P. with a Bachelor's degree (Honors) in Mechanical Engineering.
Experience	
Research	July, 2012 – till date
Academic	November, 2002 – Till date
Publications	More than 9 papers published in various National and International Journals and Conference proceedings.
Professional Membership	Associate Member of Institution of Engineers (India) Life Member of ISHRAE Society
Address **Email:**	C-19, Jyoti Marg, Bapu Nagar, Jaipur-302015 mechgit12@gmail.com