

**EVALUATION OF SUPPLY CHAIN MANAGEMENT SYSTEMS IN
AUTOMOTIVE INDUSTRY OF NORTH INDIA**

**Ph.D. THESIS SUBMITTED IN FULFILLMENT
OF
THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF**

Doctor of Philosophy

SUBMITTED BY

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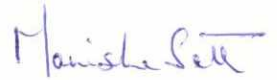
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DECLARATION

*I hereby declare that this thesis entitled “**EVALUATION OF SUPPLY CHAIN MANAGEMENT SYSTEMS IN AUTOMOTIVE INDUSTRY OF NORTH INDIA**” is an original work done by me for the award of the degree of Doctor of Philosophy in Management. I also declare that this thesis or any part of it has not been submitted by me for the award of any degree, diploma, title or recognition before.*

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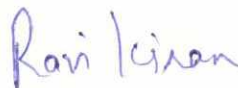
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ABSTRACT

The competition no longer exists between the companies, but it is between supply chains, this summarises the importance of supply chain in today's global competitive environment. Companies are using information and communication technology in the supply chain to gain competitive advantage. Supply Chain Management Information System (SCMIS) has gained a lot of importance due to its ability to reduce costs and increase responsiveness in the supply chain. It provides high quality, relevant and timely information flow that effectively supports decision making. The implementation of SCMIS is a complicated process with significant risk since disparate systems spanning across companies are being integrated. There is a strong evidence in the literature that implementation of SCMIS projects were either not completed on time or didn't bring about the planned effects and even exceeded their estimated costs.

Against this backdrop, the research was undertaken in automotive sector covering two major OEMs: Maruti Suzuki India Ltd. and Honda cars India Ltd., their suppliers and distributors since the benefits from the SCMIS can only be realised if there is an effective implementation of the system. Therefore the primary purpose of the study was to identify and analyse both product and process dimension so as to provide a guideline which helps practitioners for the successful implementation of SCMIS. To fulfill the purpose questionnaires based survey method was used. The questionnaires were focused on the identification of critical and hindrance factors as well as product factors of the system.

For evaluation of the product success dimension, six factors considered were: system quality, information quality, perceived importance of the system, user satisfaction, individual benefits and organizational benefits. Analysis shows system quality, information quality and perceived importance of the system as the antecedents of user satisfaction, further user satisfaction augments individual benefits measured in the form of improvement in job performance, productivity, saving time in doing a job, and helping in decision making which in turn lead to enhancement in organisational benefits.

For evaluation of the process dimension the review focuses on the processes, which are followed in implementing SCMIS. The various critical success factors were reviewed and to prioritize the factors weighted mean was calculated and the factor of Project champion had the highest weighted mean of 4.14. Other factors among the top five included user involvement (mean 4.13 and SD 0.46); top management support (mean 4.12 and SD 0.348), pre-implementation analysis (mean 4.12 and SD 0.471) and change management (mean 4.10 SD 0.429). The regression analysis showed top management

support, change Management, user involvement, effective communication, trust among the business partners; data accuracy, training and education had a positive impact on SCMIS implementation success. Next human barriers formed the major hindrance to the successful implementation of SCMIS. The human barriers included lack of users participation, resistance to change, lack of sufficient training to end users, lack of employees motivation, ineffective communication with the users and reluctance on the part of users to employ the system due to lack of understanding of the benefits that could be derived from the system. Among the human barriers, the most important was users' resistance to change. Therefore the technical problems howsoever large they may be were not perceived as the main cause for unsuccessful implementation of SCMIS projects. Thus understanding these factors will enable managers to be more proactive and better prepared for future implementations. Being aware of the factors that can help or hinder the successful implementation of SCMIS may prove to be useful to practitioners as guidance enabling system success and avoiding IS failure. The study can help them gain an understanding of the complexities intrinsic in implementing these systems, improve decision making for successful implementation of the system right from inception and subsequent realization of the enormous benefits like reduction of inventories, minimization of bull whip effect, cost reduction, etc., that will accrue with right implementation.

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LIST OF ABBREVIATIONS

SCM	Supply Chain Management
SCP	Supply Chain Performance
SCMIS	Supply Chain Management Information System
MRP	Material Requirement Planning
MRP II	Manufacturing Resource Planning
SRM	Supplier Relationship Management
CRM	Customer Relationship Management
ERP	Enterprise Resource Planning
IT	Information Technology
IS	Information System
NCR	National Capital Region
MSIL	Maruti Suzuki India Limited
HCIL	Honda Cars India Limited
HSCP	Honda Supplier Collaboration Portal
OEM	Original Equipment Manufacturer
CSFs	Critical Success Factors
CFFs	Critical Failure Factors
BPR	Business Process Reengineering
CFA	Confirmatory Factor Analysis
SEM	Structural Equation Modeling
CR	Composite Reliability
AVE	Average Variance Extracted
ASV	Average Shared Variance
GOF	Goodness of Fit
SPSS	Statistical Package for Social Sciences
AMOS	Analysis of Moment Structures

CHAPTER- I

INTRODUCTION

This chapter lays the foundation and introduces the project that has been undertaken. Section 1.1 of the chapter provides an overview of supply chain management, and the next Section 1.2 introduces the importance of sharing information in Supply Chain Management (SCM). Section 1.3 outlines the importance of information technology in SCM and Section 1.4 introduces the evolution of supply chain management information system (SCMIS) and its benefits. Further, Section 1.5 explains the dimensions of SCMIS and general model of SCMIS evaluation. Sections 1.6-1.9 outline the rationale, objectives, scope and significance of the study. The chapter concludes with the organization of the thesis.

1.1 SUPPLY CHAIN MANAGEMENT-AN OVERVIEW

The supply chain management has become an instrument for companies to compete effectively in today's challenging business environment. In today's environment, there is a growing demand of consumers, shrinking product life cycle, high buying power and competitiveness, eroding profit margins. Therefore, it is not sufficient for a manufacturer to merely produce high quality products and ward off the competition. Now they are forced to compete on the basis of the company's supply chain strategies. According to Denolf et al. (2015), the success of an enterprise depends on how well it cooperates and integrates with other businesses, as organization are no longer competing on company versus company form, but on supply chain versus supply chain form.

SCM is an important management practice for determining world-class performance. It has been recognized by many organizations as a strategy to attain business goals (Altekar, 2005; Chan & Lee, 2005). "It is not the strongest who survive, nor the most intelligent—but those most responsive to change" (Solkhe et al., 2015). SCM refers to the processes which aims for flow of materials and information in the most effective and efficient manner between a company and its immediate suppliers. Since its introduction in retailing, the supply chain concept has spread to other industries including automotives, chemicals and electronics. For most companies, it is now understandable that the supply chain that best manages the flows of both information and materials can differentiate

itself from its competitors. Thus, the competitive performance of the manufacturing companies can be enhanced through SCM by effectively linking the internal functions of a company with the external operations of suppliers and supply chain members. Companies try to minimize risk related to supply chain during new product development as any kind of anomaly developed can lead to considerable delay in product launch that can have with severe implications on the financial front (Chaudhuri, Mohanty, & Singh, 2012). The challenge is to determine how to successfully accomplish this integration.

According to Mohanty and Deshmukh (2005), key trends in supply chain management are developing of long-term relationships based on mutual confidence; improving service level through outsourcing; enhancing flexibility and reducing cost through third-party logistics. The integration across organizational boundaries (Rajaguru & Matanda, 2009; Zhou et al., 2007) can be through partnerships (Lee & Lim, 2005; McLaren et al., 2004; Mohanty & Deshmukh, 2004) through information sharing (Yu et al., 2001; Zhou et al., 2007), through collaboration (Bagchi et al., 2005) and with cooperation (Hsu et al., 2009). Therefore, the extent to which companies undertake integration is affected by partner trust, interdependence, and commitment (Lee & Lim, 2005).

1.2 INFORMATION SHARING IN SCM

Information sharing plays a key role for any kind of SCM system (Moberg et al., 2002). The crucial aspect to the performance of supply chain is the information flow. It must flow internally among the various departments such as purchasing, manufacturing, marketing, finance, logistics etc., as well as between the firm and its vendors, transporters, warehouses and customers. Thus timely and accurate information availability is essential for effective SCM. SCM enables supply chain partners to work in an environment of close coordination that helps to facilitate supplier - customer interactions and minimizes the transaction cost through information sharing (Tarn et al., 2002). To facilitate sharing of higher levels of information a good partner relationship must be established build on trust (Sahay, 2003). The operational efficiency increases when information is readily available to the trading partners (Gaur et al., 2005). Collaboration can provide the competitive edge (Sahay, 2003) that enables all business partners of a supply chain to succeed and grow. To enhance supply chain visibility and to

improve the coordination between buyers and suppliers the collaborative systems are increasingly being used by the firms (Grover, 2007).

Information is the basis upon which to make decisions regarding the four supply chain drivers namely production, inventory, location and transportation. Information is the main component of supply chain management that allows other supply chain drivers to work together with the goal of creating an integrated, coordinated supply chain. Organizations use these drivers to support either a supply chain strategy focusing on 'efficiency' or a supply chain strategy focusing on 'effectiveness'. The efficiency and effectiveness of the supply chain can be improved by quickly sharing the available data with the supply chain partners and responding to the changing needs of the customer. Therefore, information sharing will bring the organization competitive advantage in the long run (Li & Lin, 2006).

Information sharing provides tremendous benefits to all the supply chain members. It improves coordination between supply chain processes to enable the material flow and reduces inventory costs (Li & Lin, 2006). Sharing of information among members of supply chain can aid in reducing different kinds of uncertainties that may be related to demand, product and technology (Khurana et al., 2011). It also improves coordination and leads to high levels of supply chain integration. Further, information sharing influences the supply chain performance in terms of both total cost and service level. Thus, the core idea of SCM integration lies in 'information integration'.

Another important aspect apart from information sharing is the quality of information that is being shared among the supply chain partners. It has been observed that there is a built-in reluctance within organizations to give away more than minimal information since it is perceived that information disclosure may lead to loss of power and companies fear that information may leak to potential rivals (Li & Lin, 2006).

To facilitate higher levels of sharing information and quality of information, a good partner relationship must be established build on trust, loyalty, and shared vision. Thus, partner relationship plays an important role in implementing SCM practice and improving SCM performance (Li & Lin, 2006).

1.3 INFORMATION TECHNOLOGY IN SCM

The advancement of information technology (IT) has increased the ease of information flow and has provided many alternatives to share and integrate information (Khurana et al., 2011). Many business functions have been transformed due to the emergence of the Internet throughout the world around 1995 (Mahajan & Mehta, 2012). IT has transformed the supply chain, increasing information sharing within organizations and between organizations with inter-organizational systems (Li & Lin, 2006). IT, by providing timely, accurate, and reliable information, has greatly improved supply chain performance (Li et al., 2009). IT is used in supply chain for competitive advantage (Singla, 2000).

The use of IT can be categorized into the following three groups, 1) transaction processing, 2) planning and collaboration within supply chain, and 3) order tracking and coordinating delivery (Auramo, 2005). In SCM, the transaction-processing role of IT is driven by the diminution of manual work and costs, improving information quality, gearing up of information transfer, and volume of transactions (Auramo, 2005).

Based on the study of consumer durables by Mohanty and Deshmukh (2004) the benefits of integrating supply chain are elaborated in table 1.1.

Table 1.1: Benefits of integrating supply chain

Performance in delivery	15% - 30% enhancement
Reduction in Inventory	20% - 50% improvement
Completion of cycle time	30% - 60% improvement
Accuracy in forecast	10% - 80% improvement
Total productivity	10% - 25% improvement
Supply chain costs	25% - 50% improvement

Therefore, in the contemporary world, competitive advantage of an organization depends on the information sharing and information flow among the supply chain partners with the help of information technology. With information based on the use of information technologies, the effectiveness and efficiency of supply chains can be significantly enhanced. Hence, the role of information technology in supply chain integration, which

coordinates and harmonizes all elements from raw material to finished goods in order to achieve higher levels of overall performance, is enormous and has gained momentum in the present day situation.

1.4 SUPPLY CHAIN MANAGEMENT INFORMATION SYSTEM

Evolution: The growth of ERP can be attributed to the fast development of IT. Prior to 1960s, the traditional inventory management methods were adopted. The most popular technique of inventory management was economic order quantity (EOQ). Along with EOQ, various inventory models such as the fixed order quantity, periodic order method, optional replenishment method, etc., were very popular. In 1960s, a new technique was adopted popularly known as MRP (Material requirement planning). It significantly reduces the inventory and lead-time, by improving coordination and avoiding delays. It proved to be a good technique but was soon taken over by MRP II (Manufacturing Resource Planning) in 1980s, which integrated financial resources with the manufacturing activities. Transition from MRP II to ERP happened during 1980-90. Initially ERP systems were developed which focused on the optimization of the organizations internal processes. Today our focus is on integration of upstream and downstream partners through Supply Chain Management Information System (SCMIS). Supply chain management system is a cross-functional, inter-organizational system, which uses information technology for supporting and managing links within the company for activities like buying, producing and moving a product. It further integrates supplier, manufacturer and distributor's processes to improve manufacturing efficiency and distribution effectiveness. To ensure a competitive advantage, MNCs frequently need to transfer knowledge to their subsidiaries (Suyanto & Salim, 2010).

Supply chain management information systems are developed using Internets or Extranets. Technologically, SCM is based on ERP systems. Table 1.2 explains the difference between ERP and SCMIS.

Table 1.2: Comparison of SCM and ERP systems (Tarn et al., 2002)

	SCM systems	ERP systems
Objective	Integrating and optimizing internal business processes of a single organization as well as the interaction of the organization with its business partners across the entire supply chain	Integrating and optimizing internal business processes within the boundary of a single organization
Focus	Optimizing information flow, physical distribution flow, and cash flow over the entire supply chain	Optimizing information flow and physical distribution flow within a single organization
Function	Manufacturing management, inventory management, logistics management, and supply-chain planning	Manufacturing management, financial management, and human resource management

These systems lower costs, increase information speed, timely information flow and reduce information errors.

It integrates supplier, manufacturer, distributor and customer logistics processes to improve manufacturing efficiency and distribution effectiveness. SCMIS is an extension of enterprise resource planning (ERP) as shown in Fig 1.1 which integrates companies beyond the boundaries of an organization and with the advent of globalization it has further gained more importance (Gunasekaran, 2004; Marwah et al., 2012).

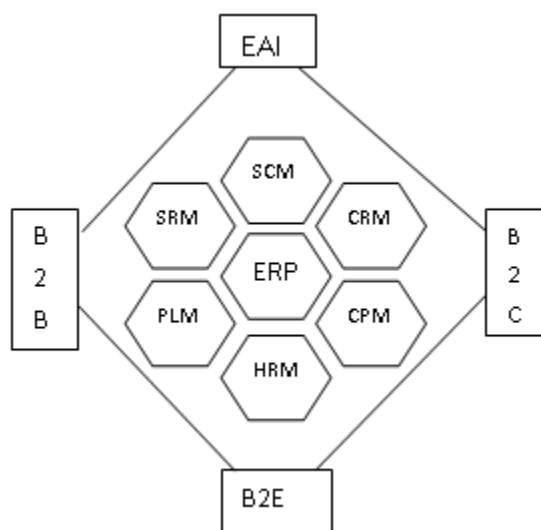


Figure 1.1: SCMIS as an extension of ERP (Moller, 2005)

SCMIS involves managing and coordinating all activities associated with goods and information flow from raw material source to product delivery, and finally to the end customers (Wei & Chen, 2008). It provides high quality, relevant and timely information flow that effectively supports decision-making for inventory replenishment, capacity activation and for synchronizing material flows at all tiers within the supply chain. Thereby it plays an increasingly critical role in the ability of firms to reduce costs, increase responsiveness (Chopra & Miendl, 2005), gain competitive advantage (Dezdar, 2011) and achieve better coordination.

Benefits of SCMIS (Wang& Sedera, 2011) are enormous as outlined below and that is why companies are willing to implement these systems, which require huge commitment of funds, time and expertise (Motwani et al., 2008).

1. Strategic Benefits

- a. Improved customer satisfaction
- b. Improved business performance
- c. Improved partnerships among the supply chain members
- d. Information sharing & transparency
- e. Integration of supply chain
- f. Improved effectiveness in supply chain

2. Managerial Benefits

- a. Better analysis and reporting
- b. Better communication
- c. Better management of business
- d. Better forecasting & planning
- e. Better management of assets
- f. Better management of inventory
- g. Better management of production

3. Operational Benefit

- a. Cost reduction
- b. Cycle time reduction
- c. Improved customer service
- d. Improved productivity
- e. Staff empowerment

- f. Improved data quality
- g. Improved system capability

However, the achievement of these above mentioned benefits depend upon the effective implementation of the SCM system. Implementing these systems is a complex, lengthy and expensive process. There is a strong evidence in the literature that implementation of SCMIS projects were either not completed on time or did not bring about the planned effects (Holland, 1999) and even exceeded their estimated costs (Davenport, 1998).

1.5 DIMENSIONS OF SCMIS

Dimensions are all about different angles or approaches to understand something. The post implementation review of IS can be done based on various dimensions. For reviewing SCMIS, dimensions can be grouped as follows:

- a) Product-based review
- b) Process based evaluation

Product based review: This type of review focuses on the product of the IS. Product success determines the value that the implemented system provides to the organization when the ultimate users use it. The product-based review can be divided into two parts: SCMIS features in terms of reliability, user friendliness etc. and SCMIS support in terms of integration support, decision support and strategic support.

Process based evaluation: This type of review focuses on the processes, which are followed in implementing SCMIS. Process success measures the effectiveness of the organization for implementing SCMIS to the end user. The various sub-processes involved in the SCMIS implementation include pre-implementation analysis, project management, BPR, change management, project champion, and so on.

1.5.1 General Model of SCMIS Evaluation

Figure 1.2 shows a general model of a successful SCMIS evaluation. As explained above, the success of the system can be viewed from two dimensions namely, product success and process success. For measuring the product success, various frameworks were examined and the inception focus was on the Delone & McLean Model of Success. The

model was modified to suit the present context of the study. The process success was studied through various critical success factors identified from the extensive review of literature.

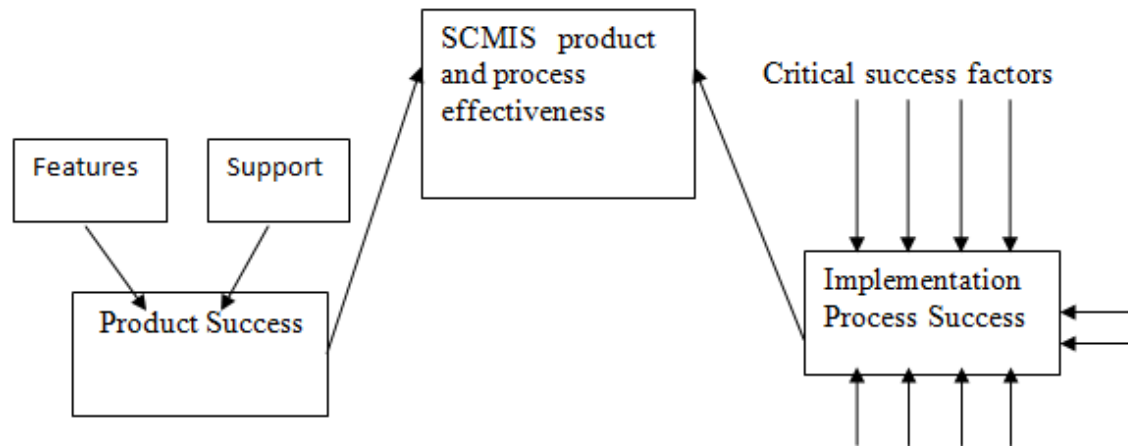


Figure 1.2: Process and Product dimensions of a successful SC MIS evaluation

1.6 RATIONALE FOR THE STUDY

Manufacturing industry including automobile companies has realized the importance of the supply chain systems as it needs to keep control over costs at every stage to remain competitive. Original equipment manufacturer (OEM) after integrating the functional areas through enterprise resource planning (ERP) within the organization, shifted focus to integration of business processes with trading partners. The emergence of e-business has thus led to different ways in which enterprise communicate, transmit and receive information with the suppliers upstream and customers downstream. However, the achievement of these above mentioned benefits depend upon the effective implementation of the system (Moon, 2007). Implementing these systems is a complex, lengthy and expensive process. These systems require huge commitment of funds, time and expertise. There is a strong evidence in the literature that implementation of SC MIS projects were either not completed on time or did not bring about the planned effects (Holland, 1999), and even exceeded their estimated costs (Davenport, 1998). This was substantiated by studies of Zhang et al. (2005) who revealed that ERP projects implemented exceeded their budget as well as the time duration and only 30 per cent of benefits promised were delivered, the study by Wang and Chen (2006) proves that added budget amounts were required since there was a delay in ERP implementations. Further the research done by

Panorama consulting solutions, which summarizes the experiences of 192 ERP customers with regards to enterprise software, vendors, consultants and overall implementation as shown in Table 1.3.

TABLE1.3: Experience of ERP users with regard to enterprise software

Year	Cost	% of cost Overruns	Duration	% of Duration overruns	% Receiving 50% or Less benefits
2013	\$2.8MM	54%	16.3 months	72%	66%
2012	\$7.1MM	53%	17.8 months	61%	60%
2011	\$10.5MM	56%	16 months	54%	48%
2010	\$5.5MM	74%	14.3 months	61%	48%
2009	\$6.2MM	51%	18.4 months	36%	67%

Table 1.3 shows that the average cost of implementation for last five years is \$6.4 million dollars and average duration for implementation is 16.6months. Further, for 2013, 54% of the projects have exceeded their planned budgets, 72% have exceeded their planned durations and about 66% of respondent organizations have received less than 50% of the benefits that were expected from the system.

The high failure rates suggest that understanding and implementing the information system is a challenging task (Al-Mashari et al., 2006). Overall failures and implementation difficulties in implementing these systems have attracted lot of research (Liu & Seddon, 2009; Singh, 2010; Syed Iftikhar, 2008).

Theoretically, at present, we are talking about a real time information flow and supply chain management playing a pivotal role as not just an enabler, but also as a differentiator. Managers now acknowledge that a firm's success is tied, in part, to the strength of its weakest supply chain partner. Therefore, the question that arises is "What are the critical success factors (CSFs) that would lead to the successful implementation of these systems?" Moreover, since these projects are expensive and time consuming therefore it becomes imperative for the management to evaluate the success of the implemented system. The SCMIS implementation is considered a technical project whereas it is important to address the socio technical aspect for the successful

implementation of the system. Too much focus is on the technical and financial part of the project and often the non-technical issues are neglected. Leon (2008) defines these systems as people's project. Therefore, SCMIS must be viewed in a different perspective, as a new business endeavor and not just an IT project. Changing this mindset will reduce the failure rate in the implementation of these enterprise systems. Further, the management should not expect the rewards for granted that may accrue from implementation of SCMIS projects. Instead, they should also consider the risks involved and the ways to tackle organizational, human and inter-organizational issues. Therefore, the study is being conducted to identify critical success factors to ensure successful implementation of the information system for the automobile industry. The study will also attempt to find out the reasons and obstacles to the successful implementation of this information system in automotive companies. The reason is being that India is now emerging as a global hub for production, and international car manufacturers are moving to India. Lastly, study will develop a model to analyze the relationships between factors and success indicators.

1.7 OBJECTIVES OF THE STUDY

Before starting any research, it is necessary to define the objectives of the study. The present study has been undertaken with following broad objectives:

O1: To identify various dimensions of SCM systems in selected organizations in the automotive sector.

O2: To analyze success and hindrance factors for SCM systems in the sector organizations.

O3: To develop a model based on (O1) to evaluate the effectiveness of SCM systems for selected automotive companies in Northern India.

O4: To test and apply the proposed model in selected automotive companies.

1.8 SCOPE OF THE STUDY

Sector Chosen: Automotive Sector

The Indian automotive sector has emerged as a 'sunshine sector' in Indian economy. India's automotive industry is the world's sixth largest producer of automobiles in terms of volume and value. It has grown by 14.4% in the last decade. The industry contributes 7% to India's GDP, 7-8% of the total employed population (about 13 million people), 4% of exports, 39% of FDI inflows (USD 5.5 billion between 2009-2013) and contributes 17% to total indirect taxes collected.

Various growth drivers of automotive companies that have driven the passenger vehicle segment are raising per capita income, changing demographic distribution, higher disposable income and easy availability of finance options. The other drivers include rise in demand from the rural and semi-urban areas, increasing income levels, and different product range available to the customers. Therefore, all such drivers make the Indian automotive industry as an emerging sunrise sector of the economy. Thus, the sector not only meets the growing domestic demands, but also gradually increasing its presence in the international markets. The vision of this sector is "To emerge as the destination of choice in the world for design and manufacture of automobiles and auto components with output reaching a level of US \$145 billion accounting for more than 10 % of the GDP and providing additional employment to 25 million people by 2016" (Automotive Mission Plan 2006-2016).

Therefore, automotive industry offers vast employment opportunities and huge growth potential in terms of sales volume. This makes it crucial for the industry to attain competitive advantage by adoption of global supply chain best practices.

Cluster Chosen: NCR (National Capital Region) region in North

The India's car manufacturing industry is evenly divided into three "clusters"

- Chennai-Bengaluru region in South
- Pune-Aurangabad in the west, and
- The NCR (National Capital Region) region in North

Companies Chosen: Maruti Suzuki India Ltd. and Honda Cars India Ltd

The study will focus on passenger car segment and the companies to be chosen from the above universe for the study should fulfill the following criteria:

1. Manufacturing unit to be located in the NCR (National Capital Region) region in North India
2. The adoption of supply chain management information system in the organization
3. Companies should have implemented supply chain management information system for over two years.

Out of the total automobile companies, manufacturing plant of Honda Cars India Ltd. is located in Greater Noida and Maruti Suzuki is located in Gurgaon and Manesar. Both companies fulfill rest of the criteria and therefore form the basis of the study.

Apart from the importance of the automotive industry in the Indian economy, the other reason for choosing it is the complex nature of car assembling and various components that go into making of it. Automotive assembly is a continuous process industry and any stoppage in the production line due to non-availability of a component is highly detrimental. Therefore, supply chain management system plays a strategic role in the automotive industry. Further Table 1.4 shows the market share of different automobile companies for the year 2010-11 and cumulative sales for the period April 2014 to Jan 2015. The table reveals the combined market share of Honda Cars India Ltd and Maruti Suzuki exceeds 50% both in year 2010-11 (year of inception of our research) and April 2014- Jan 2015.

Table 1.4: Sales and Market share of automobile companies for the year 2010-11 and for the period April 2014 to Jan 2015

S.No	Company	Cumulative sales 2010-11	Market Share (in %) 2010-11	Cumulative Sales Apr 14 – Jan 15	Market share (in %) Apr 14 – Jan 15
1	Maruti Suzuki India Ltd.	966,447	48.74%	959,091	45.21%
2	Hyundai Motors India Ltd.	358,904	18.10%	343,838	16.21%
3	Mahindra and Mahindra	10,009	0.50%	182,968	8.62%
4	Honda Cars India Ltd	58,951	2.97%	149,464	7.05%
5	Tata Motors Ltd	256,202	12.92%	128,983	6.08%
6	Toyota	19,225	0.97%	116,212	5.48%
7	Ford India Pvt Ltd.	95,395	4.81%	63,926	3.01%
8	General Motors.	87,153	4.40%	44,210	2.08%
9	Nissan Motor India Pvt Ltd.	12,551	0.63%	39,309	1.85%
10	Volkswagen India Pvt Ltd	51,608	2.60%	36,588	1.72%
11	Renault	10,009	0.50%	35,183	1.66%
12	Skoda Auto India Pvt Ltd.	21,693	1.09%	12,437	0.59%
13	Fiat India Automobile Pvt Ltd.	21,112	1.06%	9,038	0.43%
14	Mitsubishi			1,394	0.07%
15	Force motors			2,288	0.11%
16	Ashok Leyland			311	0.01%
17	Isuzu			198	0.01%
18	Others	13,443	0.006%		
	TOTAL	1,982,702	100.00	2,125,438	100.00

(Source: MotorBash report)

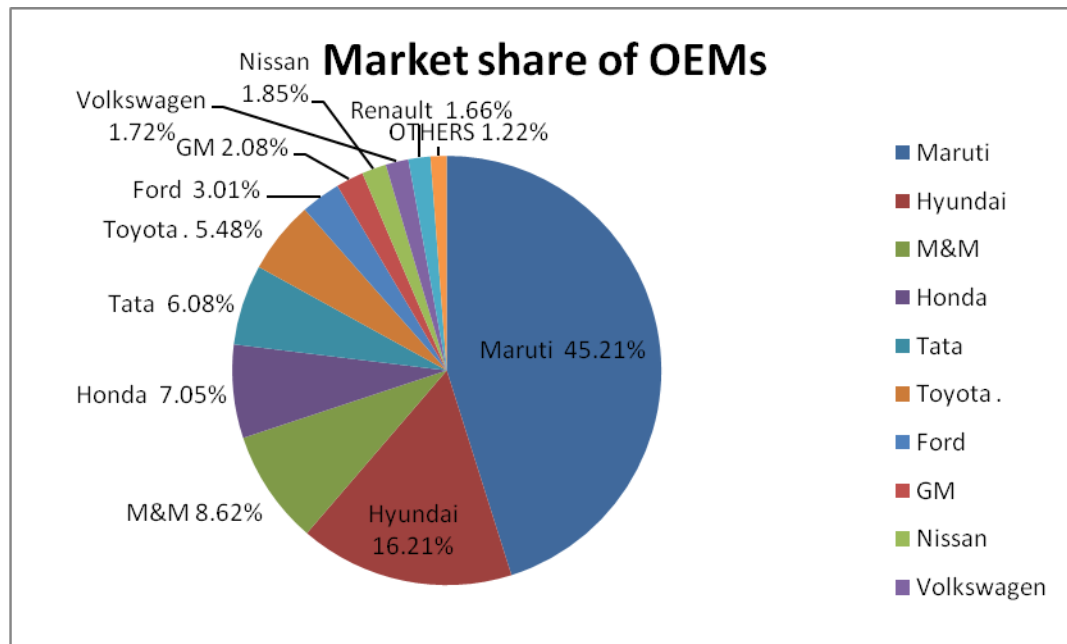


Figure 1.3: Market share of various OEMs in Indian automobile industry (April 2014-January 2015)

1.9 SIGNIFICANCE OF THE STUDY

With the forces like increased customer demand, globalization, compressed product life cycles, need for better information system, new information technologies driving supply chain integration and receiving substantial benefits like inventory reduction, increased revenue, cost reduction across the chain, improved delivery service, shorter product development cycles from the system, then also many organizations are reluctant to implement them. This is due to the complexities associated with these systems, expertise required for its implementation, huge commitment of fund and other barriers to success. The benefits from the SCMIS can only be realized if there is an effective implementation of the system. This study provides new insight into understanding the success and hindering factors for the successful implementation of supply chain management information system. Understanding and considering these factors will enable managers to prepare themselves better for the implementation of the system. Becoming conscious of the factors that can aid or obstruct the successful implementation of SCMIS may prove to be useful to the practitioners as a guide for successful system implementation and avoiding IS failure. The study being conducted is helpful for industry practitioners, researchers and policy makers. The process model and critical success factors will

provide a useful guide for industry practitioners who are planning to implement SCMIS in their organizations. It will help them to improve decision making for successful implementation of SCMIS right from inception. They will also realize the enormous benefits that will accrue with the right implementation. The study will provide recommendations based on the analysis of critical factors for the successful implementation of these systems

1.10 ORGANIZATION OF THE THESIS

Chapter I - Introduction

The chapter provides an overview about the backdrop of the research work. It provides in general the purpose of the study. It describes and defines concept of supply chain management, importance of sharing information in SCM and role of information technology in SCM. The chapter introduces the concept of SCMIS, which is an inter-organizational system, and the benefits the organization can derive after successfully implementing these systems. This chapter also covers the rationale of the study as to why such research has been done. The chapter further gives the objectives of the study and significance to industry practitioners, researchers and policy makers.

Chapter II - Review of Literature

This chapter reviews literature relevant to the identified research issues in this study. An extensive literature review was undertaken for identifying the critical success factors associated with SCMIS implementation, impediments to the successful implementation of the system and post-implementation success measurement variables. The chapter reports the framework of CSFs, which is built from two groups of studies namely factors focusing on ERP implementations and CSFs for implementation of Inter organizational systems. The CSFs and CFFs are grouped into categories based on literature. For the research model of SCMIS, Delone and Mclean (1992, 2003) model is used as an initial framework and thus is used for the product evaluation of the system. The review helps to identify the gaps in the earlier studies and thus the research is focused in the right direction.

Chapter III - Research Design and Methodology

This chapter gives the methodology used in conducting this research study. It includes sample frame, questionnaire development, pilot study and validity, data collection methods, and analysis techniques to be used.

Chapter IV – Profile of the selected companies

This chapter gives the profile of the OEMs, which are selected for the analysis. The chapter includes a brief profile of the companies which are Tier I suppliers to the selected OEMs. Further, the chapter describes the e-Nagare and HSCP (Honda Supplier Collaboration Portal) systems that are presently being adopted by the OEMs as supply chain management information systems.

Chapter V - Data Analysis and Interpretation

This chapter describes the results of the analysis. The focus of the chapter is on critical success factors, hindrance factors and model development for the successful implementation of supply chain management information system in automotive sector. The results of demographic profile of the respondents are also presented. Analysis includes factor analysis, multiple regression and ANOVA. Last section of the chapter deals with structural equation modeling (SEM) for testing the postulated hypotheses.

Chapter VI - Conclusion

The last chapter provides key inferences of the study and discusses the effects of the findings to the practitioners, academicians and policy makers. Each research objective is revisited and discussed. The chapter also includes the limitations of the research study and suggests guidelines for future research.

1.11 CONCLUDING REMARKS

Supply Chain Management (SCM) has become a very important and critical issue for an organization due to globalization (Gunasekaran, 2004) and ever-increasing competition. SCM aims at movement of goods and services from one end of the chain to the other through different stages to improve the efficiency, effectiveness, productivity and profitability of the entire process. The Information Technology (IT) plays a vital role

in the effective control of today's complex supply chain. At present focus is on integration of upstream and downstream partners through Supply Chain Management Information System (SCMIS). These systems integrate factories, suppliers, warehouses, and distribution centers for faster communication and coordination. Understanding and implementing the information system is a challenging task and the success rate is not very encouraging.

Therefore, an earnest attempt has been made to find out and investigate critical success factors and impediments to have a successful implementation of SCMIS. It is imperative to have a successful implementation process through critical factor approach that help delivering the corporate objectives and for realizing and maximizing the benefits from SCMIS. The process model will provide a useful guide for industry practitioners who are planning to implement SCMIS in their organizations. Finally, due to the limiting factors of time and resources, the research is limited to only automotive industry.

The next chapter is devoted to review of literature that gives strong theoretical foundation to the research objectives.

CHAPTER- II

REVIEW OF LITERATURE

A review of literature forms an integral part of the research process and gives a theoretical basis for the research. It fulfills the basic purpose of justifying the research, eliminating the possibility of duplication, enabling the researcher to learn from previous theory on the subject, and provides information about the research techniques adopted in the past.

As discussed in chapter I, the success of the system can be viewed from two dimensions, product success and process success. A brief overview of the researches conducted and related to both the dimensions has been presented under the following heads:

- Product-based review: Focuses on analysis of the product features based on SCMIS, and provides support, wherever applicable.
- Process-based evaluation: Measures effectiveness of the processes in implementing SCMIS. An extensive review of success factors for the successful implementation of the system is done.
- Hindrance factors for the successful implementation of SCMIS.

2.1 SCMIS PRODUCT SUCCESS MEASUREMENT

In this segment, we establish theoretical foundation of SCMIS success construct based on review of literature. What constitutes success for IT projects has been a matter of debate for the researchers. The literature reveals that the success factors can be classified into the following two categories - process and product success.

The process success evaluates the effectiveness of the organizational process in implementing the IS till the deployment of the system to the end-user. Product success evaluates the effectiveness of activities performed to include the new system into the organization normal business (usual day-to-day business operations). It is measured after the project is completed and is deployed to the ultimate users to become part of the organization (Software Education Associates Ltd 2006).

The review of literature focuses on different measures that act as a surrogate to the successful implementation of IS.

- Oliver White's ABCD Classification Scheme, which was considered by various researchers (Burns 1991; Wilson et al., 1994). They created an ABCD checklist and proposed successful implementation measures in two ways namely, improved performance and user satisfaction.
- Completion of implementation of the system on time.
- Completion of implementation of the system within budget.
- Intended business performance improvements has been used by various researchers (Al-Mashari et al., 2003; Hong and Kim, 2002; Mandal and Gunasekaran, 2002; Markus et al., 2000; White et al., 1982; Yusuf et al., 2004) as an indicator of success.
- System acceptance and usage by the users
- User satisfaction: One of the most important measure of IS success is the satisfaction of the user. Ives et al. (1983) defines user satisfaction as "a perceptual or subjective measure of IS success" and considered information product, EDP staff and services, and user knowledge and involvement as three construct to user information satisfaction which was confirmed in the study by Baroudi and Orlikowski (1988). Further research in this area was done by Doll, et al. 1995; Doll and Torkzadeh, 1988; Doll, et al. 1994; Doll and Weidong, 1997. Doll and Torkzadeh (1988) in their study proposed a second-order factor model of end-user computing satisfaction. The first-order factors measured by 12 items include content, format, accuracy, ease of use, and timeliness. The second-order factor is interpreted as end-user computing satisfaction. Doll et al. (1994) conducted a confirmatory factor analysis on the Doll and Torkzadeh model (1988) to confirm the five factor second order model.
- User involvement and information success: In this phase user information satisfaction (UIS) became a measure of the success of an IS. UIS measured of how satisfied a user is with the IS. Ives and Olson (1983) reviewed the Management Information System user involvement research literature and found thirteen studies which utilized UIS as the dependent variable or indicator of success. Study by Baroudi, et al. (1986) empirically tested the relationships among user involvement, systems usage, and user information satisfaction. They found that user involvement would enhance system usage, and user information satisfaction and user satisfaction would lead to greater system

usage. Study by Barki and Hartwick (1989; 1994) made a distinction between user involvement and user participation. They define User Involvement as “a subjective psychological state reflecting the importance and personal relevance of a system to the use” and User Participation as “a set of behaviors or activities performed by users in the system development process.” They concluded that user participation significantly influence both user involvement and user attitude.

For the present study, the success of SCMIS is utilization of such systems for the enhancement of the organizational goals (Gable et al., 2003; Ifinedo, 2006). Its definition excludes the project implementation of IS wherein the measurement indicators include cost overruns, time overruns and project management metrics (Markus, 2000; Hong and Kim, 2002). Therefore, when measuring the success of such systems specialized success measurement framework or model must be used (Ifinedo, 2006).

2.1.1 Models Related to IS Acceptance

The decisions associated with the IS implementation are mostly owned by top management since huge amount of monetary resources are involved. Most of the end-users are involved only at the later stage, such as training phase. Therefore, due to inadequate involvement of the end-user they often have different perspective about the necessity of the system. They are more skeptical about the implemented system, which is shown by either underutilization of the system, or completely rejecting the system. Therefore, even if the system were implemented within the budget and on time, it would be rendered ineffective if the users perceive the system to be useless for their work processes. Lack of user acceptance is one of the obstacles to the success of information system. Therefore user acceptance models for information systems (IS) have been developed by various studies which helps in the understanding the success of IS adoption. To derive the model for the present research problem, the approach that has been adopted follows the below mentioned steps

- a) Identify the various success measurement models
- b) Develop an improved model by adopting an implementation model from step a
- c) Validate the model

Delone & Mclean's (D&M) (1992) model is one of the most cited models for information system success (Gable, Sedera, & Chan, 2003). D&M on the basis of their extensive review of literature classified dimensions of IS success into six categories:

1. “System quality: The desired characteristics of an IS itself.
2. Information quality: The desired characteristics of the product of an IS.
3. Use: The receipt consumption of the product of an IS.
4. User satisfaction: The interaction between the user and the system.
5. Individual impact: The effect of information on the behavior of a receipt.
6. Organizational impact: The effect of information on organizational performance.”

According to them, these six dimensions of success are both dependent and interrelated. Figure 2.1 shows D&M IS success model. The model shows that system quality and information quality are both predecessors to system use and user satisfaction, which are themselves related. Further system use and user satisfaction will have an impact on the individual performance and this impact finally affects the organizational performance. Thus, the first two variables of system and information quality are quality measures; next two variables of use and satisfaction are attitudinal outcomes, and last two variables of individual and organizational impacts are basically performance related outcomes. Thus D&M model shows “temporal and causal” interdependencies between the categories proposed by them.

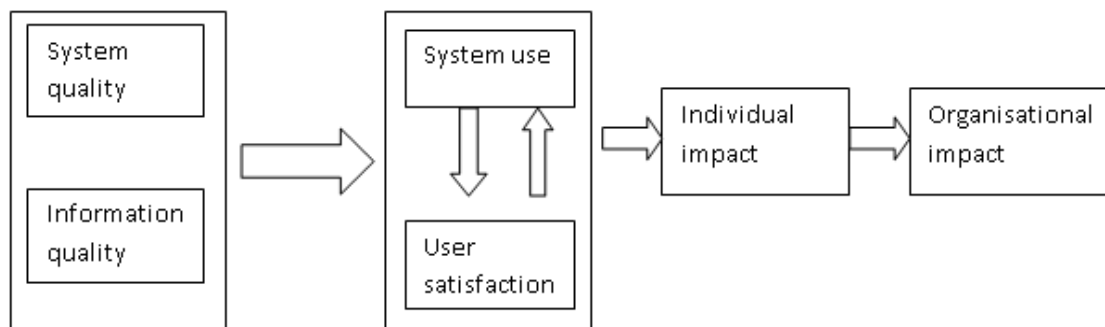


Figure 2.1: Delone & Mclean success model

Gable *et al.* (2003) developed an ERP system success measurement model that redefines the dimensions in DeLone and McLean’s (1992) model. Gable *et al.* (2003) using statistical analysis eliminated the system use and user satisfaction dimensions that were present in the DeLone and McLean (1992) framework. The retained ERP success dimensions in Gable model are information quality, individual impact, system quality and organizational impact.

The *Technology Acceptance Model (TAM)* explains and models as to how the users use a technology and the acceptance of the information systems by the users. The TAM model suggests that various factors control the decisions of the users about their using a new technology which is presented to them. The two most important factors include perceived usefulness and perceived ease of use.

- Perceived usefulness (PU) – Is defined as “the degree to which a person believes that using a particular system would enhance his or her job performance” by Fred Davis.
- Perceived ease-of-use (PEOU) – Is defined as “the degree to which a person believes that using a particular system would be free from effort” by Davis (Davis 1989).

Research studies suggest that PU and perceived ease of use are especially important as ways of measuring user satisfaction with IS (Venkatesh & Davis, 1996). One of the principal finding by Davis (1989) was that perceived usefulness was more dominant than ease of use in determining system usage. A user who perceives an IS as providing value, is more likely to be satisfied with the IS than one who does not (Calisir and Calisir, 2004). Thus, PU is an important measure of information system acceptance. User acceptance is often considered as the key factor determining the success of an IS project (Davis, 1989). The technology acceptance model specifies the fundamental relationships between the features of the system, PU, attitude toward the system, PEOU and actual usage behavior. The model is helpful in forecasting and evaluating user acceptance of information technology.

Table 2.1 shows the measures used in the most widely cited models for Information system (IS) / ERP success and success measurements.

Table 2.1: IS / ERP success measurement models

Model	Measures
DeLone and McLean Model (1992)	“1. System quality, 2. Information quality, 3. Use, 4. User satisfaction, 5. Individual impact, 6. Organizational impact”
Gable et al. Model (2003)	“1. Individual impact, 2. Organizational impact, 3. Information quality, 4. System quality”
Ifinedo (2006)	“1. System quality, 2. Information quality, 3. Vendor/ consultant quality, 4. Work group impact, 5. Individual impact, 6. Organizational impact”
Seddon’s IS success model (1997)	“1. System quality, 2. Information quality, 3. Perceived usefulness 4. Net benefits to individuals, 5. Net benefits to Organizations 6. Net benefits to society”
DeLone and McLean Model (2003)	“1. System quality, 2. Information quality, 3. Use, 4. User satisfaction, 5. Service quality, 6. Net benefits”
Technology acceptance model (Davis, 1989)	“1. PU, 2. PEOU, 3. Attitude toward using, 4. Actual system usage”
TAM2 (Venkatesh & Davis 2000)	“1. PU, 2. PEOU, 3. Attitude toward using, 4. Actual system usage 5. Subjective norm (1. Image, 2. Job relevance, 3. Output quality, 4. Result demonstrability)”

Conceptual Model for the Product Dimension

After examining various models in Section 2.1.1 for measuring the product success, the initial focus of the present study was on the DeLone & McLean Model. (DeLone & McLean, 2003). For the present study use construct given in D&M model has been dropped as done by Gable et al. (2003). DeLone and McLean suggest, “Usage, either perceived or actual, is only pertinent when such use is not mandatory.” When use of a system is compulsory, the measure of use of a system has no relevance on the success of the system and the construct of use has been omitted since studies have shown that it is relevant only for voluntary systems. However, if the use of the system is compulsory, a better measure of usefulness is proposed for the success of IS than system use. Measure of usefulness is same as PU in TAM by Davis (1989). As users realize the increasing importance of the system, it leads to more satisfaction to them in using the system. According to Seddon (1997) more is the Perceived Usefulness from the system more is the User Satisfaction. It is believed that satisfied users will be more efficient, especially where system usage is mandatory (Calisir & Calisir, 2004).

Therefore, for the present study a model is being developed and validated to measure product success from the viewpoint of the user. The study proposes to measure SCMIS success in six factors:

- System quality: It is concerned with the desired characteristics of the IS. It shows the system's overall hardware and software performance. Perceptual measures such as ease of use, easy to learn, convenient access, and integration with the legacy systems have been adopted for the system quality construct. The study by Iivari (2005) shows a strong support for the association between system quality and user satisfaction.
- Information quality: It relates with the desirable characteristics of the system output. The characteristics such as relevant output, accurate, understandable, concise, complete output, timeliness, and usability of the output have been adopted for the information quality construct. The studies by Iivari (2005) and Wu & Wang (2006) strongly support the association between information quality and user satisfaction.
- Perceived importance of the system: Various studies (Venkatesh and Davis, 1996) have suggested that PU is one of the imperative ways of measuring user satisfaction with the IS. Mawhinney and Lederer (1990) also stated in their study that perceived usefulness of the information system and user satisfaction is strongly related. Therefore, a user who perceives the system to be significant and providing value to it is likely to be more satisfied than the one without it.
- User satisfaction: The most popular instruments of user satisfaction are given by Doll (1994) and Ives (1983). Both the instruments contain measures related to service, information and system quality. Some of the researchers have chosen to make use of a single measure to determine overall satisfaction from the implemented information system (Rai et al., 2002) or make use of a differential scale (Seddon & Yip, 1992). For the present study satisfaction of the user is measured through the user's understanding of the system, his experience, and overall satisfaction with the SCMIS.

Studies have shown that there exists a strong correlation between the benefits arising from the use of the system and the user satisfaction (Iivari, 2005). It has been observed that user satisfaction has a positive bearing on user's job (Torkzadeh & Doll, 1999). It improves user performance (Mcgill et al., 2003),

efficiency and effectiveness (Halawi et al., 2007), job satisfaction and decision making capability (Ang & Soh, 1997) in him/her. Studies investigated the relationship between the impact on the organization and user satisfaction. It was established that satisfaction was correlated to the performance of the organization (Law and Ngai, 2007).

- Individual benefits: It measures the magnitude to which SCMIS contributes to the success of individuals. The factors like improved decision-making and improved productivity; saves time, enhanced performance and makes job doing easier. Since organization is made up of individuals, therefore their benefits will lead to organizational benefits.
- Organizational benefits: It measures the magnitude to which SCMIS contributes to the success of the organization. The factors, like better resource planning, improved forecasting, reduction in inventory, improved supplier on-time delivery, improved order management, improved customer relationship, increased coordination with suppliers and cost reductions, have been adopted for the organizational benefits construct.

2.2 IMPLEMENTATION PROCESS EVALUATION-CSFs APPROACH

John F. Rockart (1979) first introduced the concept of Critical Success Factors (CSFs). The rationale of this concept is to identify the critical areas that should be constantly and carefully managed by an enterprise for ensuring the organizational success. Various definitions of CSFs exist and one of the most popular and frequently cited definitions is given by Rockart. Rockart (1979) defines CSF as *“the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization”* (p. 85).

According to Rockart (1979, p. 87), while applying the CSF approach the following benefits exist for managers:

- “The process helps the manager to determine those factors on which he or she should focus on to gain management attention. It also helps to ensure that those significant factors will receive careful and continuous management scrutiny.”
- “The process forces the manager to develop good measures for those factors and to seek reports on each of the measures.”

- “The identification of CSF allows a clear definition of the amount of information that must be collected by the organization and limits the costly collection of more data than necessary.”

At present, Rockart’s (1979) CSF approach is predominant for project management and IS implementation. This approach is quite popular among the consultants and IT department as it helps in strategic planning. It has been established by Ramaprasad and Williams (1998) in their study that the main areas where the CSFs approach is being used are project management and information system implementation.

Huge cost and risk is involved in the implementation of SCMIS. Therefore, based on the above premise, critical success factors (CSFs) should be identified for the successful implementation of the system.

The research on the CSFs for the successful implementation of SCMIS is scarce and fragmented. Therefore, to build the list of CSFs, two groups of studies have been considered. Firstly, factors focusing on ERP implementations like top management support, BPR, change management, training, user involvement, communication, etc. since SCMIS is an extension module of ERP (Moller, 2005; Koh, 2011). Secondly, factors for CSFs implementation of inter-organizational systems like trust, partnership, long-term relationship, technical compatibility and pressure from the partners.

The supply chain system is a network of organizations that are connected to suppliers upstream and downstream with the customers, in the most efficient manner through various activities so that they are able to deliver value to the customer in the form of products and services. The organisations are moving towards “end-to-end” integrated systems after successfully implementing ERP systems within their organisations. The ERP systems are being integrated to SCM and CRM systems (King , 2005). There are huge challenges involved in implementing the supply chain information system as compared to an implememntaion of intra-organizational systems. (Denolf et al., 2015). Thus a comprehensive research of ERP and inter organisational systems was conducted (from journals and international conferences) to develop a framework based on critical success factors for successful implementing SCMIS.

2.2.1 CSFs Based on ERP Literature

From early 1990's Enterprise resource planning gained importance and is one of the most researched IT software application. ERP has been extensively researched because it is considered as an important strategic tool of competition and it plays an significant role in managing organisation- wide business processes. The implementation of ERP leads to integrating all business management functions and has resulted in large benefits like improve productivity, increase efficiencies and reduce costs. Another important reason for the ERP investigation popularity is that although it has been recognised as a useful tool , in practise, it has a high failure rate. Huge amount of money and time is invested by the enterprise for the implemenation of these systems and the result obtained is not as per the expectations. Thus factors are to be identified which , if taken care of , considerably improves project implementation chances. The methodolgy adopted for literature review for the identification of CSFs was based on the following criteria:

- Includes “critical success factors”, CSF, issues and
- Include either ERP or enterprise systems or enterprise resource planning or
- Include either EDI or supply chain mangement or ERP II or extended enterprise or collaborative networks

Samuel and Kumar (2014) used seven people related success factors -vendor, top management, positional power user, knowledge power-users, project team, transaction users and consultant and four success indicators –project success, financial related benefits, Process improvement benefits and future needs benefits for ERP project success. The study concluded that for the success of the project all the seven people related factors are significant.

Ijaz et al. (2014) explored CSFs in all the three phases of ERP system. For the pre-implementation phase, the study found that various CSFs of ERP system are clear objectives and scope, complete understanding, organizational analysis, product selection, project management team composition and study of organizational culture. For implementation phase, business process re-engineering, inter-team cooperation, change management, effective communication, successful training, infrastructure, leadership, top management involvement, rewards and recognitions, standardized sequence of implementation, composition of the project management team and management

commitment were identified as the CSFs. Finally, CSFs considered in post-implementation phase were motivation of the employee, organizational efficiency, satisfaction of the end-user, software reliability, support and maintenance.

The study by Bhatti (2014) have taken ERP experts' perceptions and the top five CSFs as ranked by the experts for ERP acquisition were effective communication, top management support, proper and efficient planning, user involvement and balanced team.

Dwivedi et al. (2013) explore the CSFs in the Indian context which contributes to the successful implementation of ERP systems. The study identified 14 factors like top management support, BPR, user training and education, change management, ERP teamwork and composition, project champion, business plan and vision, effective communication, project management, IT legacy systems, monitoring and evaluation of performance and software development, testing and troubleshooting, vendor selection which contributes to the successful implementation of ERP systems.

Garrett and Neubaum (2013) recommend as the support from the top management is enhanced it eventually leads to the elevated levels of initial strategic assets and thus it enhances the performance of internal corporate venture.

Saleh et al. (2013) analyzed association of vendor support, consultant competence, business process re-engineering, competence of the ERP team, ERP project manager, top management support and User support with ERP success. They concluded successful implementation of ERP in Saudi Arabia is influenced by vendor support, consultant competence, BPR, top management support and user support.

Soltanzadeh and Khoshsirrat (2012) in the study identified CSFs in implementation of ERP systems that are effective on organization success. The study concluded five main factors effective on ERP implementation success are Culture, Organizational Structure, Project Management, Support Activities and Training Issues, and the Interaction between Transferor and Transferee. They further declared that the Project Management and Interaction between Transferor and Transferee factors have the most effect on organization success after ERP implementation.

The study by Papaioannou et al. (2011) demonstrates the top management support, user satisfaction, users involvement , role of the consultant, setting of the clear goals and

objectives, effective training programs , budget planning, selection of the package, working process re-engineering, role and experience of the consultant and users acceptance of technology.

Shah et al. (2011) in the study emphasized that apart from the technical factors there are numerous socio-technical factors that are found critical during ERP implementation. The study shows BPR, change management, top management support and scope of the project are the most critical factors in the implementation of ERP system.

The study by Dezdar and Ainin (2011) examines organizational factors that affect ERP implementation success. The authors concluded that for the project to be successful top management must impart full support and commitment. Further the top management must make sure that all the plans are clearly communicated and understood by the entire company. Finally, they emphasized that proper and effective training should be provided to the users so that they can use the system effectively and efficiently thus leading to the user satisfaction, which will subsequently impact the implementation success.

Al-Fawaz et al. (2010) in the study considers critical success factors from different perspectives of technology, stakeholders, organization, process and project. Major factors found from the study are change management, project management, product selection and business process design. From every perspective, they found top management commitment as the most important factor.

Dezdar and Sulaiman (2009) developed a framework of CSFs for the implementation of ERP systems by adopting content analysis approach. The study grouped the CSFs into three parts namely ERP system, organization and implementation success. The three major environments were sub-divided into ERP project, business success, external expertise, ERP user, ERP technology and project success.

Soroor, et al. (2009) the study introduces the critical failure factors in SCM, during SCMIS development phase, and within SCMIS itself. A total of 49 CFFs as the causes of failure within SCMIS have been recognized. The prominent CFFs are lack of clear link to business objectives, inadequate training of users, lack of streamlining information and material flows, etc. The study highlights the significance of restructuring the factors that play a key role in SCMISs and disregarding them may results in system failure.

According to Ramayah et al. (2007) the critical factors for the smooth introduction and successful implementation of the system were top management involvement, change readiness, business plans and vision, team composition, vendor support, teamwork and communication were found to be to ensure a smooth introduction for successful ERP implementation.

Sternad and Bobek (2006) concluded the most important factors for ERP implementation were: clear goals and objectives, scope and planning; support from the top management, project team and user involvement.

Major CSFs extracted by Francoise (2009) comprises of top management support, BPR, project management, project team composition, organizational culture, change management, plan and vision, effective communication and organizational structure.

The study by Anbanandam, Banwet, & Shankar, (2011) proposed a model for measuring collaboration between retailers and manufacturers using variables like trust, top management support and involvement and long term relationships.

Sorenson (2005) in the study pointed towards evolution of organizational factors as CSFs in forming the partnership among supply chain members. The supply chain alliances are thus a strategic issue which gives an organization a competitive advantage.

Through a review of literature, Ngai et al. (2008) identified 18 CSFs for the successful implementation of ERP system. namely BPR, project management, project team and composition, project leader, data management, clear business plan and vision, effective communication, top management support, change management, IT legacy systems, monitoring the performance, software development, and implementation methodology. The study concluded that top management support and effective training were most frequently cited for the successful implementation of ERP systems.

Ramayah et al. (2007) examines the effect of CSFs on the successful implementation of ERP systems in Malaysian manufacturing organizations. The study concluded that change management, top management support, effective communication, project team composition, business vision and vendor support were found to be critical for the successful ERP implementation.

The study by Song et al. (2007) developed a framework that links some critical success factors (CSFs) with the implementation of ERP systems based on the theory of TAM. They inferred that user perceived fit, compatibility of an ERP system and change management of an organization will influence the adoption of the system by the user. Further, top management support was imperative for BPR, change management and effective interdepartmental communication. Top management may need to do more to influence employees attitude to change, to pay more attention to business process and to encourage more communication between departments.

Finney and Corbett (2007) in their study identified 26 CSFs and grouped them into strategic and tactical categories. Under strategic category factors included were change management, top management support, project management, project sponsor, proper building of a business case, strategy for implementation and managing cultural change. For tactical category factors included were IT infrastructure, BPR, balanced project team, effective communication plan, motivation of project team, empowering decision makers, IT legacy systems, training, product selection, project consultant and post-implementation evaluation.

Jafari et al. (2006) analyzed ten factors namely, top management involvement, BPR, clear business goals, effective communication, efficient project management, education and training , accuracy of data, suitability of software and hardware , user involvement, and vendor support for ERP implementation success. The study concluded that two most important factors for successful implementation of ERP systems are top management involvement and clear business objectives.

The study by Ehie and Madsen (2005) analyses the critical success factors affecting successful ERP implementation. The study identifies eight factors i.e. BPR, feasibility study of ERP project, top management involvement, IT infrastructure, management principles, human resource management, cost of the project and consulting services that impact ERP implementation.

Tsai, Chien et.al (2005) explores the critical failure factors in the implementation of the enterprise resource planning system. The result identifies CFFs in Taiwan for the successful implementation of ERP systems. CFFs are change management, effective training and proper project management. The study suggested that if firms can

concentrate and take care of the failure factors, they could increase the chances of successful implementation of the system.

Somers and Nelson (2004) analyzed the stakeholders and their activities for the successful implementation of ERP system. The key stakeholders identified were top management, project team, project champions, steering committee, vendors and consultants. Their major activities identified as effective training, change management, clear communication, selection of the product, customization and cooperation.

In the study by Loh and Koh (2004) ten critical success factors were identified namely, top management involvement, project leader, project management, clear communication, project team composition, clear business plan and vision, BPR , change management, software development and testing, minimum customization and evaluation of performance. Along with CSFs they also identified critical people (e.g. vendors, consultants, end users, operation manager, end-users, and IT support staff) and critical uncertainties (e.g. unrealistic budget, unskilled personnel, employees' resistance to change, unclear system maintenance).

Colmenares (2004) analyzed the degree of criticality of twenty critical success factors in the successful implementation of the ERP systems. Critical among the twenty CSFs were top management support, project champion, project management, management of expectations , clear communications and full time involvement of the team members, A factor analysis of all twenty items was done and three underlying dimensions identified were “ERP Implementation Management”, “Users Aptitudes and Communication”, and “Technical Knowledge”. They concluded that the “ERP Implementation Management” factor is the most important factor.

Nah, Zuckwiler, and Lau (2003), in the study surveyed 1,000 companies to identify CSFs according to CIOs. CIOs ranked project management, top management support, change management, project leader, project teamwork and composition, change management and culture to be the most critical for successful ERP implementation.

Al-Mashari et al. (2003) in their study presented 12 CSFs and divided them into three dimensions namely setting-up, deployment and evaluation according to the different stages of the implementation of the ERP project. The study concluded that top management support, commitment and involvement are a prerequisite for the successful

implementation of the ERP system. Another factor considered important for the successful implementation is clear vision and business director. The study also highlighted the importance of BPR and suggested the performance monitoring of the implemented system.

Umble et al. (2003) in the study identifies procedure for the selection of the software, factors critical for the successful implementation and the procedure for implementation so as to have successful implementation of the system. CSFs for successful ERP implementation identified are: change management, clear understanding of business goals, support from the top management, effective education and training and performance measures of the implemented system. The study also focuses on the three top most reasons for the failure of implementing IT systems. First being poor planning/management second is the lack of top management support and lastly is the amendment of business goals during the project. The study observed that high costs are involved in the implementation of ERP systems which puts vast demands on company's time and resources and is therefore difficult to implement. If the system does not achieve the predetermined corporate goals the implementation is classified as a failure.

Kumar et al. (2003) investigates critical management issues in the implementation of ERP systems such as training to the users, IT infrastructure development, project management, vendor selection, project leader, composition of the project team, proper project planning, implementation stakeholders and quality assurance.

Nah et al. (2001) identified 11 CSFs for the successful ERP implementation. They concluded main factors influencing the successful implementation as vendor- consultant partnership and project teamwork and composition. Another very critical factor considered in the study was change management and organizational culture. The organization where employees are ready for change and share common goals is most likely to succeed in implementing ERP. Other CSFs included were support from the top management, clear business plan and vision, effective user training, BPR, clear communication, proper education and support, project management, project leader, software development, IT legacy systems and evaluation of performance of the implemented system.

Holland & Light (1999) study proposes taxonomy of CSFs so as to help the managers formulate a strategy for the successful implementation of the system. CSFs were categorized into strategic and tactical factors. Top management support, Clear business plan and vision, project management, strategy for implementation and IT legacy systems were included in the strategic factors. Tactical factors included BPR, effective communication, monitoring and feedback, client consultation, personnel and troubleshooting.

Stefanou and Constantinos (1999) reveal the critical factors for implementing successful ERP systems. The study categorized the factors into technological and organizational. They concluded that organizational factors are more significant than the technological factors for the successful implementation of SCMIS. The study recommends the main factors for successful implementing ERP system for supply chain as proper and clear communication, effective training, organizational willingness for information sharing, motivational leadership and commitment to team-work.

After an extensive review of literature the critical success factors that are considered for the present study are discussed below.

2.2.1.1 Pre Implementation Analysis

The entire attention is paid on gauging the success of implementation of the system and the pre-implementation stage is often not given much importance, whereas the planning phase forms the foundation to the successful implementation of the SCMIS. Only few studies (Abdinnour et al. 2003; Van et al. 2009; Verville 2007) have reviewed pre-implementation stage. In the pre-implementation phase the organization prepares a business plan which includes the costs, strategic benefits, risk and resources (Wee 2000). Dantes and Hasibuan, 2011 in the study have stressed that before the implementation phase proper and diligent risk management must be done so as to be prepared with alternative solutions in case of undesirable happenings. It thus establishes the need for the system and provides justification for the investment (Tarafdar 2003; Xu et al. 2002). Another strategic factor for inter-organizational systems (IOS) in this phase is the business vision (Ngai et al. 2008 and Al Turki 2011) which explains the context of implementing the system. The vision may be reduction of cost, more flexibility, and quality improvement or to have better relation with the trading partners. Thus the system

should link clearly to business objectives (Aladwani 2002; Duplaga and Astani 2003; Fui-Hoon 2003; Parr and Shanks 2000; Soroor 2009; Sumner 2000; Umble et al. 2003). Davenport (2000) gave a rational approach for implementing the system and divided into two parts: preparing the personnel and the technical system. In preparing the personnel at pre-implementation stage studies have considered change management (Ngai et al. 2008) to be critical for the successful implementation of the system. It is very important to have a positive employee attitude towards the implementing system and user acceptance of the project (Abdinnour-Helm et al. 2003; Holland and Light 1999; Kumar et al. 2002; Parr and Shanks 2000 ; Ross and Vitale 2000). A climate for change is to be created for which the reasons for users' resistance is to be understood. The benefits of the system should be properly communicated (Bingi et al. 1999). Further effective agents of change (informal leaders) should be developed for making the change easier. The users should be involved in designing and implementing business processes as part of the change management strategy. Davenport (2000) in order to prepare the technical system describes the following processes: standardisation and conversion of data, development of the interface, software configuration , testing and performance management. Hustad and Olsen (2011) in the study reveals that during pre-implementation phase it is important to select ERP software, consultant and vendors. The study focuses on having a long term partnership and trust between the organisation, consultant and vendors.

2.2.1.2 Top Management Support

The literature has clearly cited that support of top management is critical for any IT project to succeed. Support from the top management includes providing of the resources, attention , their involvement in the implementation of the system and the authority required for implementing ERP system (Wang and Chen, 2006). An important issue that should be emphasized in the function of support from the top management is clear business plan and vision through which they can outline the risk, cost and benefits associated with the implementation of IOS system. Top management has the responsibility of aligning the system being implemented with the current business practices and prepare the employees for the change brought by the new technology . Top management should clearly understand that ERP implementation is not only changing of the software alone but it is reforming and re-engineering of the organisation which leads to transformation from the existing business practices to the best practices (Zhang 2005).

Therefore, management should be involved and committed in every aspect of the ERP implementation.

Top management support can also help to partially mitigate, user resistance by encouragement or user engagement in the implementation. (Wang and Chen, 2006). The participation of top management is also important for the effective re-engineering of the supply chain and logistics processes (Gunasekaran et al., 2004) leading to successful inter-organizational systems and relationship. It is the top management commitment and willingness to allocate the necessary resources and take up risk involved in the adoption of IOS to gain competitive advantage. Top management should give priority to the project being implemented, monitor the progress of the project and provide clear direction (Dantes and Hasibuan, 2011). According to Zhang (2002), support from the top management should focus on two main points: (1) transformational leadership; and (2) provide the necessary resources. Thus, intervention by them is necessary for financial and human resources allocation, to take fast and effective decisions, resolve conflict, mutual cooperation among the different groups of people in the company and to promote acceptance of the project being implemented. According to the study by Denolf et al. (2015) for the implementation of SCMIS approval for project plan and budget, top management support of the participating companies is required. Study by Ahmad (2013) which had reviewed over 50 papers relevant to the identification of CSFs for the ERP implementation had observed that top management support had an occurrence percentage of 100.

2.2.1.3. BPR and Minimal Customisation

Business process re-engineering (BPR) plays an important role in implementing SCMIS in which best practices of the software are adopted and existing business process are replaced. A number of studies researchers (Al-Mashari 2003; Zhang 2003) have emphasized the need for the BPR during the implementation phase of the information system. Business Process Re-engineering (BPR) is defined by the researchers as “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements is critical, contemporary measures of performance such as cost, quality, service and speed”. According to the study by Dantes and Hasibuan, 2011 BPR should precede the implementation of ERP so as to create a competitive advantage for an organisation and optimize the existing business process. It is critical to ensure that the

software fit to the business process for which the company should be ready for a change and the new system fit into the organisation with minimum customization (Loh and Koh 2004). It was emphasized in the study by Nah et al. (2003) that organisation should change their processes according to the system being implemented so as to adopt the best practices. Zhang et al. (2003) emphasized that to facilitate the change process there should be a trust factor between the top management who is initiating the implementing of the system and the people who are going to be the end users. They further considered communication as another determinant factor affecting successful BPR implementation. According to them the purpose of re-engineering should be properly communicated to the people, the clarity about their jobs should be given, and meetings should be held so as to make the employees clear about the adopted re-engineering strategy. The organization needs to understand that it is the enterprise that should fit into the system. Thus more is the willingness on part of the organization to change, higher are the chances of implementing a successful system. Dimensions concerning business process re-engineering as given by the study of Zhang (2003) are willingness of the company to re-engineer; readiness of the company to change and the capability of the company to reengineer which summarizes the important dimension of BPR and thus adoption of the system could be positively associated with change in business process (Saleh,2013)

2.2.1.4. Clear Business Plan and Vision

The system implementation requires that the key personnel within the organization should have a clear goals and vision about how to satisfy customers, facilitate suppliers and empower the employees (Umble, 2003) which should lead to the successful implementation of the system. Study by Loh and Koh 2003 defines a clear business plan that outlines costs, strategic benefits and risks associated with the system being implemented. The study by Dantes and Hasibuan,2011 also focuses that the enterprise should have a clear goals and objectives so as to guide the company to achieve the successful implementation of the system. It is essential that there should be clarity of goals , expectations, and deliverables from the system. Further this all should be well-defined without any ambiguity. The organization also needs to define the purpose of implementing the system so as to justify the investment. The vision should provide a clear link between organisational goals and IS strategy (Finney, 2007). Wee (2000) stated that in the business plan the organisation should outline costs , benefits , risks, resources and

timeline. According to the study by Denolf et al., 2015 for the implementation of SCMIS, the business vision should assess the existing current processes and design the supply chain with the new information process.

2.2.1.5. Change Management

The implementation of SCMIS requires changes in the way an individual employee performs his job. Employees are often comfortable the way they are performing their work and do not feel the need for a new system. Thus organizations face resistance to change which is considered as one of the main hindrance to successful SCMIS implementation. Therefore change management is very important which enables the employees to adapt to the change. According to the study by Umble (2003) the people should be properly prepared for the changes that will take place after the system is implemented in the organisation, otherwise it will lead to a chaotic situation and more resistance to change. Change management will effect the process change more than the technology changes and therefore it must be there in every phase of the implementation process. (Dantes and Hasibuan, 2011). Consequently, the strategies should be developed to overcome the resistance to the change and prepare the users' by providing them with the benefits and the opportunities by the system received by them. (Stratman and Roth, 2002). According to Nah et al. (2003) for a conducive change management we should manage enterprise –wide culture with shared values and structure with a strong corporate identity. If proper change management techniques are employed the organization can tap in the opportunities provided by the system. It is recommended by the researchers (Umble, 2003, Nah et al., 2003) that during the designing and implementation phase user should be involved so as to have a smooth transition from the old system to the new system being implemented. Further the user needs to be trained and educated about the system, its benefits and impact on his job. For managing the change management, Wee (2000) in the study stresses on establishing a support organization for the users' in the form of help desk and online manual. Loh and Koh (2004) in their study emphasizes that people, organization and culture should be managed by education and training to maintain the change throughout the entire ERP implementation. Due to its collaborative nature, managing people and organisational inertia change management is even more critical to ERP II implementation (Koh et al., 2008; Møller, 2005; Weston, 2003). Therefore it is very essential that organization is committed, determined and shows

perseverance to change since it is one of the key factor to the successful ERP implementation.

2.2.1.6. External Support

The implementation process requires external support in the form of vendors' and consultants' for the system to be successful. Since SCMIS are complex systems, organizations depend upon external expertise for developing, implementing and maintaining of the system. El Sawah (2008) emphasized the support of the vendor as a significant factor with any packaged software. The support includes updates, maintenance, technical assistance and special user training. The vendor support is required throughout the period and therefore most of the companies enter into long term agreement for their support. According to Zhang (2003) three dimensions of vendor support are qualified consultants having knowledge about the organisations' business processes and vendors' ERP systems ; Service response time of the software vendor; and participation of vendor in the implementation process.

Consultants support is required to facilitate the implementation process by providing suitable solutions to the problems being faced. They should possess good inter-personal skills since internal implementation team depends on the consultant for their technical expertise and knowledge transfer. A good vendor support increases a company's project success therefore selection of the vendor should be done diligently by taking into consideration the reputation, experience and previous implementation record in their sector. It is very important that the proper and complete knowledge transfer takes place from the consultant to the user of the system and therefore the consultants should not only be used during implementation phase. They should impart training to the user in the right manner and focus on the functionalities and not merely on tools of the system. Thus, consultants and vendors play a significant role in the successful implementation of the system.

2.2.1.7. Organisational Culture

The organization culture is defined as “a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems” .

According to study by Somers and Nelson(2001), a corporate culture that lays stress on the value of shared common goals over an individual and the organisation with trust between different stakeholders is more likely to have a successful implementation of ERP systems. According to the study by Nah et al.(2001) an organisation with common objective and culture with shared values is conducive to success because it emphasizes quality, and empowers the willingness to accept new technology. It would greatly aid in implementation efforts. The study by Leidner & Kayworth (2006) shows the organisation where system is aligned with the organizational culture is more likely to have a successful implementation of the system. In connecting distinct platforms, applications and data formats across the value chain; enterprises have to overcome various obstacles such as user resistance to change (Ash and Burn, 2001)and reluctance for establishing a company culture open to sharing business processes and to collaboration .

2.2.1.8. Communication

Effective and clear communication between all the members of the participating supply chain organizations forms an important basis for the successful implementation of SCMIS (Denolf et al., 2015) and the project manager should facilitate clear communication among the users , consultants and the project team members of the organisation(Dantes and Hasibuan,2011). It is essential that the management should communicate any expectation, requirement, comments and reactions clearly(Loh and Koh 2004). For this study, two communications internal and external is being considered. Internal communication is the communication between all functional department of an organization in order to ensure minimum resistance to change, clarity of business goals and strong support and commitment . Proper communication in regard to the change management, BPR and the rationale for the implementation with the users' is very important to have a successful implementation of the system (Mandal and Gunasekaran, 2003) . It is imperative to have complete co-operation from the executives and users' since technology alone cannot act as a tool of organizational competitiveness. It is imperative that for the successful implementation the users' should participate in the implementation phase and should also understand the benefits that would accrue to them after the system is implemented (Ngai et a.l., 2004). External communication takes place between the organisation , suppliers and customers outside the enterprise boundaries for determining business requirements, needs and opportunities, and for taking decisions.

Effective external communication facilitates cooperation from the suppliers. Thus for the successful implementation of SCMIS, internal communication has to be clubbed with the effective external communication with the suppliers.

2.2.1.9. User Support and Involvement

These factors are critical as the system being implemented is for the employees. Therefore, the user involvement and participation should start much before the implementation takes place as has been emphasized by various studies (Holland et al., 1999). Hartwick 2001 defines user involvement as “A psychological state of the individual, and as the importance and personal relevance of a system to a user”. Studies by Duplaga (2003), Hong (2002), and Rajagopal (2002) show one of the important critical factor for SCMIS implementation as resistance to change. Henceforth, enterprise should establish change management teams to deal successfully with this resistance to change. by establishing change management team. Studies by Ketikidis et al. (2008) and Soroor et al. (2009), also show organizational resistance as a common cause of implementation failure. This resistance can be diminished with user involvement in the implementation process. According to the study by Esteves (2003), by involving the user in ERP system implementation the organisation can get user requirements and hence will be able to deliver better quality of the system.

2.2.1.10. Effective Project Management

Effective project management is very important and which leads to successful implementation of SCMIS. The success of IS projects are gauged by timely and within the budget constraints completion. The study by Loh and Koh (2003) stresses that individuals or group of people should be assigned responsibilities for different parts of the project and deliver a successful project management. According to the study by Zhang (2003) the parts of project management are: “(1) a formal implementation plan, (2) a realistic time frame, (3) periodic project status meetings, (4) an effective project leader who is also a champion, and (5) project team members who are stakeholders. It is very important to establish and define the clear scope of the project, schedule with clearly defined milestones (Holland et al., 1999) with responsibility allocation. Further it is important to set up a realistic time frame and put in all efforts to adhere to the timeline of the project.

For implementing SCMIS a project management approach should be adopted where a project management team should be formed and they will be responsible to provide financial and technical support and for planning the activities for implementation. Studies by Aladwani (2002), Fui-Hoon (2003), Parr and Shanks (2000), Umble et al. (2003) shows importance of the implementing team which should include IT expert , business expert and consultants so as to posses both business and IT skills (Kalling, 2003). Project management also includes the appointment of the project champion and the need of having project champion have been extensively researched (Ngai et al., 2008; Bradley, 2008). The project champion should posses leadership qualities (Mandal and Gunasekaran 2003) and managerial competencies (Kraemmergaard and Rose, 2002).

2.2.1.11. Project Champion

A project champion is defined as “any individual who made a decisive contribution to the innovation by actively and enthusiastically promoting its progress through critical stages in order to obtain resources and/or active support from top management” Roure (1999, p. 4). Project leader plays a crucial part in the implementation of the system. According to Basu et al. (2011) the project champion should be authorized to set goals and to introduce any changes required. Project managers must posses strong leadership quality, should be committed to the success of ERP implementation, understand the existing business process and knowledge of IT (Dantes and Hasibuan,2011). Project leader should be place in charge for business perspective, resolve conflicts and manage changes throughout the organization (Loh and Koh, 2004). The project champion at times needs to boost the morale of the team members and restore the commitment level of all the members as and when there is a decrease in employees’ morale due to putting in long hours during the implementation phase (Nah, 2003). The project champion can make a huge difference to the implementation of the project therefore transformational leadership is essential for the success of the system(Nah et al., 2001).

2.2.1.12 Project Team Composition

The implementation team is important because it is responsible for creating the initial, detailed project plan or overall schedule for the entire project, assigning responsibilities for various activities, determining due dates, and arranging the necessary resources (Umble et al., 2003). Project team composition further plays a key role in the system

implementation. The study by Nah et al. (2003) stresses the team to be cross-functional, full time committed towards the project implementation. A cross functional team should consist of the personnel which understand the organization's existing business processes and system's technical know-how (Loh and Koh, 2004). According to the study by Denolf et al. (2015) project team must consist of staff from the participating supply chain partners also. Study by Dantes and Hasibuan (2011) suggested that team should consist of personnel who understands the existing business process and also is committed for the successful implementation of the system. The implementing team should be more responsive towards the user of the system and a positive relationship between the two exists as has been stated in the study by Gefen and Riding (2002) . Further, the team members must possess the power and authority to take up quick decisions and should have clear communication with the management.

2.2.1.13. Training and Education

Another factor considered by the researchers for successful implementation is training and education (Bradley, 2008; Ngai et al., 2004). The objective of the training is to explain the features of SCMIS to the users. The main goal of providing training is to clearly understand the various business processes and should deal and explain all the features of the system. Users should be given hands-on training so that they overcome the fear of the new system being implemented. Researchers have proposed that training in the IT skills for the users should be included in it (Stratman and Roth, 2002; Tarafdar and Roy, 2003). The users should be explained about why the system is being implemented, how the system is going to change the organizations business processes (Vadbya, 2010), and the benefits that would accrue to the organization and to them through automation. The researchers (Al-Mashari, 2006; Zhang, 2002) have emphasize that it is very important for the users to understand the process behind the ERP application. This factor assumes importance because if proper training and education is not provided to the employees there will be high resistance for change. The study by Soroor et al. (2009) considers inadequate training for the team members and lack of user participation in the project as one of the SCMIS development failure factors. It was suggested by Dantes and Hasibuan (2011) that there is a need of providing quality training to the users'. The post training analysis should be done to see whether the users have received the training as it was intended. Therefore human plays an important role in the successful implementation

of these systems (Aladwani, 2002; Duplaga and Astani, 2003; Rajagopal, 2002; Robey et al., 2002; Sumner, 2000) and therefore training will facilitate the users for smooth transition to the new system adopted. Though the importance of for training is known, executives underestimate the cost and the level of training to be provided to the users. Therefore, top management should be committed towards training and include its cost as part of the budget. Study by Umble, 2003 has suggested that there will be 80% chance of having a successful implementation by providing around 10% of the total cost for training. This summarises the criticality of the training as a dimension in successful implementation of SCMIS.

2.2.1.14. Technical infrastructure

Complexity of the software has been studied extensively by various researchers (Adam and O'doherty, 2000; Francalanci, 2001; Parr and Shanks, 2000; Ribbers, 2002; Sumner, 2000) and they have concluded that there exists a negative relationship between complexity of the software and successful implementation of these systems. According to the studies (Petter et al., 2008) the information systems in the supply chain should be user-friendly, accessible, compatible, stable and reliable and requiring minimum training. The system quality features included in the studies were flexibility in the system, ease of use and learning, customization, system accuracy and sophistication and integration capability. They further included information quality features like usability, understandability, relevance and conciseness.

Hardware and software reliability is another factor to be considered for success of the system. The software reliability includes maintenance of the system, accurate data and the capability of the hardware in the study by Ngai et al. (2004). The study by Craighead et al. (2006) related the reliability of the EDI system with the frequency of downtime which may lead to a lack of faith in the system. Therefore for success the system should be free from unplanned downtime.

Another technical parameter somewhat related to reliability that is considered by Craighead et al. (2006) is in-house ability to maintain and to change/update hardware and software. Soliman et al (2004), Bouchbout and Alimazighi (2008) studied the technical factors critical to companies adopting inter-organizational information systems. They

suggested main factors that affect the adoption decision are cost of establishment, data security, reliability of the network, scalability and complexity.

Relatively inexpensive, simple for the customers and suppliers to adopt, and ease to expand to other customers and suppliers, are another technical dimension studied by Craighead et al. (2006).

According to the study by Dantes and Hasibuan (2011) it is important to have a mature infrastructure in the process of implementation of the systems for obtaining good performance and supporting the complexity of ERP systems.

2.2.1.15.Data Accuracy and Integrity

According to the study by Dantes and Hasibuan (2011), one of the important aspect of the implementation process is the analysis of data and its migration into the new system, errors in this component will lead to data inconsistency. Data accuracy is required for SCMIS to function efficiently. The integrated nature of the system across organizations makes it more vulnerable to feeding of inaccurate data into one module which will affect the functioning of the subsequent modules (Zhang, 2003). Therefore, data conversion from the legacy systems to SCMIS should be done very carefully without any error. For this, it becomes very important that users understands the importance of data accuracy and are educated about the correct data entry procedures. (Umble, 2003)

2.2.2 CSFs Based on Inter-Organisational Implementation

IOS has changed the way organisations conduct their business and the focus has shifted from internal to external orientation. The enterprises have realised that to perform effectively and to ward off competition they need to form information system linkages with their business partners. Therefore at present focus is on integration of upstream and downstream partners through supply chain management information system (SCMIS).

SCMIS is an extension of ERP which integrates companies beyond the boundaries of an organization and with the advent of globalization it has further gained more importance (Marwah, et al., 2012 and Gunasekaran, 2004). It has been recognized by many organizations as a strategy to attain business goals (Altekar, 2005; Chan and Lee, 2005). SCMIS involves managing and coordinating all activities associated with goods and

information flows from raw material sourcing to product delivery, and finally to the end customers (Wei and Chen, 2008). It provides high quality, relevant and timely information flow that effectively supports decision-making for inventory replenishment, capacity activation and for synchronizing material flows at all tiers within the supply chain. Thereby it plays an increasingly critical role in the ability of firms to reduce costs, increase responsiveness (Chopra and Miendl, 2005), gain competitive advantage (Dezdar, 2011) and achieve better coordination. Thus to make supply chain as a whole more competitive business partners are making efforts towards cooperative relationships. IOS an extension of ERP is sometimes referred to as ERP II.

The ERP II is more complex than its predecessor since integration is across the organisations and among disparate systems which is substantiated in the study by Denolf et al. 2015. For IOS to be successful organisation requires cooperation & commitment, long term relationships, trust and partnerships with their business partners. Thus factors are to be identified separately for implementing IOS system.

According to Denolf et al. (2015) for implementing supply chain information system the various critical issues are effective communication, project team composition, management of relationships, top management responsibility, alignment of vision for all collaborating partners and build plan, sharing of costs, benefits and risk among the partners, assessment of business and IT legacy system, selection of vendor and software package, re-engineer processes, management of project, management of data exchanged, change management & training to the users and monitor & evaluate performance.

Kumar et al. (2015) identified 13 CSFs for implementation of SCM in SMEs and studied their impact on performance of Indian SMEs. Top management commitment, long term vision, focus on core strengths, devoted resources for supply chain, and development of effective SCM strategy emerged as the most relevant CSFs.

The study by Chong et al. (2009) examines the tools for the adoption of e-Collaboration and its relationship between factors of supply chain. The finding of the study was that the supply chain factors like trust and product complexity affect the adoption of e-Collaboration. They also concluded that for the adoption of e-Collaboration trust was found to have formidable influence.

The study by Beheshti (2006) examines critical issues that should be addressed by the executives / decisionmakers of the organisation who are in the process of implementing an ERP/ERP II system . The extended ERP system is known as ERP II which is being widely adopted to improve competitiveness. It generates accurate and on time information through the organisation and its supply chain organisations. Beheshti analysed that before implementing the system the decisions regarding project management, vendor selection, consultant, training and implementation method should be taken. The study concluded that support, commitment, participation and involvement from the top management is required from the inception to the end.

Lu et al. (2006) studied inter-organizational information system of two companies, and the research revealed CSFs for the IOS. These are: inter-organizational BPR, intensive stimulation, shared vision, advanced legacy information system , implementation team, infrastructure, high integration with internal information systems, and shared industry standard.

Lee and Lim (2003), studied the impact of partnership attributes for the successful implementation of EDI. The results show that partner trust, interdependence, and commitment affect the extent to which companies undertake EDI integration and increase the percentage of EDI exchange and performance. The researchers suggest that companies considering EDI should set up compatible business processes and a high-quality partner relationship for implementation and performance.

Critical factors in the adoption decision of IOS were studied extensively by Soliman and Janz (2004) . the study identified support from the top management, costs of establishment, reliability of the network, data security , trust between the partners, pressure from the competitors , pressure from the trading partners, complexity and scalability as critical in the adoption decision of IOS.

Ngai, et al. (2004) in the study identifies CSFs of supply-chain management systems. The five major dimensions identified in the study are top management support and involvement, effective training and education, reliability of the hardware and software, clear communication and data security. The findings of the study will help the organisations that are planning to implement these web based supply chain information

systems. The system being implemented will be delivered successfully if the identified areas are addressed diligently by the organisation.

The study by Abdinnour Helm et al. (2003) examines the relationship between the employee attitudes and the implementation success of the system. The study observed employee attitude as one of the significant factor which determines effectiveness of implementation. The major findings of the study are that first the enterprises with more new employees is more likely to succeed in implementing of ERP system in the organisation than the organisation with more old employees as older employees are more resistant to change. Second the quick implementation approach should be avoided as the employees may get very little time to learn the new system and realise the full benefits that would accrue to them from the successful implementation of the system. Third, following a rational approach as given by the consultants and others for the ERP implementation may not be sufficient to overcome resistance being shown by the employees. The study focuses on developing of the positive attitude of the employees to the system being implemented by providing them with pre-implementation training, changes in roles and responsibilities ,explanation of the total benefits that would accrue on the successful implementation of the system, incentives and reward plan.

2.2.2.1 Cooperation and Commitment of Trading Partners

Inter organisational factors are significant in the implementation of SCMIS which is an inter organisational system as it integrates upstream with its suppliers and downstream with the customers. For the IOS system to be successful it is imperative to have cooperation among the trading partners and at the same time there should be a sense of commitment among themselves (Premkumar and Ramamurthy, 1995). Further cordial relationships (Gunasekaran et al., 2008; Ketikidis et al., 2008) should be developed among the trading partners thus forming the basis of successful IOS.

CSFs for inter organisational system has been studied by Lu et al. (2006). The study reveals shared industry standard, formation of implementation team which is cross-organizational , integration with the internal systems, shared vision, BPR, legacy systems and infrastructure, as CSFs for IOS.. Another issue widely studied is inter-organizational information sharing quality (Li and Lin, 2006; Hsu et al., 2009) focused their study on information transparency and visibility. Soliman and Janz (2004) studied the degree of

comfort about sharing sensitive information with the trading partners. Based on information sharing supply chain partnerships can be formed and benefits can be reaped which has been emphasized in the study by Yu et al. (2001). According to Kumar et al. (2015), collaborative decision making by supply chain members results in better forecasting of demand, trust between the supply chain members, and flow of information.

2.2.2.2 Trust

The literature has also researched trust between trading partners and has confirmed the trusting relationship for improving coordination between the partners as critical for the success of the system being implemented. Mutual trust refers to a favorable attitude that exists when the channel members have confidence in their partners' reliability and honesty; namely, the channel members do business with one another on a foundation of mutual trust so the long-term and extra benefits are achieved. Soliman and Janz (2004) in the study have emphasized the importance of having trusting relationship in implementation of Inter organizational information systems. Study by Bagchi et al. (2005) emphasizes that most organisations are vigilant when it they need to share sensitive data. Trust is required for uninterrupted flow of information in the supply chain. Studies by Mihok and Frank (2007), Ratnasingam (2005), Hart and Saunders (1997) have also considered trust as important success factor in implementing IOS.

2.2.2.3 Data Security

The data flowing through the system is extremely valuable and therefore studies by Ngai et al. (2004); Warren and Hutchinson (2000); Premkumar (2000); Bouchbout and Alimazighi (2008) included data security as an important technical factor for implementing of supply-chain management systems successfully. It is a matter of concern for the collaborating organisations in the supply chain about the security of the data and information access privileges (Lee & Wang, 2000; Premkumar 2000). The study by Premkumar (2000) observed that the data security issues usually get larger as the number of competitors increases.

2.3 HINDRANCE FACTORS

2.3.1 Impediments for ERP and IOS Implementation

Critical Failure Factors are the strategic areas which are of great concern since any error in these areas will lead to failure in the implementation process. Huge cost is involved in the implementation of these complex systems, and failure would lead to huge monetary loss to an organization or even push it to bankruptcy. Therefore to avoid such costly failures researchers are putting in efforts so as to help organizations make better use of their resources. Failure may be defined in terms of project factors like cost or time overruns. It may also be defined as a failure if the system is not able to meet the desired expectations of integrating organizational information, better communication across the organizations, better decision making, and reduction in cost. As is evident from the literature, the rate of failure of ERP implementation is very high. According to the study conducted by Zhang, 2005 , the system being implemented is taking 2.5 times longer duration than estimated, is delivering only 30% of the benefits than promised and are 178% over budget. Also it has been observed that about 70% of the implemented projects fail to deliver the promised benefits (Kumar, 2003). With such high failure rates scenario it becomes imperative to identify the risk and the failure factors that may arise during implementation and the ways to tackle these risks. Therefore, an extensive review of literature was undertaken to categorize the impediments which are defined by Peng & Nunes, 2010 as “An obstacle that prevents an action or event from being carried out successfully”. Two groups of studies have been considered, firstly, failure factors focusing on ERP implementations and secondly, CFFs for implementation of inter-organizational systems.

Basu and Biswas (2013) in the study attempted to evaluate the factors critical in the implementation of ERP in the Indian context. The factors that lead to unsuccessful implementation of ERP were poor quality of testing & BPR, poor consultant effectiveness, lack of clarity in communication, high customization of the software and high turnover of project team members.

For ERP implementation, Garg and Garg (2013) analyzed and identified the failure factors using cause-effect and Pareto analysis. The failure factors identified were lack of top management involvement, insufficient resources, lack of user involvement, poor

project management, unclear communication, lack of proper project scheduling, high turnover of project team members, high resistance to change by the users', poor change management strategies and lack of proper project team composition. These critical failure factors considered should be taken care of diligently in the implementation process for the system implementation to be successful.

The main purpose of the study by Amid et al. (2012) was identification of the factors and the study further classified these factors into seven groups so as help the implementers and consultants to prevent the failure in implementing these IS projects. The CFFs were classified in seven groups named as "vendor and consultant, human resources, managerial, project management, processes, organizational and technical." They analyzed and concluded the following important CFFs: a) the lack of any clearly defined IT strategies and its alignment with business strategies and goals, b) the lack of a full time and cross functional project team, c) lack of human resources management d) inaccurate data, and e) the lack of readiness assessment before implementation of the project.

Shah et al. (2011) attempted to understand how critical failure factors obstructed the successful implementation of ERP in a public organization. Critical failure factors included lack of top management involvement, absence of proper change management, insufficient vendors experience and support, high turnover of project team members, absence of user involvement, thus all these factors lead to project exceeding the planned cost, projects not meeting the schedule deadline and the system not able to meet user requirements.

Khurana et al. (2011) identified and measured the perceived importance of information sharing barriers in SCM. The barriers have been categorized as managerial, organizational, technological, individual, financial, social and cultural. The crucial barriers found in the study were financial, technological and organizational barriers for information sharing in SCM industries. The top three barriers were 'financial constraints for high cost of maintenance' under financial barrier category, followed by 'data and information security' from the category of technological barriers and finally 'cost of specialized manpower and training' from financial barrier category.

The study by Ganesh and Mehta (2010) identifies and validates CFFs that affect the successful ERP implementation in context to Indian SMEs. CFFs included were lack of

support and involvement from the top management, users' resistance to change, unrealistic expectations, lack of proper project management, lack of proper BPR, poor quality of testing, lack of sufficient IT infrastructure, poor consultant effectiveness, users resistance to change, software modification, problem with system functionality, unsure concept about the system, high turnover rate of the project team members and informal strategy.

The study by Peng and Nunes (2010) identifies, assesses and discusses organizational, cultural and system barriers for the successful implementation of ERP systems. The study identifies perceived system barriers as more significant to the implementation process rather than the organizational barriers. Thus insufficient supports and services from system vendors, system incompatibility, slow system response time, System inflexibility, Deficient design of the system, Inexperienced and low-qualified system consultants, Power centralization of top management, Lack of in-house IT specialists, high cost for additions in the system development were reported as barriers to successful implementation of ERP.

The study by Garg (2010) explores the literature extensively to find the critical failure factors that hinder the successful implementation of the system in the context of Indian retail organizations. The CFFs are categorized into strategic, tactical and operational aspects. Strategic dimension included top/middle management in implementation of ERP, tactical dimension dealt with the issues related to the product selection and various issues of project management; finally operational dimension consisted of factors dealing with imparting training and involvement of the user.

Soja (2008) identified barriers to enterprise system (ES) adoption success. The barriers were categorised as economic, technical, organisational and social. He concluded in the study that the most important issues were connected with infrastructure, time, cost, and knowledge. The outcome of the study was that people involved in project teams should represent all areas of the company which are affected by ES adoption and should hold various positions across different levels of the company's organisational hierarchy. He also stated that it would be beneficial to involve people from outside the organisation, who have expert knowledge and extensive ES implementation experience.

Wong et al. (2005) examines critical failure factors leading to the implementation failure of ERP system. Failure factors identified were ERP system misfit, poor quality of BPR, lack of support from the top management, users' resistance to change, high turnover of implementation team members, heavy customization, inadequate IT infrastructure, lack of consultant effectiveness, poor knowledge transfer to the users', lack of project management, unrealistic expectations and project schedule. The study concludes poor BPR, poor consultant and poor project management as the most critical among the identified failure factors.

The critical management issues in the implementation of ERP were investigated by Kumar et al. (2003). The study concluded that the organization faces more of behavioral and management issues obstructing successful implementation of ERP systems like resistance to change, lack of readiness on part of the user to accept the changes, absence of training, lack of planning, high turnover of the project team members than technical problems like software bugs and configuration difficulties.

Tapp et al. (2003) in the study tries to address the potential pitfalls namely inadequate education and training, resistance to change by the users, lack of support from the top management and unrealistic expectations for benefits for the implementation of ERP.

Study by Umble and Umble (2002) investigates how to avoid ERP implementation failure. The study divided ERP implementation failures into 10 categories: lack of involvement and support from top management, unrealistic expectations, inadequate education and training, poor project management, a bad match, trying to maintain the status quo, inaccurate data, viewing the implementation of the system as an IT project, adding and automating superfluous processes in the new system, and significant technical difficulties.

These impediments were categorized into six main barriers

- Financial barriers
- Organizational Barriers
- Inter organizational barriers
- Human Barriers
- Project Management barriers
- Technical barriers

2.3.1.1 Financial Barriers

The research by Kang et al. (2012) considers financial hindrance as a prerequisite for any implementation. Huge investment is required for the implementation of SCMIS (Gebauer & Buxmann, 2000). The general financial barrier includes cost of the system and cost of trainings. Cost benefit analysis is done to justify the investment. The various costs involved are cost of the software, migration of legacy data, implementation consultant cost, internal project team costs, training cost, and post-implementation maintenance cost. Both tangible and intangible benefits accrue from the implementation of the system. Tangible benefits include reduction in inventory, better forecasting, improving supplier on time delivery, reduction of lead time in production and delivery, better resource planning and reduction in workforce costs. Intangible benefits include improvement in communication, reduced chaos and confusion, real time flow of information and better services to customers. The company analyzes economic feasibility, and often fails to draw a clear return from the investment that is being transpired. Thus, unclear ROI from the system forms one of the major barriers for the implementation of the system (Koh et al., 2008). Cost and time overruns is another problem faced by the organization which adds up to the otherwise expensive IS. According to the study by Soja (2006) lack of funds is the main cause of failure of ERP.

2.3.1.2 Organizational Barriers

One of the prime hindrance factors is the *lack of top management support, vision, and focus*. Various researchers like Supramaniam & Kuppusamy (2011), Shah et al. (2011), Finney & Corbett (2007), Bhatti (2005), and Wong et al. (2005) have stressed that if there is lack of commitment and participation from the top management, there are huge chances

of failure. The top management must view SCMIS implementation as an improvement in the way the company is doing the business and not just an IT project. Top management support is needed in all phases of implementation (Sarker & Lee, 2003) like adoption of proper change management, understanding the limitations of the system, management of expectation (Tapp et al., 2003) and regular feedback from the project management team. Less active participation (Umble, 2003) and lack of tracking of the project progress by the Top Management becomes one of the barriers for the successful implementation of the system (Bhatti, 2005).

Poor middle management support will also have an adverse effect on the day-to-day operations associated with SCMIS, and the reluctance for adoption of the system by middle management is one of the impediments for the successful implementation of the system (Terziovski, 2003). Middle management acts as a change agent, and their uncertainty management is important in assisting their employees in the change transition (Herzig & Jimmieson, 2006). Hence the pragmatic and intuitive approach of middle management is very essential in successful implementation of SCMIS.

There should be a formal communication about the benefits of the system to the users (Sarker & Lee, 2003), because it is very important to convince the users that ultimately the change is for the betterment of both the company and the individual and ineffective communication with the users would lead to the failure of the system. The proper communication would lead to thorough understanding of “As-Is” & “To-Be” business models and would lead people moving in the right direction from the top to the bottom by understanding the future benefits of collaborating with the partners, both downstream and upstream. Thus *lack of clear formal communication* among implementation team, software provider, and the users would lead to informal channels of communication which may lead to inaccurate flow of information in the organization. Thus it forms a barrier to successful implementation of the system.

Change management (Aleballa & Al-Mudimigh, 2011; Leon, 2008) is one of the factors that affect the ERP adoption in organizations. The organization faces two types of changes namely the way business is done and the way people do their job therefore for successful implementation of the system both these changes need to be addressed so as to overcome the resistance otherwise lack of commitment to change forms a barrier in the implementation process. The studies by Lindley et al. (2008), and Umble et al. (2003)

consider the lack of change management as a hindrance for successful implementation, and Kim et al. (2005) pointed that unless change management is appropriate in an organization, it would be difficult to adapt to the new system and to obtain total benefits from it.

Poor quality BPR leads to unsuccessful implementation of the system. The role of BPR in the implementation of SCMIS is of prime importance. If business processes are not re-engineered properly with the SCMIS system it leads to system configuration problem. Most of the researchers are of the opinion to fit business process to the system so that minimal customization is to be done.

Wong et al. (2005) have studied CFFs by selecting four cases where a failed ERP implementation has taken place. Poor quality BPR is one factor which is common to all. The members of the project team revealed that it was not made clear to them as to why and how to conduct BPR. The consultants hired for aiding in the implementation process did not advice the team members properly for conducting BPR. Thus the members were not able to collaborate and contribute to BPR which led to complications in the system configuration. Due to poor BPR the business processes were not re-engineered fully so as to successfully fit in the system being implemented. The users were also not ready for the change in the business process. There was also a mismatch between the business processes and the systems due to lack of aligning the software functionalities with business requirements.

According to Bingi et al. (1999), implementing an ERP system involves re-engineering the existing businesses to the best business process standard. Thus BPR outlines how to reengineer human and system behaviors to fit SCMIS to the enterprise and lack of it will be detrimental to the success of the system. Another problem faced is the *absence of readiness assessment before project implementation*. Individuals and organizations might not be ready for complex level of integration leading to unsuccessful implementation of the system.

Finally *an unrealistic expectation from both the management and the user side* forms the barrier to the successful implementation of the system. The management has to be prepared for the decrease in the productivity of the people in the initial phase of the

implementation and cannot expect return overnight. Also the users need to understand that they will require time to become efficient in using the new system.

2.3.1.3 Inter-organizational Barriers

Study by Weston (2003) has divided barriers to the implementation of ERP II system into two categories, general business issues and issues related to technological infrastructure. The study refers issues of collaborative BPR or business management process as a barrier to implementation. Inter-organization relationship which includes trust, willingness for collaboration and shared vision between the partners is imperative for the successful implementation of SCMIS. The *Lack of trust* among supply chain members has been considered by various researchers (Schoorman et al., 2007; Vangen & Huxham, 2003) as a barrier to information sharing. Premium on trust is placed since an organization allows an outsider to view their transaction level data which in term faces the competitive risk (Young et al., 1999). Thus due to the collaborative nature, trust and security issues which were not there in case of ERP surfaces in case of SCMIS implementation. Another barrier is *inter-rivalry* as researched by Fawcett et al. (2012) which include the lack of willingness to share information, risk, and rewards. Further due to cultural differences, span of relationship, and volume of transactions, trading partners may be *unwilling to collaborate* leading to the unsuccessful implementation of the system.

Additionally, the *lack of shared vision* between supply chain partners leads to less information sharing (Boddy et al., 2000; Mentzer et al., 2000) and more resistance from people leading to reduction in the quality of information being shared, causing less successful implementation of the system. Most of the executives' lack business understanding which become more challenging when external partners are included (Koh, 2011).

2.3.1.4 Human Barriers

The *resistance to change* by the people (Tapp et al., 2003) forms one of the critical barriers to successful implementation of enterprise system. It is the people who can make or break the success of a project without their buy –in and support projects are doomed. Leon (2008) in the study has stressed that system implementation is not a technology but a people project. To examine the human angle in the implementation of SCMIS, we can compare it to Newton's law of motion. Comparing it with 1st and 3rd law of motion,

people tend to remain in a state of inertia and when an external force (for example SCMIS Project) is applied in them the expected and immediate reaction is resistance.

According to Umble et al. (2003) people always prefer the status quo therefore do not require a new system and are resistant to change but it's not a resistant itself that leads to failure, it's the way we handle it. To respond to resistance in an effective and proactive manner we must first understand why we are facing resistance. The study by Umble (2003) have shown that the resistance is due to lack of understanding about the system, lack of process orientation, fear of unknown, fear of computers, fear of non-performance getting exposed, transparency of data and information, increase in accountability, fear that their importance might get reduced, not knowing the degree of priority assigned by top management and fear of losing job. Therefore to be successful in SCMIS implementation it is important to overcome this resistance.

Lack of sufficient training will result in users that are unable to run the system properly (Umble et al., 2003). Insufficient training and education will increase the resistance associated with the system. These systems are extremely complex and require thorough training. Unless and until proper training is given the user will not understand about what the new system will achieve and how his way of working will change (Kang et al., 2012). Proper confidence building should be done in the training period otherwise the user will keep on working in the legacy way leading to the failure of the system. Training will help to meet users' expectation and decrease the uncertainty associated with the system. It will help the users' to be satisfied with the system and it will act as a measure of information systems success (Wu, 2002).

Lack of users' participation, involvement, and motivation will act as a hindrance factor to the successful implementation since users would be less motivated to use it and at the same time they might fear the new system. Studies by Francoise et al.(2009) , Ngai et al. (2008) and Zhang et al.(2002) includes two important areas for users' participation, i.e., when the organization is defining the need for adoption of the system and during the implementation phase. Lack of participation will lead to more resistance from the users as since they fail to understand the future prospects of adopting the system and how they fit into the system. Thus user acceptance for the project will be less and it would be difficult to achieve project success.

Poor consultant effectiveness will act as a failure factor as has been studied by Wong et al. (2005). According to the study one of the failure factors that were common to all the four cases studied was poor consultant effectiveness. The team members of the implementation project team considered consultants to be inexperienced and who could not advise them professionally nor guide them about ERP project planning. Further during the implementation phase there was a lack of clear communication from the consultants regarding BPR and implementation process. The consultants also did not provide the users and the team members with a proper training. The training provided by the consultants was more like pre sales demonstration and thus poor training by the consultants acted as a barrier to the successful implementation of the system. The consultants also provided poor quality reports to the management due to insufficient experience in implementing ERP systems. The consultants provided unprofessional and insufficient service to the project team members and the end users in respect of training, project management, BPR and implementation process. The document provided by the consultants who could be used and referred to in case of some problem or the training manual was too wordy, unhelpful and insufficient to resolve the problem. As the importance of consultants is known therefore poor consultant effectiveness will act as a detriment to a successful implementation of SCMIS. The studies of Ganesh and Mehta, 2010; Ngai et al, 2008; Nah and Lau, 2001 have substantiated the importance of consultants in conducting BPR, communication within the team and imparting training for the successful implementation of the system.

2.3.1.5 Project Management Barriers

Project management deals with planning, execution, monitoring and controlling of a project. It requires the ability to examine in project details while keeping a perspective on the original business objectives. *Lack of effective project management methodology* plays a major role in the failed implementation of the systems. Without proper project management, system will not be able to deliver the promised functionalities and will experience time overrun and cost overrun. According to the study by Umble et al. (2003) one of the reasons for system implementation failure is the underestimation of the scope, size, and complexity of the project. They also emphasized about the lack of development of achievable schedules and lack of proper communication of realistic expectations unfavorable to the successful implementation of the system. Poor project management

effectiveness was one of the failure factors that were common to all the four cases studied by Wong et al. (2005). They emphasized that poor project management effectiveness was due to lack of experience from the top management and the project manager in regard to planning, leading, monitoring and managing the project. Another major problem in project management was lack of resources, unrealistic project time schedule and tight budget which lead to the failure of ERP implementation. The project managers were not able to cope up with the consultants, vendors and also could not report the problems being faced by them to the top management in the process of implementation. For the successful implementation of the project it is imperative to clearly mention the scope of the project. The project manager should clearly develop a formal plan for the implementation of the system with realistic budget and time frame. The project management should conduct formal meetings periodically so as to know the exact status of the progress of implementation. The project management also includes formation of the project team which should include members who are also the stakeholders. The *lack of experienced project leader* also becomes a hindrance factor. He also plays a crucial role in the selection of the implementation team (Sarker& Lee, 2003). The project manager needs to have the ability to overcome the deadlock through a judicious combination of different qualities of visionary, mentor and a leader (Umble et al., 2003). *Weak implementation team* forms a hindrance to the implementation of the system (Gargeya& Brady, 2005) since it is the responsibility of the team to coordinate, communicate, and reduce the resistance among the users. The team should be able to collaborate and contribute only if the team understands the requirements of the organization, is cross-functional and technologically proficient. The members of the team with poor project management skills, limited ERP knowledge (Akkermans and van Helden, 2002), lack of monitoring the project will result in the failure of the system being implemented. Thus it becomes difficult for a weak team to choose system for the future.

2.3.1.6 Technical Barriers

SCMIS involves complex transition from the legacy systems to an integrated inter-organizational system; therefore, problems interfacing with existing systems and hardware difficulties (Umble et al., 2003) lead to the failure of the IT system. Al-Mashari (2002) and Jarrar (2000) in their study emphasize that *lack of adequate IT infrastructure in hardware and networking* will lead to the failure of ERP system. SCMIS implementation faces distinctive technological barriers since different systems in different

organizations need to communicate freely with each other. This technology is known as Enterprise Application Integration (EAI). Another important barrier to the successful implementation of the system is related to data standards and accuracy (Kang et al., 2012). In case standardized data is not there between disparate systems, erroneous data will be spanning to various organizations. Data flowing through the system is like blood flowing in the body, and therefore *poor data conversion and quality* may cause negative domino effect in the organization, thus causing delay in the implementation of the system and may even lead to a failure of the project (Soja, 2006).

Overreliance on heavy customization would lead to higher implementation cost, causing project delays and unreliable system. Larger companies with enough resources choose this type of re-engineering approach where heavy customization of the software is done which otherwise becomes a barrier. Since SCMIS is an inter-organizational system, therefore further customization makes it difficult to use the software on disparate systems. Software upgrades end up in extensive software changes which require a huge financial implication (Subramoniam, 2009). Relying heavily on customization to fit with the business processes might lead to sacrificing best practices set in the system (Wong et al., 2005).

2.4 GAPS IN LITERATURE

SCMIS has gained a lot of importance because it is able to reduce costs and generate responsiveness in the supply chain. However, the benefits mentioned above can only accrue to an organization in case of successful implementation of the system. The implementation of SCMIS is a complicated, lengthy and expensive process with significant risk since disparate systems spanning across companies are being integrated. These systems require huge commitment of funds, time and expertise (Motwani et al., 2008). There is a strong evidence in the literature that implementation of SCMIS projects were either not completed on time or did not bring about the planned effects and even exceeded their estimated costs. Therefore, conducting research is crucial in order to have a successful implementation of these SCMIS projects. Research is being carried out to investigate CSFs for the implementation of SCMIS which is an intra-organizational management system. Studies have been undertaken and models have been suggested for assessing IS success. Various models have been developed which deals with IOS implementation but however, these models are concerned only with certain facets of IOS

adoption or use. Review of literature on SCMIS reveals that most of the studies are on the importance of integration of SCM and potential benefits of the system.

It can be inferred from the above that the research on identifying the critical success factors and impediments for the successful implementation of SCMIS is rare and fragmented. CSFs for implementing SCMIS have only been analyzed with a limited scope and very few studies have been done on the evaluation of the process of implementation. Whereas, the evaluation of the system is very important since the implementation of these systems is a hugely difficult, time consuming and costly affair. Further, the system on which so much of resources have been spent needs to be evaluated to see whether it is fulfilling the objective for which it was implemented. Most of the research undertaken investigates on one aspect of the evaluation i.e. either it is evaluating the process of implementation or the product being implemented. Thus, there exists a gap in literature and therefore the study was undertaken to evaluate SCMIS implementation based on integrating both process and product dimension and thus attempts to fill the gap identified. Also, study undertaken portrays the Indian scenario, since previous research has been carried out in other countries. Therefore, a need was there for a study that can focus on inter organizational management systems, its implementation process and evaluation of the implemented product so as to reap the benefits of these systems. Therefore I proposed to undertake the study on: **“Evaluation of Supply Chain Management systems in Automotive Industry of North India”**.

2.5 CONCLUDING REMARKS

To summarize, this chapter has provided a review of relevant literature to answer a very pertinent question of “What makes information systems projects successful?” The chapter examines success of the IS implemented from two perspectives – Process Success and Product Success. For the process success, critical success factors (methodology popularized by John Rockart) are reviewed for the implementation phase of SCMIS. These should be constantly and carefully managed by an enterprise for ensuring the success of IS. For the process success hindrance, factors are also reviewed which must be waned of for the successful implementation of IS. Based on CSF approach, a framework which identifies CSFs has been proposed.

Product success measures the value the implemented system returns to the enterprise, when the system is finally adopted by the end users. For this post-implementation success measurement, various user acceptance models for information systems (IS) were reviewed that have been developed by various researchers and which helps in the understanding the success of IS adoption. Based on review of literature, we propose to measure SCMIS product success in six dimensions.

CHAPTER- III

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter offers a detailed discussion about the adopted research methodologies. Research design, questionnaire development and measurement of constructs, data collection, and analysis techniques are discussed in this chapter.

3.2 SAMPLE

3.2.1. Original Equipment manufacturers (OEMs)

India's car manufacturing industry is evenly divided into three "clusters":

1. Chennai-Bengaluru region, in South
2. Pune-Aurangabad in West, and
3. NCR (National Capital Region) region in North

The automotive companies whose manufacturing units were located in the third cluster i.e. the NCR region of India were chosen for the study. Based on the dominant market share, the two major OEMs selected were:

1. Maruti Suzuki India Ltd.
2. Honda Cars India Ltd.

3.2.2 First Tier suppliers to OEMs

The studies have shown that it is rarely seen that in the context of supply chain management and integration spreads beyond first tier of suppliers and customers (Frohlich and Westbrook, 2001). Therefore, it was decided to build the stratified sample of first tier suppliers, and for selecting top 5 suppliers, OEMs were requested to provide the data for the volume of business conducted by each one of them. Since this data was confidential, therefore, it was not shared and only list of suppliers was provided.

Thereafter, convenience sampling was adopted and five suppliers were selected. These top five ‘first tier suppliers’ are listed in the following table.

Maruti Suzuki India Limited	Honda Cars India Ltd
1. Motherson Sumi Systems	1. Motherson Sumi Systems
2. Subros Limited	2. Motherson Automotive Technologies
3. Sona Koyo Steering Systems Ltd	3. Exedy
4. Gabriel India Limited	4. Autoform
5. Motherson Automotive Technologies	5. Gabriel India Limited

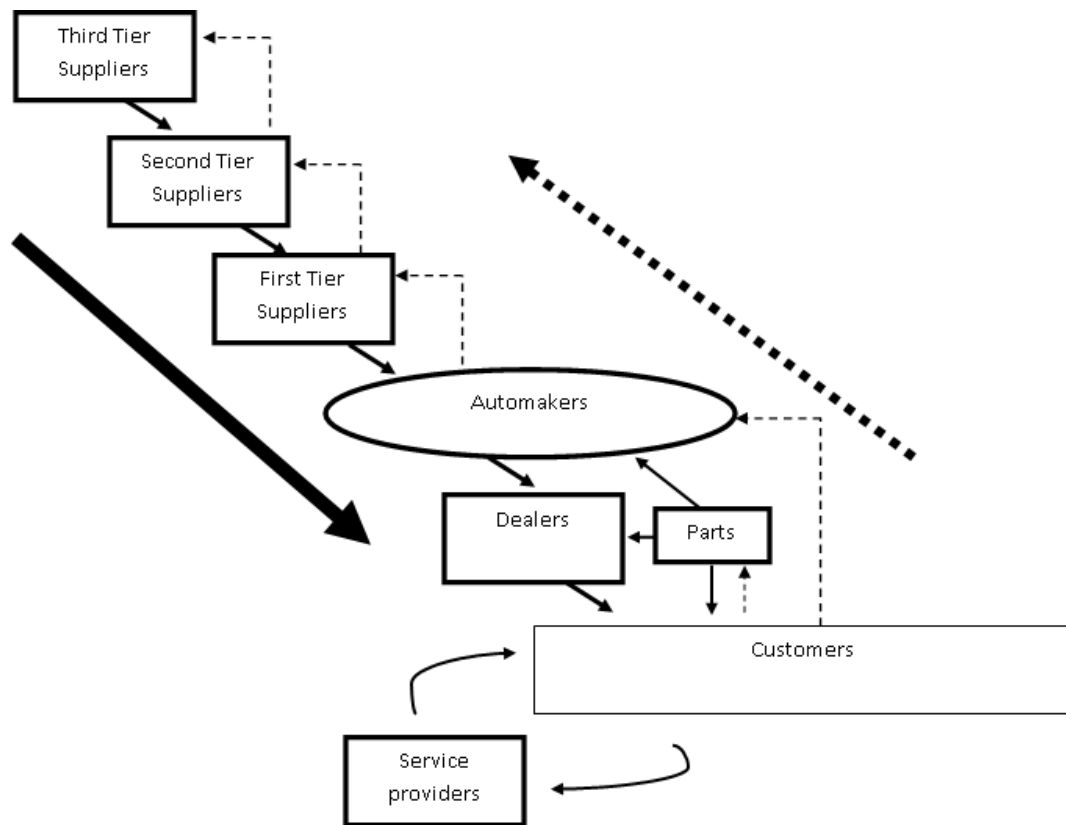


Figure 3.1: The Supply Chain of Automobile Industry

A detailed study was conducted for these five ‘first tier suppliers’ of each OEM.

3.2.3 Dealers of OEMs

Using the same approach as discussed in the last sub-section in selecting top five ‘first tier suppliers’, we identify the top five dealers for each OEM. It is listed in the following table.

Maruti Suzuki India Limited	Honda cars India ltd
1. Rohan Motors Limited	1. Pearl Honda
2. Vipul Motors Limited	2. Ace Honda
3. Competent Automobiles Co. Ltd	3. Prime Honda
4. Bagga Link Motors Limited	4. Ring Road Honda
5. Apra Auto India Pvt. Ltd.	5. Crown Honda

A detailed study was conducted for these five dealers of each OEM.

The profile of all the participating companies will be discussed in the next chapter.

3.3 RESEARCH DESIGN

In order to satisfy the research objectives, both exploratory and descriptive research design is used. The first objective is to identify the various dimensions of SCMIS in the selected automotive sector. For this, exploratory research design has been used. The second objective of the study is to analyse CSFs and hindrance factors for the successful implementation of SCMIS. For evaluating the success and hindrance factors, a descriptive research design has been used.

3.4 QUESTIONNAIRE DESIGN AND CONSTRUCT MEASUREMENT

The measurement items used for the study are based on the existing research reports and relevant discussions with the researchers, experts and practitioners in this field. The items that were operationalized and tested in previous studies were modified to fit the context of this study. Such an approach enhances the content validity and reliability of items measured. Table 3.1 shows the construct and details of the measurement items for each variable used in this study.

Table 3.1: Constructs and Measurement Item details for Critical Success Factors

Constructs	Measurement items	Literature References
1.Top Management Support (TM)	5 items : • Providing leadership • Providing the necessary resources • Good understanding of the system • Commitment from the top management • Involvement of the top management	Zhang (2003) Ngai (2004) Loh and Koh (2004) Law and Ngai (2007) Sarker and Lee (2003)
2.Communication (Co)	4 items : • Open and honest communication throughout the supply chain • Managing user input in the communication process • Accurate and timely communication in the supply chain • Clear communication between the customers and suppliers	Esteves and Pastor (2000) Zhang (2003) Loh and Koh (2004) Ngai (2004) Ngai (2008)
3.Organizational Culture (CT)	4 items : • Change culture • Shared beliefs • Relationship building • Open culture for sharing business process	Al-Mashari 2003 Stefanou (2013) Dezdar (2009) Francoise (2009)
4.Training & Education (TRA)	4 items : • Extensive training on system implementation • Qualified personnel to execute training, • Education on new business processes • Hands-on training	Al-Mashari (2003); Dezdar (2009) Ngai (2004) Akkermans and Helden, (2002);
5.User Support & Involvement (US)	2 items : • User involvement at the time of defining the need for the system ; • User participation in the system implementation	Holland and Light (1999) Zhang (2003) Garcia-Sanchez (2007) Francoise (2009)
6.Change Management (CM)	4 items : • Recognizing the need for change, • Commitment to change (determination and perseverance), • Managing conflicts (reasons for users resistance) • Managing changes (monitoring and evaluating change management strategies)	Nah and Delgado (2006) Loh and Koh (2004) Dezdar (2009) Jarrar (2000) Nah (2003)
7.External Support (ES)	3 items: • Vendor's Service response time • Consultants understanding of organisations' business processes and information technology • Vendor's participation in the system implementation.	Zhang (2003) Ngai (2008) Motwani (2005)

Constructs	Measurement items	Literature References
8.Cooperation and Commitment Of Trading Partners (CC)	5 items: • Sharing of agreed objectives, • Desirability of establishing a long-term relationship from a business perspective • Partners' willingness to participate in system implementation • Technical compatibility • Technical expertise of the partners	Premkumar and Ramamurthy (1995) Kwon and Suh (2005)
9.Trust (TRU)	5 items : • Trading partners are honest and truthful • Confidence among the trading partners • Integrity, • Reliability • Trustworthiness	Neelay (2006) Kwon and Suh (2005) Allen et al. (2000) Sahay(2003)
10.Pre Implementation Analysis (PRE)	4 items: • Identifying business process rationale for SCM system • Calculating various costs involved • Conducting technical feasibility • Inputs from all relevant functional areas for strategic SCMIS planning	Abdinnor-H.S et al. (2003) Davenport(2000)
11.Data Security (DS)	4 items : • For transmitting information availability of secure modes • Handling of sensitive information • Secured transactions across the system • Cost-effective security system	Ngai (2004) Lee and Whang (2000) Kwon and Suh (2005)
12.BPR (BPR)	3 items : • Organization's preparedness for reengineering, • Organization's motivation for change • Organization's capability for reengineering	Zhang (2003) Loh and Koh (2004) Nah (2003)
13.Effective Project Management (PM)	5items: • Formal project implementation plan • Periodic meetings to know the project status • Carefully defined scope • A realistic time frame • Composition of project team	Loh and Koh (2004) Zhang (2003) Somers and Nelson (2003) Ngai (2008) Koh (2006)
14.Clear Business Plan And Vision (VB)	5 items : • Clear vision statement and well-defined business plan • Well-defined goals and objectives • Desired outcomes • Feasibility-evaluation of the project • Link to business strategy	Dezdar (2009) Al-Mashari (2003) Loh and Koh (2004) Nah (2001) Jarrar (2000) Holland and Light (1999)

Constructs	Measurement items	Literature References
15. Project Team Composition, Competence, Compensation (TC)	5 items: - Building of cross functional team, - Having team members proficient in both technical and business skill sets, - Empowered to make decisions about the project, - Members need to focus only on the assigned project and should work full time on the same - Appropriate incentive and compensation for the team members	Nah (2001,2003) Dezdar (2009) Wee (2000) Loh and Koh (2004)
16. Project champion (PC)	3 items : - Experience in project management, - Adequate authority in the organization, - Strong and committed leadership	Dezdar (2009) Loh and Koh (2004) Nah (2001) Francoise (2009)
17. Technical Infrastructure/Suitability of Hardware and Software (TI)	3 items: - Connectivity speed and response time of the server. - Reliability of software and hardware - Support of the technical team	Ngai et al. (2004) Zhang (2003) Kumar (2003);
18. Data Accuracy (DA)	4 items: - Ensure data robustness (no loss of data) amongst the business processes - Ensure data accuracy (no change of data) amongst the business processes - Importance of data integrity - Importance of data accuracy	Ehie and Madness (2005) Jafari (2006) Lu (2006) Finney and Corbett (2007), Koh (2011),

Table 3.2 Constructs and Item Details for Product Success Measures

Construct	Item	Measure	References
System Quality(SQ)	SQ1	The SCMIS is easy to use	Gable, Sedera & Chen (2003) Delone and Mclean (2003)
	SQ2	The SCMIS is user-friendly and easy to learn	
	SQ3	The SCMIS has easy accessibility	
	SQ4	The SCMIS is cumbersome to use.	
	SQ5	The SCMIS features are as per the requirement	
	SQ6	The SCMIS has integrated well with the legacy (existing) systems	

Construct	Item	Measure	References
Information Quality (IQ)	IQ1	Information usability	Gable, Sedera & Chen (2003) Delone and Mclean (2003)
	IQ2	Information understandability	
	IQ3	Information completeness	
	IQ4	Information timeliness	
	IQ5	Information relevance	
	IQ6	Information conciseness	
Perceived Usefulness/Importance (IMP)	IMP1	Using the system is important	Davis (1989); Venkatesh and Davis(2000)
	IMP2	Using the system is self relevant	
	IMP3	Using SCMIS increases the effectiveness in the job	
	IMP4	Overall the system is useful/needed in the job	
Individual Benefits(IB)	IB1	Using SCMIS improves the job performance	Gable, Sedera & Chen (2003) Delone and Mclean (2003)
	IB2	Using SCMIS in the job improves the productivity	
	IB3	Using SCMIS makes it easier to do the job	
	IB4	SCMIS acts as decision support system	
	IB5	Using SCMIS saves times for individual tasks and duties	
User Satisfaction (US)	US1	Satisfaction with the information quality of the SCMIS	Delone and McLean (1992)
	US2	Satisfaction with the performance of the SCMIS	
	US3	Overall satisfaction with SCMIS	
Organizational Benefits(OB)	OB1	Better forecasting	Gable, Sedera & Chen (2003) Delone and Mclean (2003)
	OB2	Better resource planning	
	OB3	Reduction in inventory level	
	OB4	Reduction of production lead time	
	OB5	Improves supplier on-time delivery	
	OB6	Improves order management	
	OB7	Improvement in customer relationship	
	OB8	Better coordination with suppliers	
	OB9	Cost saving	

3.5 PILOT STUDY AND VALIDITY

A pilot test was conducted for measuring the face and content validity of the survey instrument. Validity of the instrument was done to see:

- If the questionnaire is measuring what it is intend to measure
- Is the questionnaire comprehensive enough to collect all the information needed to address the purpose

Thirty practitioners and academics scholars were actively involved in the pilot study. They were provided with the questionnaire and asked to comment on its format, readability, and comprehensiveness. Specifically experts were requested to provide the factors that were not there in the questionnaire but should have been addressed. Thus, the validity of questionnaire content was established by taking help from a panel of experts and having discussions with academicians and implementers. The discussion with the experts led to certain changes in the wording of some survey items which was incorporated into the draft of the questionnaire.

3.6 DATA COLLECTION

Questionnaires based survey method was used and the questionnaire used as the research instrument directed towards identification of critical factors for successful implementation of SCMIS in the context of Indian automotive industry was used. It identifies perception of the respondents' towards the important critical factors in the implementation process of SCMIS in Indian automotive industry. The survey questionnaire used to gather data is provided in Appendix A. The questionnaire developed was divided into four parts. Part A included the questions pertaining to organization and key informant demographics. Part B was used to collect data regarding the identification of CSFs for the successful implementation of SCMIS in the context of Indian automotive industry. In conducting study, participants were asked to respond on the item, "How critical are the following items for a successful implementation of SCMIS?" The respondents were asked to respond on five-point Likert scale for each item, the value "1" signifying "Strongly Disagree" and "5" "Strongly Agree." This part also included an item where participants are asked to response on the item; "How successful has the SCMIS been in meeting the overall goals of your organization", using a scale where "5" signifies "Highly Successful" and "1" "Complete failure". Part C of the

questionnaire was used to collect data regarding identification of CFFs that hinder successful implementation of SC MIS in Indian automotive industry. The questionnaire covering these factors were framed on five-point Likert scale ranging from 1 (no problem at all) to 5 (serious problem) to measure the attitude of respondents for every question. Part D of the questionnaire was used to evaluate the success of SC MIS in the organization from the users' perspective. The questionnaire is based on quality of system, quality of information, user satisfaction, individual benefits, and benefits to the organization. The questionnaire was framed on five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) to measure the attitude of respondents for every question.

The pretested questionnaire was given to 320 executives of two main companies namely – Maruti Suzuki India Ltd. and Honda Cars India Ltd. for their opinion on CSFs and CFFs. The questionnaires were administered through e-mail and personal meetings with the respondents. Table 3.3 shows the actual response and % response rate of the respondents. The final analysis is based on the 137 questionnaires complete in all aspects.

Table 3.3: Response for the opinion on CSFs and CFFs

S.No.	Company	Population	Sample	Actual response	% response rate
1	Maruti Suzuki India Ltd.	260	160	90	56.25
2	Honda Cars India Ltd	310	160	85	53.13

The part D of the questionnaire, which evaluates the success of SC MIS in the organization from the user's perspective, was given to 320 executives of 2OEMs and 40 executives of suppliers and dealers located in the National Capital Region of India. The questionnaires were administered through e-mails and personal meetings with the executives of OEMs, but for dealers and suppliers, personal interviews were held and only 2 executives from each supplier and dealer expressed their opinion about the system implemented. Table 3.4 shows the actual response and % response rate of SC MIS users. The final analysis is based on the 218 questionnaires complete in all aspects. The respondents expressed their opinion about SC MIS in their organization.

Table 3.4: Response of the users of SCMIS

S.No.	Company	Population	Sample	Actual response	% response rate
1	Maruti Suzuki India Ltd.	260	160	120	75
	1 st Tier Suppliers	10	10	10	100
	Dealers in NCR	10	10	10	100
2	Honda Cars India Ltd	310	160	115	72
	1 st Tier Suppliers	10	10	10	100
	Dealers in NCR	10	10	10	100

3.7 TOOLS AND TECHNIQUES

Data has been analyzed with the help of SPSS (Statistical Package for Social Sciences) package and AMOS (Analysis of a Moment Structures). Statistical tools like Descriptive Statistics, ANOVA and Factor Analysis have been applied to test the hypotheses. Step wise regression in SPSS was carried on to develop the model. AMOS has been used to conduct CFA and SEM.

3.7.1 ANOVA and Independent t-test

The independent t test is used to test for a statistically significant difference between two means. In this test, the two means are compared to check whether the populations from which samples are chosen are different. Therefore, when two unrelated groups are to be compared we use Independent t-test.

A one-way Analysis of Variance (ANOVA) can be performed while comparing means of three or more samples.

3.7.2 Regression

Multiple regression used in this study is an extension of simple regression. It is used to assess the relationship between a variable which is to be predicted based on several predictors. The end-result of multiple regression is the development of a regression equation (line of best fit) between the predicted variable and the independent variables.

The model in the study has one independent variable and multiple predictors for success of system implementation as dependent variables.

The multiple regression model is written as:

$$y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + b_{15}X_{15} + b_{16}X_{16} + b_{17}X_{17} + b_{18}X_{18} \dots (1)$$

Where

b_0 is the y intercept

b_i ($i = 1$ to 18) are the coefficients/slope of the predictors X_i ($i = 1 - 18$)

Further, a common problem with multiple regression is that there may be large set of predictor variables. The final objective is to choose a small subset from the larger set so that the resulting regression model is simple, yet have a good predictive ability. Step-wise regression is used for the study, which enters and removes predictors, in a systematic manner, until there is no justifiable reason to enter or remove more. According to Dash and Kumar (2013), following are the attributes of good multiple regression model:

- Correlation analysis: Correlation between dependent and independent variables must be high which means they are highly correlated with each other. Acceptable value > 0.6 .
- R-Squared (R^2): Statistical measure that gives information about the good fit of a model. It shows the percentage variance of a dependent variable as explained by independent variables. A high value of R^2 model is considered good.
- Adjusted R-Squared: The adjusted R^2 is one of the several statistics that attempts to compensate for the artificially increase in accuracy of R^2 . For good model fit, difference between R^2 and adjusted R^2 should not be greater than 0.5.
- F-value: For good model fit F-value should be > 10
- p-values: For good model fit p-value should be < 0.05
- t-values: For good model fit t-value should be > 1.96
- Variance Inflation factor (VIF): Value < 3 indicated no problem of multi collinearity.
- Durbin Watson Value: Value of 2 indicates no autocorrelation problem.

3.7.3 Structural Equation Modeling

SEM is a multivariate technique to find patterns and relationships between several variable simultaneously. SEM is an attempt to model causal relations between variables and to visually identify the factors which influence the results. The visual representation makes clearer conceptualization of the study. Few basic concepts and terms used in SEM are explained below.

Variables

There are two types of variables that are used in SEM. The first type is measured variables, which are variables that can be directly measured or observed by the researcher. A second type of variable is a latent variable, which cannot be measured directly but implied by the covariance between two or more indicator variables. Latent variables can be exogenous, which are independent variables and cause fluctuations in other variables. Other latent variables are endogenous, which are dependent variables and are influenced by exogenous variables.

Model Components

There are two model components: the measurement model and the structural model. The relationship between observed and latent variables is defined by the measurement model. It represents confirmatory factor analysis and determines which measured variables are indicators of a latent variable. It is basically used for validation and reliability checks and does not explain the relationships between the variables.

The structural model defines the relationship between latent variables. This specifies the influence of latent variables in the values of certain other unobserved variables in the model. Therefore, it is used for hypotheses testing and association between the constructs.

These two parts of the model are combined to make a whole model that comprehensively describes the relationships between variables. For developing SEM framework, the present study uses AMOS 21 statistical software and includes both measurement component and structural component. The structural model follows the estimation of the confirmatory measurement model.

3.8 CONCLUDING REMARKS

The chapter explains the details of data collection from Maruti Suzuki India limited and Honda Cars India Limited. This chapter describes in detail the research methodology adopted for the present research. The chapter describes sampling frame, questionnaire design and constructs measurement, pilot study and validity, and data collection techniques. The chapter explains that ANOVA has been used for comparing means of respondents based on the work experience. The outline of research methods used for designing the model for product and process dimension has been elaborated. The chapter explains various tools and techniques that have been used to test the hypotheses for the research.

CHAPTER- IV

PROFILE OF THE SELECTED ORGANISATIONS

This chapter covers the profile of few selected organizations. Section 4.1 elaborates about the selected OEMs, their background, products and the present supply chain management information system being adopted. Section 4.2 provides the profile of the suppliers to the OEMs under study. The section further provides the background, products being manufactured by the suppliers and the major customers to the selected vendors. Section 4.3 provides a brief overview about the OEM dealers.

4.1 ORIGINAL EQUIPMENT MANUFACTURERS (OEMs)

4.1.1. Maruti Suzuki India Limited

4.1.1.1 Background

Maruti limited was incorporated in 1981 and Suzuki Motor Corporation was chosen as the JV partner of the company by the government of India. An agreement was signed between the government and Suzuki. It is the largest player in the passenger car segment and accounts for more than 50 % of the market share. The company was earlier known as Maruti Udyog Limited and was set up under the provisions of Indian companies Act 1956.

Though Maruti Udyog Limited was established in February 1981, the actual production commenced only in 1983. Right from its inception, the company came up with a Japanese philosophy “smaller, fewer, lighter, shorter and neater”. The philosophy was very simple yet powerful.

Maruti Suzuki has got two production units located in India. The first facility which spreads over 300 acres is located in Gurgaon and the other facility with a total area of 600 acres is located in Manesar.

The Gurgaon facility – there are three fully integrated plants located in Gurgaon. The total installed capacity of the three integrated plants is 350,000 cars per year. The company follows policy of Kaizen where productivity improvements are done

continuously over the years on the shop floor and thus because of this the plant is able to manufacture 7, 00,000 cars per year at its Gurgaon facility.

The Manesar facility – The facility at Manesar in Haryana was started in the year 2007 to fulfill the world wide ambition of MSIL and SMC. The plant is one of the modern plants with inbuilt mechanisms. The Manesar facility manufactures models of Swift, Dzire and SX4.

4.1.1.2 Products

The company's product range includes Alto 800, Omni, Gypsy, Zen, WagorR, Swift, Grand Vitara, Dzire, Ritz, Eeco, Estilo, Ertiga, Celerio, Ciaz, so on.

4.1.1.3 E-Nagare system

Maruti Suzuki is a success story in supply chain and logistics management in the Indian automobile market. The organization started with JIT system to wane off increasing competition from global OEMs and increasing customer expectations. Through JIT, the company wants to achieve higher operational efficiencies and reduce inventory cost so as to retain the market leadership. MSIL adopted the e-Nagare system which connects the company to its 246 local vendors and 20 global ones in a seamless manner. E-Nagare or 'electronic flow' is an important part of Maruti Suzuki and has completely transformed the supply chain. It is an online system built in-house based on Oracle technology and became operational in January 2003. This system helps the company manage JIT system of inventory. The system is linked with VIT, another system for efficient working. The cycle time which used to be 30 days in the past has come drastically down to 2 hours due to the adoption of E—Nagare. In this system Maruti receives multiple supplies every 2 hours based on the schedule sent by the company to its vendor on the previous night. Thus, e- nagare has transformed the system and the supply of goods has become a seamless activity for the organization. The total number of suppliers used to be around 385 but with the adoption of this system Maruti has reduced its number of local Tier I to 246. Thus, it is because of this system that Maruti can produce around 5000 cars a day.

Monthly scheduling system was followed before e-Nagare was implemented which lead to the suppliers producing more and the inventory levels at MSIL started to go up. In view to reduce inventory levels, MSIL started following fortnightly production system and the inventory levels inside the plant fell by an impressive 70 per cent. Now presently within the factory premises, the inventory hold up is just two hours.

To achieve JIT system, the local based suppliers were given preference and vendors were located within 100 km radius of its plants. Over 76 per cent of the company's 246 suppliers are located within 100 kilometers of radius, who supply 86 per cent of the components by value to Maruti. For e-Nagare and the present system six month plan is given in advance. For first two month firm plan is given, for 3rd and 4th month tentative plan, and for last two months very tentative plan is given. Along with six month plan a fortnightly plan is also given, a firm schedule is given a day before and a variation of 10%-15% from fortnightly schedule is considered as acceptable.

E-Nagare specifies the exact time, place and quantity of materials to be supplied. Supplier cannot club the supplies of two plants and should ensure to supply parts in correct sequence. The electronic flow or e-Nagare system will make any inefficiency visible in the supply chain and at the same time it has enhanced the clarity on an hourly basis.

4.1.2 Honda Cars India Ltd.

4.1.2.1 Background

Honda Cars India Ltd was established in 1997. It is a subsidiary of Honda, and is responsible for the production, marketing and export of passenger cars in India. Established in December 1997 with a 49 percent Honda stake, today it stands at 99.9 percent Honda Motors Co. Ltd. and 0.1 percent SIEL Ltd. which is a Shriram Group company. Honda cars India ltd. provides good quality passenger cars and technologies to the Indian customers. The total investment made by the company is to the tune of Rs 1620 crores in establishing and modernizing the greater Noida plant. Further an amount of Rs 784 crores was invested in Tapukara plant. The total installed capacity of the facility at Greater Noida is 120000 units. The second manufacturing unit was

set up in Tapukara, Rajasthan, which started the production from February 2014 and has an annual production capacity also of 120000 units.

4.1.2.2 Products

The company's product range includes Honda Brio, Amaze, Honda All New Jazz, City, Mobilio and CR-V.

4.1.2.3 Honda Supplier Collaboration Portal (HSCP)

HSCP is the Supplier Collaboration Portal of Honda, which covers the complete lifecycle of delivery of part being used in car to Honda premises by the supplier. It starts from raising the RFQ by the buyer to raising the quotation by supplier for a particular part required by Honda. The price of the part is fixed between the buyer and supplier. After the approval of price by the Purchasing Director, the PO is raised for the supplier. Now the Delivery / Ordering Schedule for the parts for all suppliers all over India are updated on portal through one of the Production Systems (GPCS). Next, the supplier plans the dispatch of the material to the Honda which is received and stocked in, thus increasing the inventory of the part. Finally, the supplier makes payment for the parts received.

Thus, HSCP portal covers Quotation, Purchasing, Ordering/Dispatching, and receiving and Payment process for the part manufactured by supplier.

4.2 SUPPLIERS TO OEMs

4.2.1 Sona Koyo Steering Systems Ltd

Background

It is an India-based company, engaged in the manufacturing of steering systems for passenger car and light commercial vehicles in India.

The company has collaborated technically and financially with JTEKT Corporation, Japan which is the largest producer of steering systems in the world.

Products

The Company's products include tilt steering column, intermediate shaft for CEPS, telescopic shaft for steering column, telescopic I-shaft for CEPS, hydraulic power steering gear, steering gear for CEPS system, power steering system (ECPS), column technology for HCV, telescopic I-shaft technology for HCV, Steer-by-Wire, Steering Electronic Control Unit and Electric Power Assist Module (EPAM).

Major customers

Sona Koyo's customers include Tata Motors, Maruti Suzuki, Mahindra & Mahindra GM, Toyota, Ford and Hyundai.

4.2.2 Gabriel India Limited

4.2.2.1 Background

The history of Gabriel dates back to 1961, when Mr. Deep C Anand as a young entrepreneur launched his very first business venture - Gabriel India. He started his venture in Mumbai and started manufacturing shock absorbers in collaboration with Maremont Corporation, USA.

Presently Gabriel brand is synonymous with Shock Absorbers in India with a significant presence across all automotive customer segments. Gabriel has three state of the art R&D centers at Chakan, Hosur and Nashik to develop new products, further optimizing product performance and capability. These facilities provide value-added services to Gabriel customers in areas of noise measurement and value engineering, and also provide improved product quality by root cause analysis of customer complaints as well as cost reduction through localization efforts.

4.2.2.2 Products

The products manufactured by Gabriel India for passenger cars & SUV are McPherson struts, Gas shock absorbers and Cartridges.

4.2.2.3 Major customers

Gabriel India limited customers include Ford Motors, Maruti Suzuki India Limited, Tata Motors, General Motors, Honda Cars, Hyundai Motors, Mahindra, Renault and Toyota Kirloskar.

4.2.3 Subros Limited

Background

It was started in 1985 as a JV of Suri group with Denso Corporation & Suzuki Motor Corporation. It is the leading manufacturer of thermal products for automotive applications in India.

The company started in 1985 as an assembly operation with a capacity of 15,000 AC and presently it is one of the largest manufacturers of auto air conditioning systems.

The manufacturing facilities have been set up at Noida, Manesar, Pune, Sanand and Chennai.

Products

The main products of Subros are auto air-conditioning, compressors, condensers and engine cooling systems. It also manufactures HVAC which stands for heating, ventilation, and air conditioning systems for passenger as well as commercial vehicles. The company also manufactures heaters, evaporators, tubes and hoses.

Subros has collaborated for the technology with Denso who are world leader in manufacturing automotive components.

Major Customers

Subros Limited customers include Indian Railways and vehicle manufactures, such as Mahindra, Maruti Suzuki India Limited, Tata Motors, Renault Nissan, Force, Daimler, and Ashok Leyland.

4.2.4 Motherson Sumi Systems Ltd

Background

Motherson Sumi Systems, established in 1986 is the main company of the Samvardhana Motherson Group. Over the years MSSL has successfully collaborated with global technology leaders to further enhance its competency to create technologically sound products in state-of-art facilities and infrastructure to ensure superior efficiencies and total customer satisfaction.

Products

It manufactures Wiring Harnesses, the nervous system of a vehicle which carries current and signals from one point to another in a vehicle when connected to a power source. Other products manufactured are high tension cords, battery cables and high level assemblies.

Major Customers

Motherson Sumi Systems Ltd customers include major manufactures such as Maruti Suzuki India Limited, Honda Cars India Ltd, Mahindra, and Renault.

4.2.5 Motherson Automotive Technologies and Engineering

Background

Motherson Automotive Technologies & Engineering (MATE) is the polymer division of Motherson Sumi Systems Ltd (MSSL) and was established in 1997. The company is one of the largest suppliers of molded parts, assemblies and module supplier to the Indian automotive industry. MATE manufactures a wide range of plastic components and fully equipped facilities to support customers in the automotive and the non-automotive segments.

Products

The company manufactures wide range of polymer products that include plastic components and modules for vehicle interiors, such as cockpit modules, door trim modules, centre consoles and pillar trims, as well as vehicle exteriors, such as bumper modules and front end modules.

The Group manufactures resin molded parts like interior trims, cowl grilles and engine covers.

Major Customers

Motherson Automotive Technologies and Engineering customers include passenger vehicle manufacturers such as Maruti, Honda Cars India Ltd., Tata Motors, Honda Cars India Ltd. and Renault.

4.2.6 Autoform India

Background

It is a leader in providing premium quality seat covers and is an ISO 9001:2010 certified company. The manufacturing plant spreads over an area of 1, 00,000 square feet and is situated in Dehradun. The plant is equipped with all the modern facilities and latest machines like auto cutter and automatic Stitching Machine. The company has been in this business for last 25 years and they have equipped themselves with all the modern facilities so as to match high quality production standards.

Products

Premium quality car seat covers for the passenger cars.

Major customers

The major customers of Autoform are Fiat, GM, Hyundai, Nissan, Skoda, M&M, Honda and Volkswagen.

4.2.7 EXEDY India Ltd.

Background

The company was established as Ceekay Automotive Limited in 1973. In 1975 it entered into technical collaboration agreement with Daikin Manufacturing Co. Ltd. Exedy invested 25% in the equity in year 1987. In 1998, the company established facility at Greater Noida and the capacity increased to 1.5 million clutch discs and 1.1 million clutch cover assemblies. Exedy increased its stake from 25% to 32.5% in the year 1998. In the year 2010, Exedy's stake increased to 69.14% and the name of the company was changed from Ceekay Daikin Limited to Exedy India limited.

Products

Today, Exedy India Ltd.'s products encompasses a range of clutches such as – clutch disc assemblies and one way clutches which can be used in wide range of applications.

Major Customers

Ceekay Daikin [CDL] is a leading manufacturer of clutches and a leading supplier to the original equipment market such as Volvo, Tata Motors, Honda, Maruti, Mahindra, Eicher, Premier Auto etc

4.3 OEM DEALERS

4.3.1 Dealers of MSIL

Vipul Motors Pvt Ltd.

Vipul Motors Pvt. Ltd. was established in 1987 in Faridabad. They expanded their operations and set up their showroom in Gurgaon, Noida and Jaipur. They are among the top four authorized dealer of Maruti vehicles. They are committed to provide good sales & service to the customers and because of this they have won many awards from Maruti.

Rohan Motors Ltd.

Rohan Motors Ltd is the part of diversified Suri Group, which has interests in Air Conditioning systems, Automotive Components, Education, Hospitality and Telecom.

Rohan Motors Ltd. a platinum dealer of Maruti Suzuki India Ltd was established in 1988, and since then has built up a credible track record of performance and customer satisfaction under the able guidance and leadership of Mr Ramesh Suri, the founder Chairman of Rohan Motors. Over the last 25 years Rohan Motors Ltd have expanded their presence across Northern India with 15 service locations and 13 showrooms.

Competent Automobiles Co. Ltd. (CACL)

CACL was established in 1985 and the promoter of the company is Sh. Raj Chopra of Delhi based competent group. This was the first appointed dealership of Maruti. It is a profit making venture since it was promoted in 1985 and is listed in Bombay stock exchange. It has its branches in Delhi, Haryana and Himachal Pradesh. It is committed to give excellent sales and service to customers. It has 5 showrooms and 3 workshops in Delhi alone.

Bagga Link Motors Ltd

They started as a dealer of “Burmah Shell” way back in 1952. In 1981 they started with the dealership of Bajaj and for almost 30 years they were the top dealer in terms of sales volume for Bajaj in North India. It was only in 1995 that Bagga Link Group started with a dealership of Maruti. They were declared as “Platinum Dealer” for the year 2004-2005 & 2006-2007. They have provided excellent sales and service to their customers and therefore have won several awards for highest customer satisfaction in terms of sales and service both.

APRA Auto (India) Pvt. Ltd.

This dealership was established in year 2000 at 32nd Milestone Complex in Gurgaon. In the short span they have established their rapport as a committed dealer and provide good sales and support to the customers. They have more than 50% of the service market share. It has got eight showrooms, two true value outlet and nine dealer workshop.

4.3.2 Dealers of HCIL

Pearl Honda

Pearl Honda is an authorized Honda car dealers located in Gurgaon, Haryana. It boasts of world-class facilities and state-of-the-art services for Honda cars. The main objective of pearl Honda is to provide service of high quality to its customers and lead to customer satisfaction. For providing service they have centres at Noida and Gurgaon.

Ace Honda

Ace Honda, was inaugurated in 2007 by president of Honda Sael cars India ltd. They are an exclusive authorized Honda dealer in Noida. They cater to the demands of the customer in East Delhi, South Delhi, Noida, Greater Noida and Ghaziabad.

Prime Honda

Capital Cars Private Limited, also known as Prime Honda, is strategically located at Patparganj Industrial Complex, East Delhi. Prime Honda, is one of the reputed Honda dealers and has won many accolades: Best Service Advisor Award, Best Service Technician Award, Green Dealer Award, Best Paint Technician Award etc.

Prime Honda, is committed towards quality, environment and safety. It is ISO-9001:2008 certified for quality, ISO 14001:2004 certified for Environmental and OHSAS 18001:2007 certified for Safety and Health.

Crown Honda

Crown Honda - fastest growing authorized dealer of Honda cars in Delhi/ NCR. It is promoted by Action Automotives Pvt. Ltd. and strategically located in the heart of Noida and Ghaziabad. Crown Honda, is promoted largely by expertise in automobiles sector since 1996.

4.4 Concluding Remarks

The chapter provides a brief about the OEMs selected for the study. To complete the supply chain of MSIL and HCIL, the chapter provides the profile of the vendors and the distributors to the selected OEMs. The chapter also explains e-Nagare system – the system that is presently being followed by MSIL and about Honda Supplier Collaboration Portal through which HCIL communicates with its vendors.

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

The findings from the study are presented in this chapter. The findings focus on critical success factors, hindrance factors, model development and validation for the successful implementation of supply chain management information system (SCMIS) in automotive sector. Section 5.1 provides the results of the analysis for the product dimension. It covers the demographic profile of the users and development of the model. Section 5.2 analyses and discusses the hindrance factors to the successful implementation of SCMIS. Section 5.3 analyses and discusses the importance and impact of critical success factors (CSFs). Section 5.4 develops a second order model using factor analysis. This section also analyses the proposed theoretical model using structural equation modeling (SEM). Section 5.5 and 5.6 validates and applies the model in the selected automotive companies. The chapter concludes with the analysis of the demographic influences of the respondents on the criticality of success dimensions using one way ANOVA and independent t-test.

5.1 PRODUCT DIMENSION

The first objective was to identify various dimensions of SCM systems in selected organizations. For reviewing SCMIS, dimensions were grouped into two broad areas:

- a) Product-based review
- b) Process based evaluation

This section discusses the first dimension.

Product based review is a type of review that focuses on the product of the information system (IS). Product success is the measure of the value that the delivered system returns to the organization after completion of the project and when it is deployed to the eventual users.

5.1.1 Demographic Profile of the Users for Product Dimension

The present section covers the demographic profile of the respondents for analyzing product dimension success of SCMIS. The classification is based on four parameters namely company, gender, total work experience and department. Table 5.1 shows 51.83%

of respondents are from Maruti Suzuki India Limited (MSIL) and 48.17% from Honda Cars India Limited (HCIL).

Table 5.1: Demographics profile of Respondents based on company

Organization	Number of respondents	Percentage of respondents	Cumulative percentage
Maruti Suzuki India Limited, their suppliers and distributors	113	51.83	51.83
Honda cars India Limited, their suppliers and distributors	105	48.17	100.00

Table 5.2 shows the frequencies for the 218 respondents' based on the gender classification. Majority of respondents were males constituting 81.65% of the total respondents.

Table 5.2: Demographics profile of Respondents based on gender

Gender	Number of respondents	Percentage of respondents	Cumulative percentage
Male	178	81.65	81.65
Female	40	18.35	100.00

Table 5.3 highlights the frequencies for the respondents' total work experience. 27.5 percent of respondents has < than 5 years work experience, 40.4% of total respondents had 5-10 years working experience and 32.1% respondents had working experience of more than 10 years.

Table 5.3: Demographics profile of Respondents based on total work experience

Total work experience	Number of respondents	Percentage of respondents	Cumulative percentage
Less than 5 years	60	27.5	27.5
5-10 years	88	40.4	67.9
More than 10 years	70	32.1	100.0

Table 5.4 presents information about the respondents' functional area. Majority of the respondents (N = 95) work in the supply chain management department and represent 43.6% of the sample. Production (N =33) accounts for 15.1% of the sample. The table further indicates that around 11% each of the total respondents worked in IT, Marketing, and Purchase Departments.

Table 5.4: Demographics profile of Respondents based on functional area

Department	Number of respondents	Percentage of respondents	Cumulative percentage
Production	33	15.1	15.1
Purchasing	25	11.5	26.6
Supply chain Management	95	43.6	70.2
IT	24	11.0	81.2
Finance	06	02.8	84.0
Marketing	26	11.9	95.9
Others	09	04.1	100.0

The same has been graphically represented through figure 5.1. As shown, the sample is dominated by respondents working in supply chain management (SCM) department.

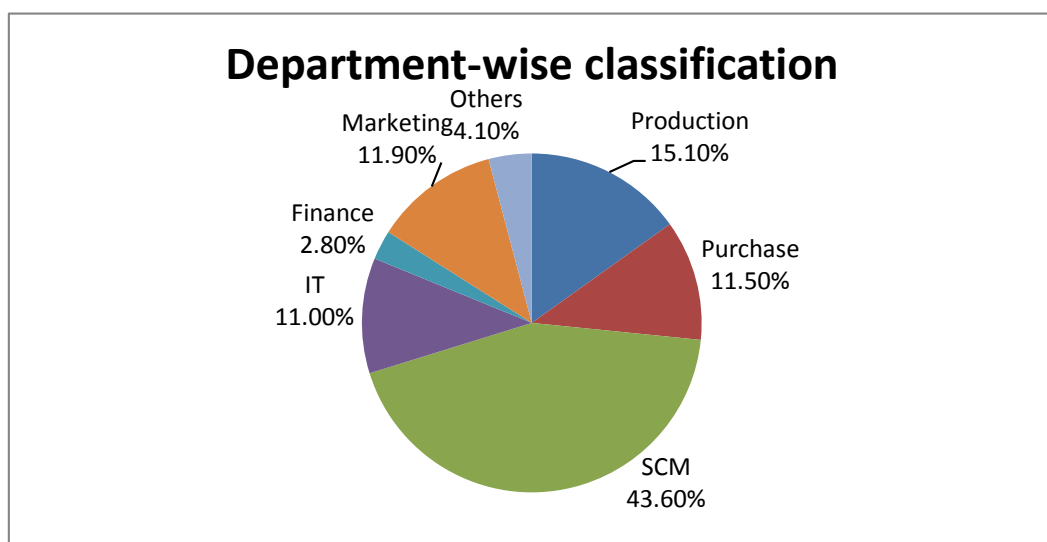


Figure 5.1: Classification based on functional area

As per the records available, the respondents were well educated and well experienced. Further, they had an access to the supplier portal in their organization and thus the respondents were well informed to answer the survey.

5.1.2 Analysis of Product Success using SEM

In this section the data was analyzed using SEM approach. This part of the research is a confirmatory study as it is investigating a well established theory, which is explained in subsequent section.

Confirmatory factor analysis-Measurement model

CFA is a statistical technique which allows the researcher to test the hypothesis and the existence of a relationship between the observed variables and latent constructs. It also verifies the factor structure of the observed variables (Suhr, 2006). The estimation of the confirmatory measurement model is used to determine that how exogenous variables measure the latent variable constructs.

SEM can be used to describe the relationship between two variables namely latent and observed / measured variables. Observed or measured variables are one that is being measured by the researcher directly. The latent variables are not being measured directly but are of interest to the researcher. Therefore to observe latent variables, a conceptual model should be developed to express latent variables in terms of observed variables. For developing SEM framework, the present study uses AMOS 18 statistical software and includes both measurement component and structural component. The measurement component determines that how exogenous variables measure the latent variable constructs and the structural component models the relationship between the latent variable constructs.

Both parts of the model are combined to design a holistic model that comprehensively describes the relationships between variables. The structural model follows the confirmatory measurement model.

For evaluation of the product success dimension, six factors were chosen, based on D&M model. The factors chosen for the present research were system quality (6 items), information quality (6 items), perceived importance of the system (4 items),

user satisfaction (3 items), individual benefits (5 items) and organizational benefits (9 items). All the mentioned factors have been explained in the Section 2.1 of the thesis.

The measurement model represents confirmatory factor analysis that specifies the pattern by which each measure loads on a particular latent factor. It defines the relationship between the observed and unobserved variables. The measurement model only deals with validating the model. The model was specified and tested based on sample data that comprised of all observed variables in it. The primary task in this model testing procedure was to determine the goodness-of-fit between the sample data and the hypothesized model.

Validation of the Measurement Model

To assess the measurement model evaluation, discriminant and convergent validity of each of the measurement scale is done. It is imperative to establish reliability and validity checks of the instrument. The following construct validity checks were carried out.

- Discriminant validity
- Composite reliability
- Convergent validity
- Content validity

The Content validity has already been discussed in Section 3.4 of Research Methodology chapter. The reliability, discriminant and convergent validity, was checked using Composite Reliability (CR), Average Shared Variance (ASV), Maximum Shared Variance (MSV), Average Variance Extracted (AVE) measures. The thresholds for these values as given by Hair et al. (2010) are as follows:

- Composite reliability: it is defined as the degree to which measurements are free from error and, therefore yield consistent results.

$$CR > 0.7$$

$$CR = (\text{square of summed standardized loadings}) / (\text{square of summed standardized loadings} + \text{sum of measurement error variances})$$

$$CR = \frac{(\sum \lambda_i)^2}{[(\sum \lambda_i)^2 + \sum (\delta_i)]} \dots\dots\dots (1)$$

Where λ is the standardized factor loadings and δ is the indicator measurement error.

- Convergent validity: Convergent validity is shown when each measured item correlates strongly with its assumed theoretical construct.

For the convergent validity, the factor loadings and Average Variance Extracted (AVE) should be greater than 0.5. The AVE for each of the factors is calculated manually for all the constructs using the formula suggested by Hair et al., (1995) as given below:

AVE= (sum of squared standardized loadings) / (sum of squared standardized loadings + sum of measurement error variances)

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \delta_i} \dots\dots\dots (2)$$

Where λ is the standardized factor loadings and δ is the indicator measurement error.

- Discriminant validity: Discriminant validity is the extent to which a construct is truly distinct from other constructs.

The following relationships should be checked for establishing discriminant validity

- MSV < AVE
- ASV < AVE
- Square root of AVE greater than inter-construct correlations

The standardized factor loadings of construct items have been shown in table 5.5.

Table 5.5: Standardized Factor Loadings of Construct Items

Construct	Item	Construct statements	Factor loadings (λ)
Perceived Usefulness/Importance (IMP)	IMP1	Using the system is important.	0.860
	IMP2	Using the system is self relevant	0.854
	IMP3	Using SCMIS Increases the effectiveness in the job.	0.772
	IMP4	Overall the system is useful/needed in the job	0.800
Organizational benefits(OB)	OB1	Better forecasting	0.807
	OB2	Better resource planning	0.772
	OB3	Fall in inventory level	0.838
	OB4	Decrease in lead time of production	0.780
	OB5	Improves supplier on time delivery	0.790
	OB6	Improves order management	0.754
	OB7	Improvement in customer relationship	0.803
	OB8	Better coordination with suppliers	0.766
	OB9	Cost saving	0.807
Information Quality (IQ)	IQ1	Information usability	0.776
	IQ2	Information understandability	0.820
	IQ3	Information completeness	0.805
	IQ4	Information timeliness	0.843
	IQ5	Information relevance	0.800
	IQ6	Information conciseness	0.701
System quality(SQ)	SQ1	The SCMIS is easy to use	0.859
	SQ2	SCMIS is easy to learn	0.852
	SQ3	SCMIS is accessible easily	0.691
	SQ4	The SCMIS is cumbersome to use.	0.723
	SQ5	The SCMIS features are as per the requirement	0.645
	SQ6	The SCMIS has integrated well with the legacy (existing) systems	0.645
Individual Benefits(IB)	IB1	Using SCMIS improves the job performance	0.798
	IB2	Using SCMIS in the job improves the productivity	0.812
	IB3	Using SCMIS makes it easier to do the job	0.862
	IB4	SCMIS acts as decision support system	0.812
	IB5	Using SCMIS saves times for individual tasks and duties	0.814
User Satisfaction (US)	US1	Satisfaction with the system quality of the SCMIS	0.773
	US2	Enjoying working on the SCMIS	0.858
	US3	Overall , satisfaction with SCMIS	0.673

Note: Factor loadings significant at $p < 0.001$

Composite reliability

Composite reliability, Convergent and Discriminant validity are calculated as shown in table 5.6 to ensure the appropriateness of groupings of factors into six dimensions for the product evaluation of SCMIS.

Table 5.6: Composite reliability, Convergent and Discriminant validity

Construct	Composite reliability	Average variance extracted	Maximum Shared Variance	Average Shared Variance
Perceived Usefulness/Importance (IMP)	0.893	0.677	0.545	0.498
Organizational benefits(OB)	0.938	0.626	0.596	0.486
Information quality	0.910	0.627	0.570	0.476
System quality	0.878	0.550	0.415	0.372
Individual benefits	0.911	0.672	0.596	0.457
User Satisfaction (US)	0.814	0.596	0.503	0.424

The above table shows the value of CR for all the six factors, system quality has CR of 0.878, for information quality CR value is 0.910, CR is equal to 0.893 for perceived importance of the system and CR is equal to 0.814, 0.911, 0.938 for user satisfaction, individual and organizational benefits, respectively. The value of CR for all the dimensions is more than 0.7 thus indicating adequate internal consistency.

Convergent and Discriminant Validity

The convergent and discriminant validity was checked using Average Variance Extracted (AVE), Maximum Shared Variance (MSV), and Average Shared Variance (ASV) measures. For the convergent validity, the AVE values of the factors are greater than 0.5 and CR is more than AVE. These comply with the threshold values as indicated by Hair et al. (2010) hence convergent validity was established.

For establishing discriminant validity, MSV should be less than AVE, ASV less than AVE and Square root of AVE greater than inter-construct correlations. First two conditions for

establishing the discriminant validity was shown in Table 5.6 and the last condition is proved in Table 5.7. The diagonal items in the Table 5.7 represent the square root of AVE's, which is a measure of variance between construct and its indicators, and the off diagonal items represent squared correlation between constructs. This analysis showed that the shared variance between factors were lower than the AVE's of the individual factors, which confirmed discriminant validity.

Table 5.7 Factor matrix showing discriminant validity

	IMP	OB	IQ	SQ	IB	US
Perceived Usefulness / Importance (IMP)	0.823					
Organizational benefits(OB)	0.730	0.791				
Information quality (IQ)	0.722	0.755	0.792			
System quality (SQ)	0.623	0.580	0.644	0.741		
Individual benefits (IB)	0.738	0.772	0.643	0.588	0.820	
User Satisfaction (US)	0.709	0.628	0.678	0.614	0.620	0.772

Model Fit of the Measurement Model

After establishing validity and reliability of the instrument the results of CFA was used for model fit of the measurement model. Structural models may be just-identified, over-identified, or under-identified. If the number of estimable parameters is less than the data points it is an over identified model, if the number of estimable parameters is equal to the data points it is a case of just identified model and if the number of estimable parameters is less than the data points it is a case of under identified model . For the present study, since the number of estimable parameters is less than the data points it is an over identified model.

The model estimation method used is maximum likelihood estimation. This method is often an iterative method whereby initial solution is improved over subsequent cycles of calculations.

Model Evaluation Criteria: Goodness of Fit

In the process of model fitting, goodness-of fit between the sample data and the proposed model is determined. To evaluate the fit of CFA model various goodness of fit (GOF) indices are employed. The indices are categorized into three groups namely absolute, incremental and parsimony fit measures. Various GOF indicators included in the study to assess the model's goodness of fit are the ratio of χ^2 to degrees-of-freedom (DF), comparative fit index (CFI), goodness-of-fit index (GFI), root mean square error of approximation (RMSEA), incremental fit index (IFI), root mean square residual (RMR), standardized root mean square residual (SRMR), Parsimonious Normalized Fit Index (PNFI) and Parsimonious comparative fit index (PCFI).

Assessing Overall Measurement Model Fitness

This requires that till the GOF indices don't reach the recommended values, initial SEM framework is refined to improve overall fitness. The initial framework improvement was performed over several iterations, using modification indices and theoretical justification to reach a final satisfactory framework. The refinement was done according to the modification indices provided by the AMOSS software. The various GOF indicators with their recommended values is given in the column 2 and 3 of Table 5.8 and last two columns shows the values of the indices for the initial model and final framework, respectively.

Table 5.8: GOF indices for initial and final framework

Evaluation Index	GOF indices	Threshold	Initial model	Final model
Absolute fit index	Pearson chi-square (χ^2)	The least	739.655	577.550
	Degrees of freedom		480	467
	CMIN/DF	<3 good <5 sometimes permissible	1.541	1.237
	P value	>0.05	0.000	0.000
	RMR value	<0.05	0.03	0.026
	SRMR value	<0.05	0.043	0.038
	RMSEA value	<0.05	0.05	0.03
	GFI value	>0.9	0.83	0.87
Relative fit index	IFI value	>0.9	0.95	0.98
	TLI value	>0.9	0.94	0.97
	CFI value	>0.9	0.95	0.98
Parsimonious fit index	PNFI value	>0.5	0.78	0.80
	PCFI value	>0.5	0.86	0.87

The results shown in table 5.8 provides GOF indices for initial and final framework, with the value of χ^2 (577.550), together with its degrees of freedom (467). A low value of χ^2 supports the proposed theoretical model being tested. Although χ^2 seems good but the value of χ^2/DOF is a better indicator as former is sensitive to sample size. The recommended value for this GOF indices is less than 5 and for the present model the value of χ^2/DOF is 1.237 ($\chi^2= 577.550$ and $\text{DOF}=467$), suggesting acceptable model fit. Further other measures to assess goodness of fit is Goodness of Fit index (GFI) whose value is 0.87 as against the threshold value of above 0.90 which may be acceptable in some cases as other indices fall under the threshold level., The Comparative Fit index (CFI), incremental fit index (IFI), Tucker Lewis Index (TLI) are 0.98, 0.98, 0.97, respectively, as against the threshold value of above 0.90.

The value of RMSEA is 0.03 and is well below the recommended limit of 0.05, Standard Root Mean Square Residual (SRMR) has a value of 0.038 below the acceptable limit of 0.05. The Root Mean Square Residual (RMR) value is .026 which is also well below the recommended limit of 0.05 . Hence the model shows an overall acceptable fit.

The final SEM framework selected after the refinement and with the best performance of GOF indices is shown in the Figure 5.2.

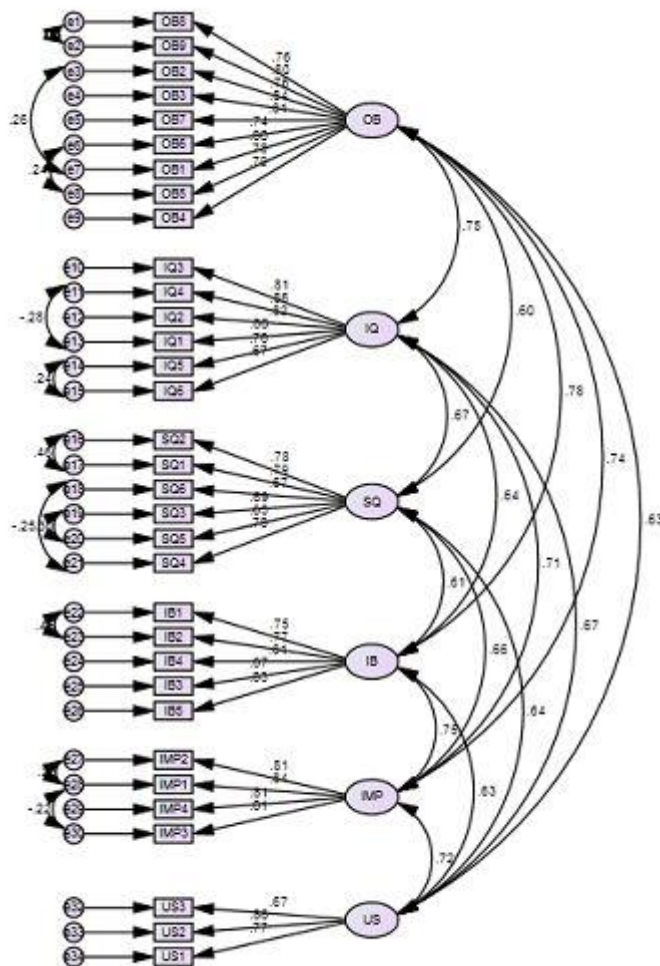


Figure 5.2: Final measurement model

Structural Model

Structural model defines relations among the unobserved variables. It models causal relations between the variables and is concerned with how constructs are associated with each other and is used for hypotheses testing. The first step in SEM is to specify a model thus next point proposes the conceptual model used in the study.

Proposed Conceptual Model

Our SCMIS product success model is composed of six main dimensions. These dimensions are importance of the system, user satisfaction, systems quality, information

quality, individual impact and organizational impact. A conceptual model has been proposed for the measurement and assessment of SCMIS product success. The framework of the proposed conceptual model is given in Figure 5.3. In particular, one-way arrows represent structural regression coefficients and thus indicate the impact of one variable on another.

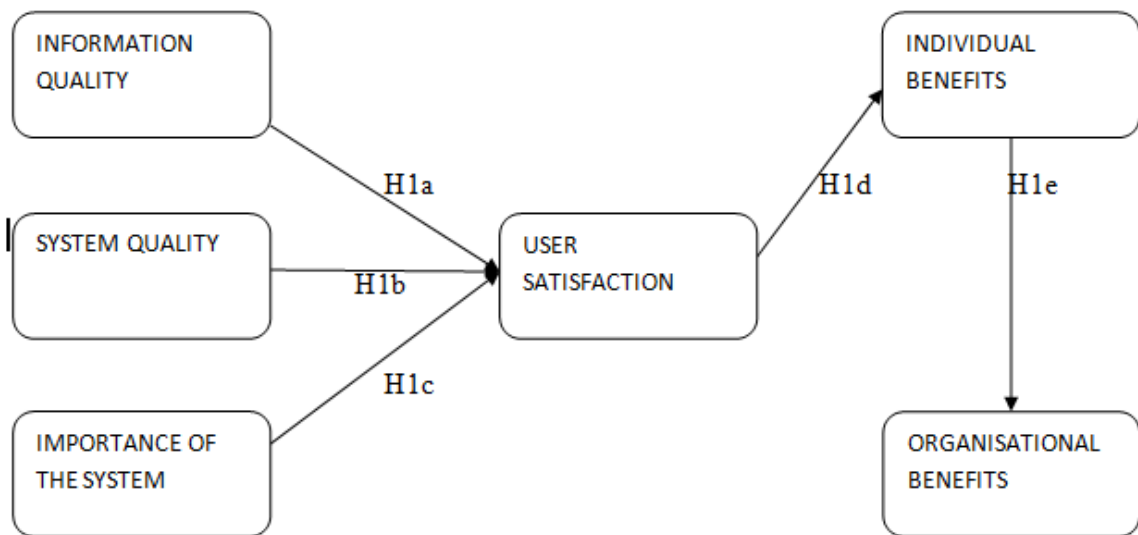


Figure 5.3: Conceptual model for evaluation of product success

The following hypotheses were tested and the results are given in section:

- H1a: Information quality will positively contribute to user satisfaction
- H1b: System quality will positively contribute to user satisfaction
- H1c: Perceived importance of the system will positively contribute to user satisfaction
- H1d: User satisfaction leads to more individual benefits
- H1e: Individual benefits leads to more organizational benefits

Structural Model – Hypotheses Testing

SEM was conducted for hypotheses testing on the structural model using AMOS18. In reviewing the model, information quality, system quality and perceived usefulness to the users are antecedents to user satisfaction. Further, individual benefits and organizational

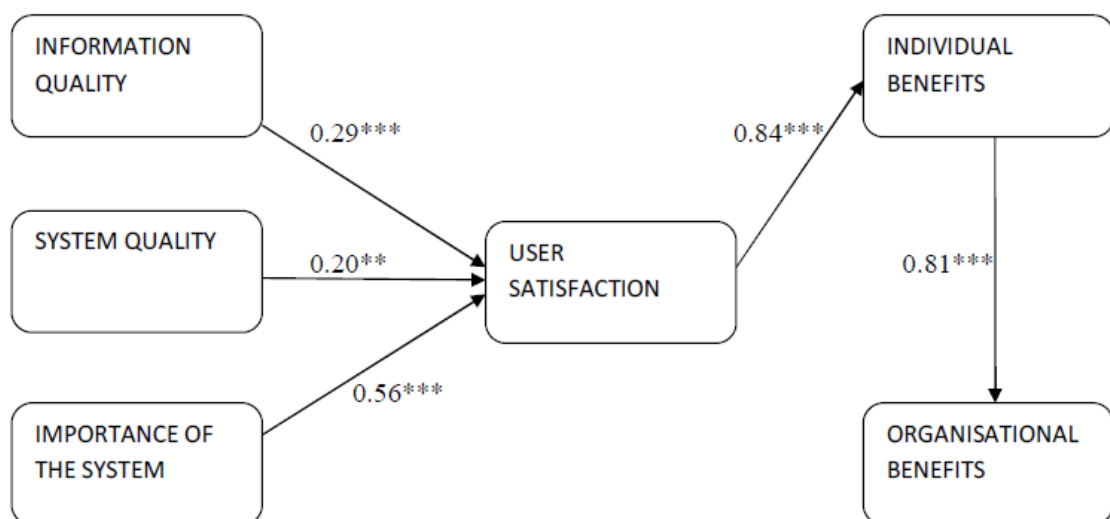
benefits are both influenced by the user satisfaction level. This section deals with hypotheses testing and the results are presented.

Assessing Structural Model Fitness

The structural model's validity needs to be established and it follows the same guidelines that were adopted for the measurement model. The only difference between the two is that in measurement model all the constructs are correlated, but in structural model the relationships between some constructs are assumed to be zero. The result of the select fit indices of the structural model shows that the model provides a good fit. The value of Chi square is 1.537, which is below the recommended level of 3.0. The values of CFI (0.949), IFI (0.949) and TLI (0.944) are greater than the recommended values of 0.9. The value of RMSEA is 0.05 and RMR 0.043, which is below the recommended value of 0.06. Hence it is concluded that the proposed research model fits the data reasonably.

Testing Structural Relationships

The hypothesized research model exhibited good-fit with observed data as mentioned above. Therefore, hypotheses are tested to find the relationship between various dimensions. Figure 5.4 shows the standardized regression estimates of the hypotheses tested.



*** $p < 0.001$, ** $p < 0.01$

Figure 5.4: Standardized regression estimates

Following are the observances from the preceding figure:

- The coefficient for the path from information quality to user satisfaction is positive and significant ($\beta=0.29$, $p<0.001$) which supports hypothesis H1a.
- The coefficient for the path from system quality to user satisfaction is positive and significant ($\beta =0.20$, $p<0.01$) which supports hypothesis H1b.
- The coefficient for the path from importance of the system to user satisfaction is positive and significant ($\beta =0.56$, $p<0.001$) which supports hypothesis H1c.
- The coefficient for the path from user satisfaction to individual benefits is positive and significant ($\beta =0.84$, $p<0.001$) which supports hypothesis H1d.
- The coefficient for the path from individual benefits to organizational benefits is also positive and significant ($\beta =0.81$, $p<0.001$) which supports hypothesis H1e.

The model shows that information quality, system quality, and perceived importance of the system leads to 88% of the user satisfaction. The model altogether explains 66% of the organizational benefits that can be derived from the system based on the developed model. The Figure 5.4 shows the default model as given by AMOS.

Standardised regression estimates of the hypotheses tested

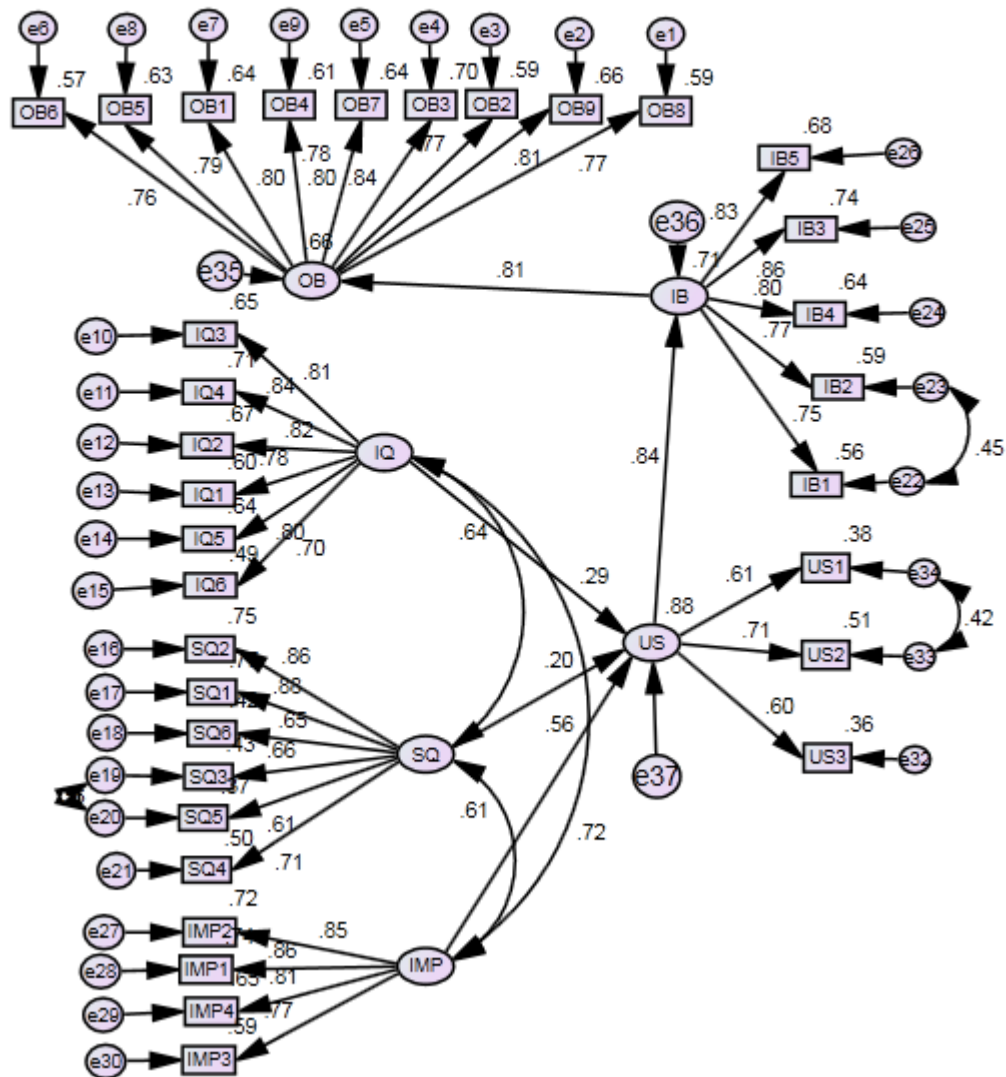


Figure 5.4: Regression estimates

The findings of this part of the thesis support the proposed hypothesis that:

- Information quality is directly and positively correlated to user satisfaction (H1a), so an increase in the quality of the information indicates an increase in user satisfaction.
- System quality is directly and positively correlated to user satisfaction (H1b), so an increase in quality of the system indicates an increase in user satisfaction.

- Perceived importance of the system is directly and positively correlated to user satisfaction (H1c), so an increase in the perceived importance of the system by an individual user indicates an increase in user satisfaction.
- User satisfaction is directly and positively correlated to individual benefits (H1d), so a buildup in the user satisfaction will lead to an expansion in realization of individual benefits.
- Individual benefits are directly and positively correlated to organizational benefits (H1e), so an increase in the individual benefits leads to an escalation in organizational benefits.

System quality includes ease of use, ease to learn, convenience of access, features as per the requirement and the integration with the legacy systems. Thus, a net positive effect from these factors will result in a positive effect on the user satisfaction. These factors constitute an important consideration for the users of SCMIS.

Information relevance, conciseness/precision, timeliness, usefulness, clarity and understandable constitute the construct information quality. Thus, a net positive effect from these factors will result in a positive effect on the user satisfaction. The SCMIS should provide relevant, useful, concise, clear and understandable information for providing user satisfaction.

Perceived usefulness, importance, and self relevance measure the importance of SCMIS for the user. Thus, a net positive effect from these factors will result in augmenting of the user satisfaction. Higher the perceived usefulness, importance and self relevance to the user, higher is the satisfaction user derives from SCMIS.

System understanding that the user possess, the functions it provides, information quality, performance of the system and user's overall experience with SCMIS constitutes the construct of user satisfaction. Thus, a net positive effect from these factors will result in a positive effect on the individual benefits and organizational benefits.

Individual benefits are measured by improvement in job performance, productivity, saving time in doing a job, and helping in decision making. Thus, a net positive effect from these factors will result in a positive effect on the benefits that an organization will finally realize.

The results from the research model also demonstrate that information quality, system quality and perceived importance of the system were related positively to user satisfaction. Perceived importance of the system with $\beta = 0.56$ had the most influence on the user satisfaction. This was followed by information quality from the system with $\beta = 0.29$. System quality had the least influence on the variable ($\beta = 0.20$). Further, user satisfaction leads to individual benefits ($\beta = 0.84$) which would finally lead to the organizational benefits ($\beta = 0.81$). The model altogether explains 66% of the organizational benefits that could be derived from individual benefits.

5.2 HINDRANCE FACTORS

This section analyzes the hindrance factors for SCM system for fulfilling objective 2 which states to analyze success and hindrance factors for SCM systems in the sector organizations.

The implementation of SCMIS is a complex, time consuming and an expensive endeavor as it relates to enterprise, people and technology and thus encompasses socio-technical aspects. The analysis in this section attempts to understand how different factors obstruct successful implementation of SCMIS.

As explained in Section 2.2 of the thesis the various impediments identified are based on the previous studies reported in the literature, and discussions with the researchers, experts and practitioners in this field. They were categorized into six main barriers

- Financial barriers
- Human Barriers
- Organizational Barriers
- Project Management barriers
- Inter organizational barriers
- Technical barriers.

Each impediment was analyzed on multiple dimensions which added up to forty dimensions for all the six impediments together. Each of the dimension was measured on a five point Likert scale ranging from 1 (No Problem at all) to 5 (very serious Problem). The score calculated represented the severity of the problem. Thus, higher the score higher is the severity of the barrier and its related dimensions.

5.2.1 Conceptual Model

The conceptual model for impediments in the successful implementation of SC MIS is shown in the Figure 5.5. The model shows the various barriers which should be waned for the successful implementation of SC MIS.

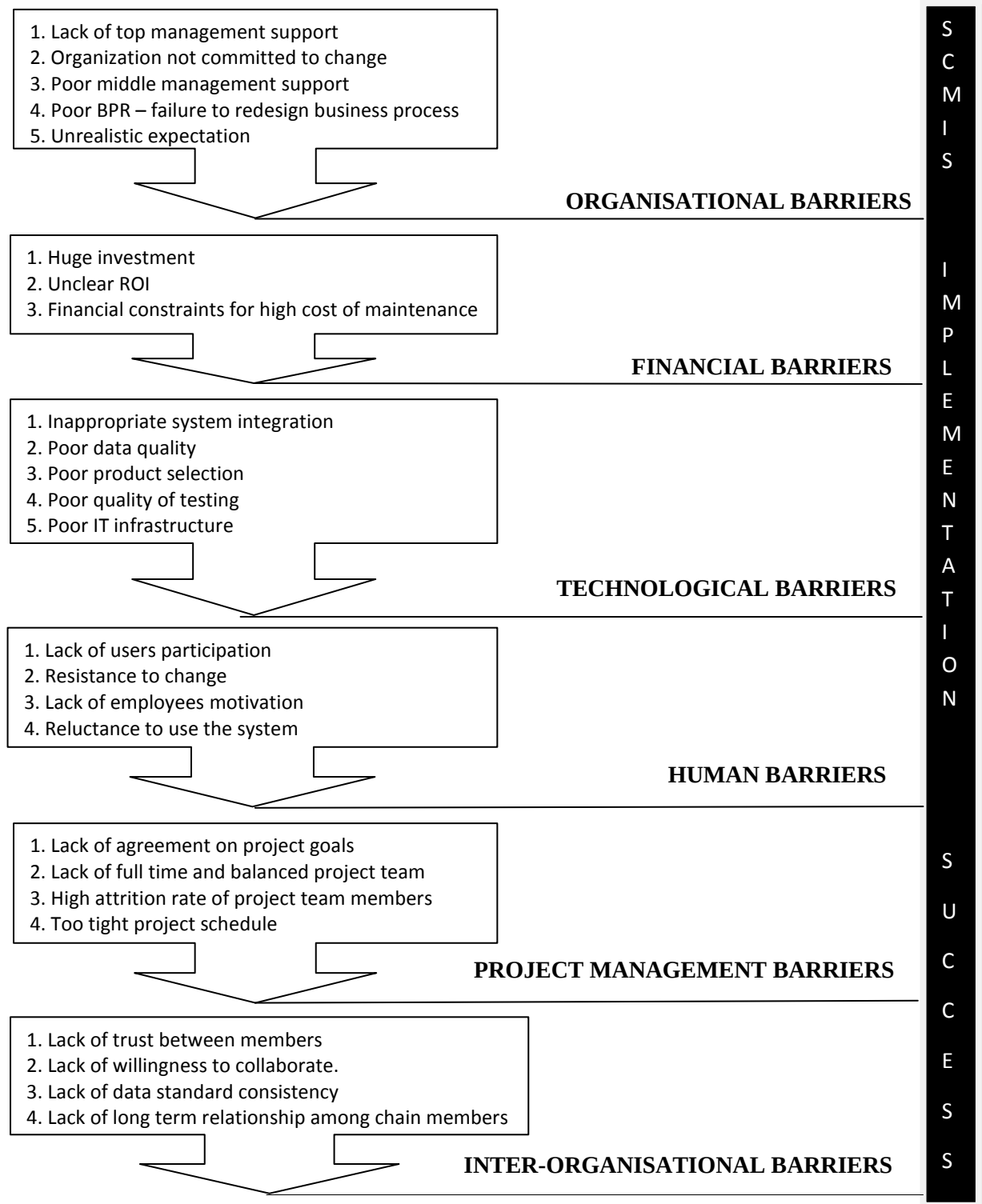


Figure 5.5: Conceptual model for impediments in the successful implementation of SC MIS

5.2.2 Measurement of Severity for Each Barrier

To measure the severity of the barriers, an un-weighted summated scale was used, and was equal to the sum of all the responses of the dimensions for the related barrier by the respondent. The various variables are: OBsum which represents organizational barrier and is the sum of score given to nine dimensions OB1, OB2, OB3, OB4, OB5, OB6, OB7, OB8, and OB9.

Thus,

$$OBsum = \sum_{i=1}^9 OB_i \dots\dots\dots (3)$$

Table 5.9 explains all the dimensions. The organizational barrier has nine dimensions and the range for each is from 1 to 5, then the range for OBsum is 9 to 45. High score will suggest higher severity of the barrier. Similarly, FBsum represents financial barrier and is the sum of score given to 3 dimensions FB1, FB2 and FB3. Technical barrier is represented by TBsum and is the sum of score given to 8 dimensions TB1, TB2, TB3, TB4, TB5, TB6, TB7 and TB8. Further HBsum represents human barrier and is the sum of score given to 8 dimensions HB1, HB2, HB3, HB4, HB5, HB6, HB7 and HB8. PMBsum represents project management barrier, which is a sum of 6 dimensions PMB1, PMB2, PMB3, PMB4, PMB5 and PMB6. Lastly, inter-organizational barrier variable is represented by IOBsum, which is the sum of score given to 6 dimensions IOB1, IOB2, IOB3, IOB4, IOB5 and IOB6.

For the comparison and ranking for each of the barrier, severity was calculated using the formula given in the study by Chaturvedi & Goyal (2012).

$$Severity = 100\{[(Mean\ score - minimum\ possible\ score) / (Maximum\ possible\ score - minimum\ possible\ score)]\} \dots\dots\dots (4)$$

Higher severity means high barrier to the successful implementation of SCMIS, therefore it was given highest ranking.

Table 5.9: Descriptive Statistics

Barrier		Variables	Mean	S.D	MIN	MAX
1. Organizational (OBsum)	OB 1	Lack of top management support	34.86	2.91	20	44
	OB 2	Lack of alignment between IT and organizational objectives.				
	OB 3	Organization not committed to change				
	OB 4	Poor BPR – failure to redesign business process				
	OB 5	Absence of readiness assessment before implementation				
	OB 6	Poor middle management support				
	OB 7	Perspective of SCMIS as just a technical system				
	OB 8	Unrealistic expectation				
	OB 9	Inexperienced consultants				
2. Financial (FBsum)	FB 1	Huge investment	11.51	1.43	8	15
	FB 2	Unclear ROI				
	FB 3	Financial constraints for high cost of maintenance				
3. Technological (TBsum)	TB 1	Inappropriate system integration	30.08	3.29	18	38
	TB 2	Relying heavily on customization				
	TB 3	Poor data quality				
	TB 4	Lack of data standards				
	TB 5	Poor product selection				
	TB 6	Poor quality of testing				
	TB 7	Poor IT infrastructure				
	TB 8	Lack of data and information security				
4. Human (HBsum)	HB 1	Lack of users participation	32.75	3.54	21	40
	HB 2	Resistance to change				
	HB 3	Lack of sufficient training to end users				
	HB 4	Inadequate employee involvement				
	HB 5	Lack of employees motivation				
	HB 6	Lack of understanding of the system benefits				
	HB 7	Ineffective communication with the users.				
	HB 8	Reluctance to use the system				
5. Project Management (PMBsum)	PMB 1	Lack of effective project management methodology	22.67	2.58	17	30
	PMB 2	Lack of agreement on project goals				
	PMB 3	Lack of full time and balanced project team				
	PMB 4	High attrition rate of project team members				
	PMB 5	Lack of a project champion/ establishment of an inexperienced project mgr				
	PMB 6	Too tight project schedule				
6. Inter Organizational (IOBsum)	IOB 1	Lack of trust between members	22.54	3.25	11	29
	IOB 2	Lack of willingness to collaborate.				
	IOB 3	Technological incompetence's within trading partners				
	IOB 4	Culture of the partner may not support sharing of the information				
	IOB 5	Lack of data standard consistency				
	IOB 6	Lack of long term relationship among chain members				

Table 5.9 shows the various variables for the respective barriers. Non parametric analysis of the six barriers using summated score is done. Table 5.10 shows ‘Organizational’ barrier with a mean, minimum value and maximum value of 34.86, 20 and 44 respectively. The standard deviation is 2.91. Likewise Table 5.10 also shows mean, minimum value, maximum value and no. of dimensions for all the ‘Barriers’ considered in the study. These scores cannot be compared since the number of dimensions in various barriers varies between 3 and 9. Therefore, each impediment is converted into severity score which is expressed in percentage. The Table 5.10 shows the severity score of organizational barrier as 71.83%, financial barrier has a score of 70.96%, technical barrier has 69% and human barrier has a severity score of 77.34%.

Table 5.10: Percentage Severity of the Barriers

Barrier	No of dimensions	Mean score	Max possible score	Min possible score	Severity (%)
OBsum	9	34.86	45	9	71.83
FBsum	3	11.51	15	3	70.96
TBsum	8	30.08	40	8	69.00
HBsum	8	32.75	40	8	77.34
PMBsum	6	22.67	30	6	69.45
IOBsum	6	22.54	30	6	68.90

The barriers are arranged in the descending order on the basis of severity score. The Table 5.11 shows the ranking of the barriers. The highest rank with severity score of 77.34% was that of human followed by organizational barriers with score of 71.83%.

The highest severity among the barriers is that of Human which is supported by Leon (2008) who stressed that system implementation is not a technology but a people project. According to the study 69%, 28% and 13% failure rate of the ERP systems is due to people, process and technological problems respectively. The findings from the study by Hawking et al. (2004) also reinforced enterprise resource planning implementations as people focused projects, which rely heavily on change management for success. Further studies on information system also indicate that failure is largely due to organizational and social, rather than technical factors (Fitzgerald & Russo, 2005).

Table 5.11: Ranking of the Barriers

Barrier	Severity	Rank
HBsum	77.34	1
OBsum	71.83	2
FBsum	70.96	3
PMBsum	69.45	4
TBsum	69.00	5
IOBsum	68.90	6

Among the human barriers, the most important is users' resistance to change that can be better understood by the concept of force-field analysis developed by Lewin Kurt (1951) as shown in Figure 5.6. According to him any change situation is faced by two opposing forces namely driving forces and resisting forces. He points out that increasing one set of forces without decreasing the other set of forces will lead to conflict in the organization.

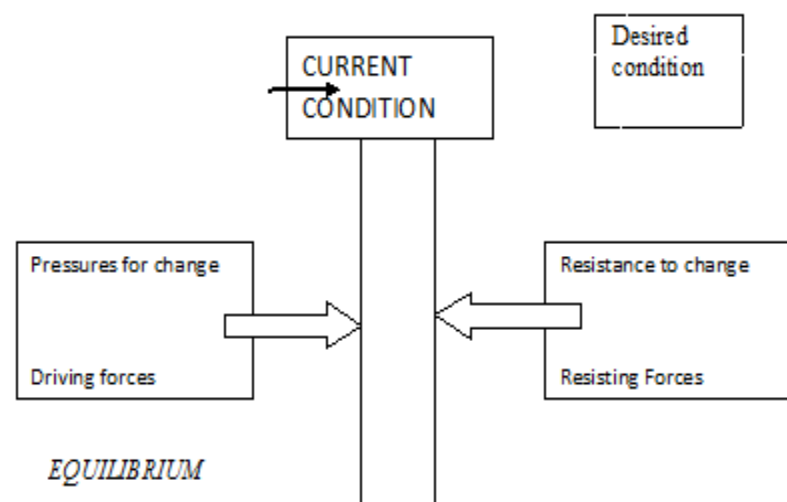


Figure 5.6: Lewin's force-field theory of change

Therefore, it is better to reduce the resisting force rather than increasing driving forces which may otherwise further lead to increase in resistance. Thus, particularly lowering the resistance will lead to increase in user satisfaction.

People prefer status quo as change produces anxiety and uncertainty. People resist change because of several reasons like rationale for change not clear, non participation of the

users in the change process, modification in the working relationships between people, no proper communication with the users, threat of job, power or status, and benefits not adequate for the effort involved in learning. The employees usually do not resist technical change but it is the social change that is resisted. Therefore at the outset it is very important for an organization to understand the nature of resistance, before adopting any strategy for minimizing this resistance.

Overcoming resistance to change

The organizations should implement the strategies for minimizing this risk and should be competent enough to facilitate a smooth implementation of the system. The most frequently used strategies to overcome resistance to change are communication, user participation, user involvement and training.

- i. *Communication:* As the organizations move towards integration with the outside world proper communication is imperative between the users, top management, project management team and leader. Communication is required in every phase before, during and after the implementation. Proper communication should ensure that the users understand the need and the benefits associated with the adoption of the inter-organizational system. Communication should be two way as well as open where employees are free to express themselves and give their feedback. Communication will reduce the uncertainty with the adoption of the information system and would diminish the concern about the threat of job, power or status.
- ii. *User participation and involvement:* Briolat and Pogman (2000) defined “user participation is advocated in order to discover users’ needs and point of view to validate specifications, and hence build better IS for the Organization”. The users who participate in the planning and implementing stage of the system are less likely to resist the change. Users’ participation can improve system quality by knowing exactly the information requirements, not adding any superfluous feature that adds cost of implementation but does not provide any value addition for the user. The users should be asked to give their suggestions and feedback in the implementation process, which will improve user understanding of the system. Thus it is very important to keep the users and other stakeholders motivated and actively involved.

- iii. *Top Management support:* Top management plays a significant task in reducing resistance to change. Formal and honest communication from the top management leads to reduction in the resistance to change. Employees and the management acting in tandem as a team can alleviate the resistance. The management can facilitate team spirit by empowering the employees and also create a conducive environment for the employees to accept change. They can also develop informal leaders who can become effective agents of change and also can practice soft coercion tactics to reduce resistance. Top management should assign sufficient resources to the change management and should act as a leader and not boss. Top management should establish reward system which would further reduce the resistance.
- iv. *Education and training:* Effective training should be provided to the user so that he becomes comfortable with the system. Due to lack of training users are not comfortable to retrieve or input data on the system (Peng & Nunes, 2007). The user will be willing to use the system or will not possess sufficient skill unless and until sufficient training is imparted to him. The staff that is not effectively trained represents a potential barrier to the use of ERP systems (Sherer & Alter, 2004; Wright & Donaldson, 2002). It is very important to give hands-on training to the user so that he gets a feel of it. A formal training program should be developed to meet the requirements of the users. Proper allocation of resources for the training should also be done. The training could be organized in-house or at the training centre where consultants could transfer knowledge to the technical personnel and end users. Training forms one of the costly component of the implementation process (Estevez et al., 2003) so the proper monitoring and evaluation should be done to ensure that the employees have received the appropriate training.

It is very necessary to reduce human impediments because user satisfaction has been accepted widely as a measure of success for the information system (Wu et al., 2002). According to Holsapple et al., (2005) user satisfaction is one of the important factor that affects the success of management information systems.

5.3 CRITICAL SUCCESS FACTORS

This section discusses the second dimension of objective 1 which states that to identify various dimensions of SCM systems in selected organizations in the automotive sector and also analyses the success factors for SCM system for fulfilling objective 2 of the study which states that to analyze success and hindrance factors for SCM systems in the sector organizations.

Process based evaluation

This type of review focuses on the processes, which are followed in implementing SCMIS. Process success is a measure of the effectiveness of organizations approach for implementing SCMIS, up to the point of deployment of the new system to the end user. For this CSFs approach has been adopted.

Today, the CSFs approach is widely exercised by consultants, managers, and IS department as a means of strategic planning for information systems (Esteves, 2004). It helps in determining those factors that must go right to have a successful implementation of a project and succeed in achieving the requisite goals and objectives. Implementation success of the system as defined by Pinto and Slevin (1987) is

$$S = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}, x_{11}, x_{12}, x_{13}, x_{14}, x_{15}, x_{16}, x_{17}, x_{18}) \dots\dots\dots(5)$$

where, S is project success and x_i the CSF_i

Thus, an attempt has been made to define a model of this nature for process evaluation of SCMIS implementation project. Through an extensive literature review as given in Chapter 2 the 18 CSFs identified for the successful implementation of SCMIS are:

- 1) x_1 - Clear Business plan and vision (VB)
- 2) x_2 - Pre implementation analysis (PRE)
- 3) x_3 - Top management support (TM)
- 4) x_4 - Change management (CM)
- 5) x_5 - User involvement (US)
- 6) x_6 - Business process reengineering (BPR)
- 7) x_7 - Communication (Co)
- 8) x_8 - Technical infrastructure (TI)

- 9) x_9 - Effective project management (PM)
- 10) x_{10} - Project team composition (TC)
- 11) x_{11} - Project champion (PC)
- 12) x_{12} - Data accuracy and integrity (DA)
- 13) x_{13} - External support (ES)
- 14) x_{14} - Data security (DS)
- 15) x_{15} - Trust (TRU)
- 16) x_{16} - Cooperation and Commitment of Trading Partners (CC)
- 17) x_{17} - Organizational culture (CT)
- 18) x_{18} - Education and training (TRA)

5.3.1 Importance of Critical Success Factors

To prioritize the factors weighted mean was calculated using the formula given below:

Weighted mean for a factor = $\sum x_i y_i$ / Total no of respondents (7)

Where

x_i = No of responses for a rating score

y_i = rating score (i=1, 2, 3, 4, 5)

Table 5.12 shows the mean score; SD and rank for all the factors which must be considered for the successful implementation of SCMIS in the automotive industry.

Table 5.12: Weighted Average rating of CSFs

CSF	CSF Mean	Std. Deviation	Rank
1) Clear Business plan and vision	4.06	0.405	7
2) Pre implementation analysis	4.12	0.471	3
3) Top management support	4.12	0.348	4
4) Change management	4.10	0.429	5
5) User involvement	4.13	0.464	2
6) Business process reengineering	4.05	0.490	8
7) Communication	4.01	0.470	12
8) Technical infrastructure	3.86	0.456	18
9) Effective project management	3.97	0.393	14
10) Project team composition	3.99	0.437	13
11) Project champion	4.14	0.504	1
12) Data accuracy and integrity	3.95	0.391	15
13) External support	3.89	0.522	17
14) Data security	4.03	0.515	10
15) Trust	4.02	0.514	11
16) Cooperation and Commitment of Trading Partners	4.04	0.380	9
17) Organizational culture	3.92	0.450	16
18) Education and training	4.08	0.440	6

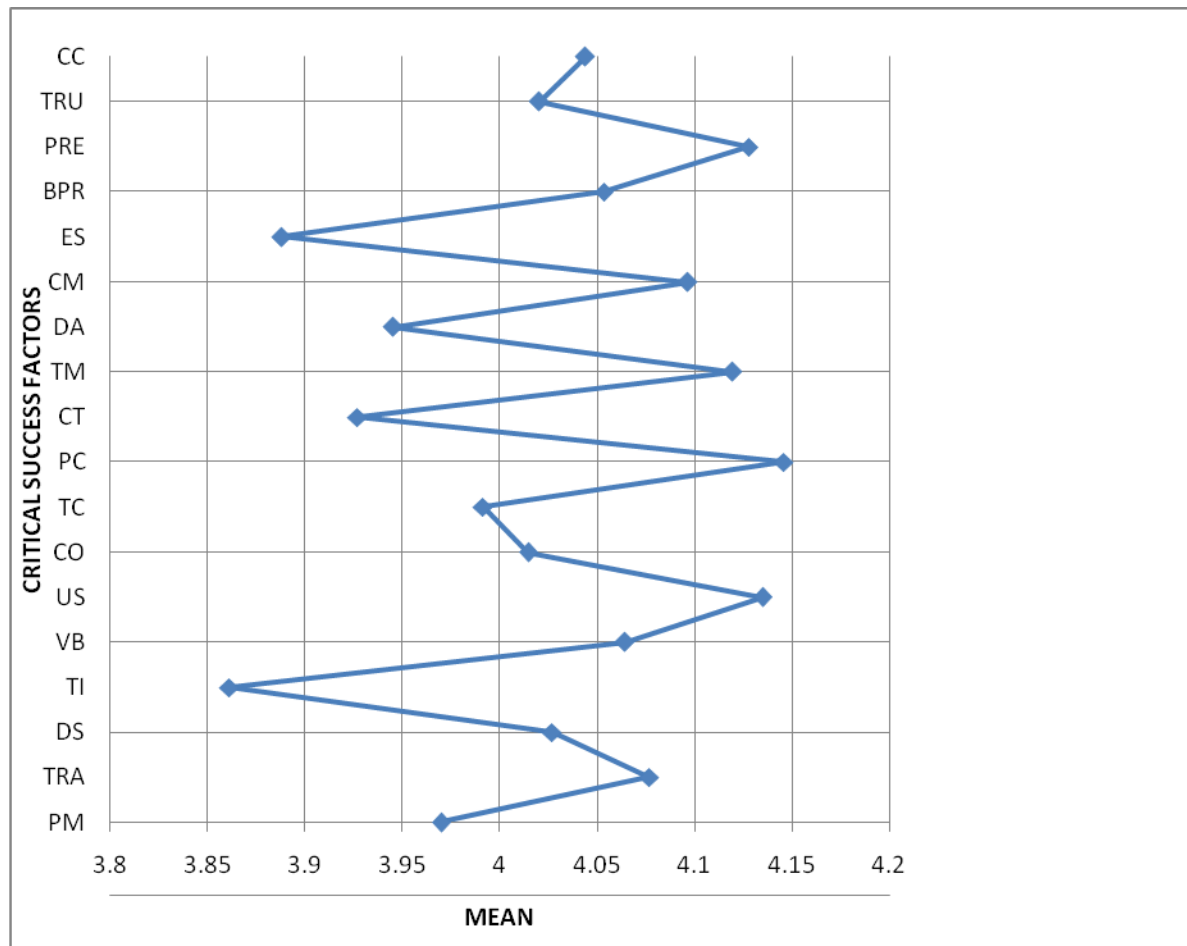


Figure 5.7: Weighted Average rating of CSFs

Table 5.12 and Figure 5.7 shows the weighted mean of CSFs. It reveals that the factor of Project champion has the highest weighted mean of 4.14 and SD as 0.50. Other factors among the top five include user involvement (mean 4.13 and SD 0.46); top management support (mean 4.12 and SD 0.348), Pre implementation analysis (mean 4.12 and SD 0.47) and change management (mean 4.10 SD 0.43).

As seen from the analysis none of the technical factors appear in top five success factors thus these systems should not be viewed as an IT implementation but instead as an organizational revolution which would transform the organization processes. Study by Finney and Corbett (2007) has stated that among CSFs significant roles are played by an adequate definition of requirements, experience of project team headed by project champion and involvement of the company's resources. The companies have realized the importance of pre implementation stage which is the planning phase and forms the foundation to the successful implementation of the SCMIS and it is imperative for an

organization to assess the readiness for implementing change. Various studies by Markus & Tanis, (2000); Ross & Vitale, (2000); Somers & Nelson, (2004) have substantiated that pre implementation is the main phase which results in the agreement and definition of the requirements for the target system. Thus pre implementation becomes a pre condition for the successful adoption of this kind of projects.

5.3.2 To Find the Impact of CSFs on Successful Implementation of SCMIS.

Multiple regression was used to find out the effect of success factors in the implementation process of SCMIS. The linear regression assumes that there exists a linear relationship between the dependent variable and each predictor. The total score obtained from the sample consumers about the perception of the implementation success of the system is tested against all success variables.

The equation tested is

$$y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + b_{11}X_{11} + b_{12}X_{12} + b_{13}X_{13} + b_{14}X_{14} + b_{15}X_{15} + b_{16}X_{16} + b_{17}X_{17} + b_{18}X_{18} \dots\dots\dots (8)$$

where

y=Perceived successful implementation of the system (SI) (Dependent variable) and
X₁ to X₁₈ are success factors (Independent variable).

Research Model

Based on the factors, a conceptual model has been proposed for a successful SCMIS implementation. The framework of the proposed conceptual model is given in Figure 5.8. The model shows the success factors which would help in successful implementation of the information system.

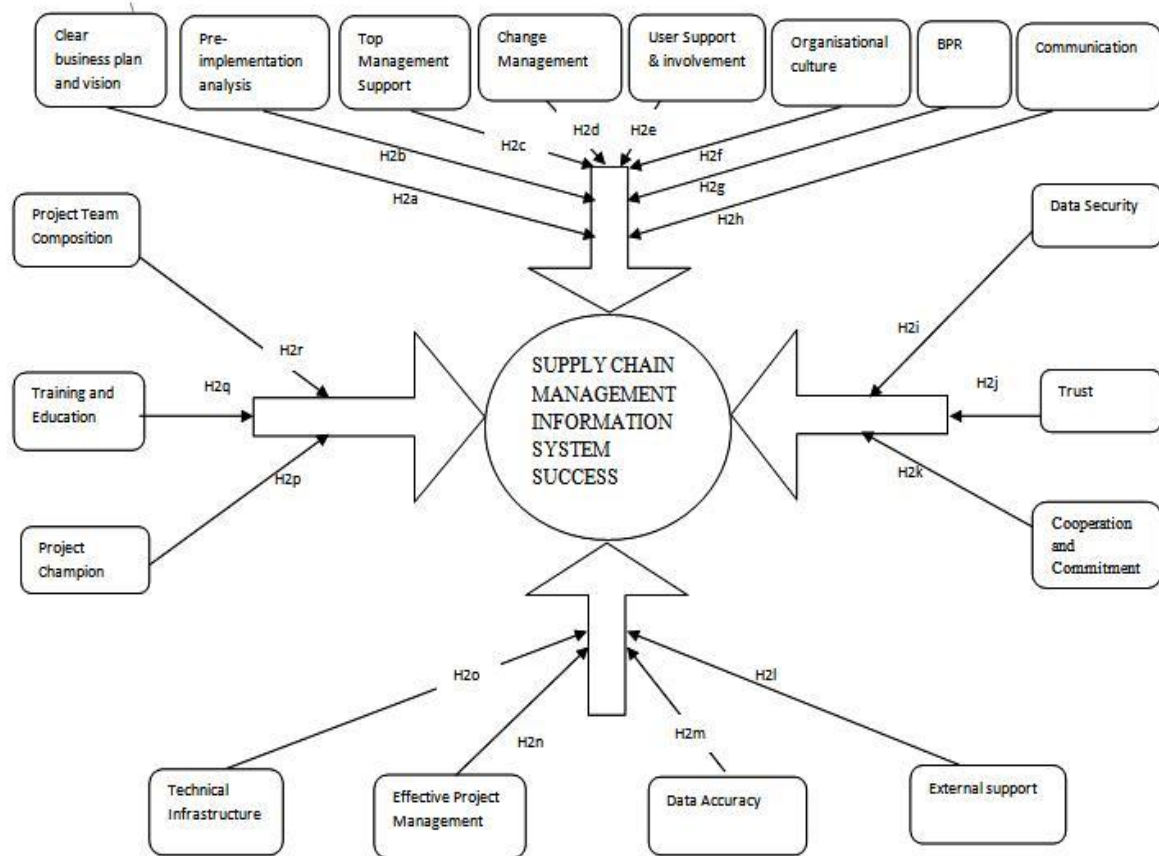


Figure 5.8: Conceptual model for successful implementation of SCMIS

Hypotheses and Testing Using Regression:

The following hypotheses were formulated based on the above addressed issues:

H2a: Clear Business Plan and vision has a positive impact on SCMIS implementation success.

H2b: Pre-implementation analysis has a positive impact on SCMIS implementation success.

H2c: Top management support has a positive impact on SCMIS implementation success.

H2d: Change Management initiatives have a positive impact on SCMIS implementation success.

H2e: Involving user has a positive impact on SCMIS implementation success.

H2f: Organizational culture has a positive impact on SCMIS implementation success.

H2g: BPR has a positive impact on SCMIS implementation success.

H2h: Effective communication has a positive impact on SCMIS implementation success.

H2i: Data security has a positive impact on SCMIS implementation success.

H2j: Trust among trading members has a positive impact on SCMIS implementation success.

H2k: Cooperation And Commitment of Trading Partners has a positive impact on SCMIS implementation success.

H2l: External support has a positive impact on SCMIS implementation success.

H2m: Data accuracy during conversion has a positive impact on SCMIS implementation success.

H2n: Effective project management has a positive impact on SCMIS implementation success.

H2o: Technical infrastructure has a positive impact on SCMIS implementation success.

H2p: Project champion has a positive impact on SCMIS implementation success.

H2q: Training and education has a positive impact on SCMIS implementation success.

H2r: Project team composition has a positive impact on SCMIS implementation success.

All the success factors were entered and step-wise regression was performed. Table 5.13 shows the model summary; the predictors included in the model were TM, US, TRU, TRA, CM, DA and Co. The value of R, which is the square root of R-Squared, is 0.861, which is more than the acceptable value of 0.6. Further, the table reveals the value of coefficient of determination R^2 as 0.741 which means that 74.1% of the total variation in the dependent variable is explained by the above mentioned independent predictor variables. The value of Adjusted R Square to the model is 0.727 which penalizes extraneous predictors, and the difference between R^2 and adjusted R^2 is less than 0.5 which indicates good model fit. The value of Std. Error of the estimate is 0.281.

Table 5.13: Regression Model Summary: Impact of CSFs on the implementation process of SCMIS.

MODEL	R	R ²	ADJUSTED R ²	Std Error Of Estimation	
1	0.861	0.741	0.727	0.281	
ANOVA	Sum Of Squares	Df	Mean Square	F	Significance
Regression	29.170	7	4.167	52.764	.000
Residual	10.188	129	0.079		
Total	39.358	136			
Coefficients					
Variable	B	Standardized Coefficients	t- value	Significant Level	
Constant	-2.236		-6.398	.000	
TM	0.334	0.216	3.368	0.001	
TRA	0.279	0.228	4.071	0.000	
CM	0.273	0.218	3.683	0.000	
DA	0.226	0.165	3.356	0.001	
TRU	0.157	0.129	2.410	0.017	
US	0.154	0.132	2.106	0.037	
Co	0.138	0.120	1.994	0.048	
Independent variable: Critical success factors					
Dependent Variable: Implementation success of SCMIS					

*** p<0.001, ** p< 0.01,*p<0.05

Table 5.13 also indicates analysis of variance in which the total variance with value 39.358 is partitioned into the variance with value 29.170 which is explained by the independent variables and the variance with value 10.188 which is not explained by the independent variables. The significance value refers to the test of the entire model (i.e. the entire collection of independent variables) as a whole. The general form of the hypothesis test is:

H₀: None of the independent variables are significant predictors of the dependent variable.

Thus, the table shows $F(7,129) = 52.764$, $p < .001$ and therefore null hypothesis is rejected and proves the alternative hypothesis that at least one independent factor is a significant predictor of the dependent variable.

Result obtained through regression analysis for the successful implementation of SCMIS, factors that have significant impact at 5% or higher level include change management, top management support, training and education, data accuracy, trust, user support and involvement, and communication as shown in Table 5.13. Beta values indicate the coefficients and constant for the regression equation that measures predicted value for implementation success of the system. While Beta (β) values refer to the standardized regression coefficients that allow for an equal comparison of the coefficient weights. The t value refers to the Beta value divided by the standard error of Beta. The significance indicates the probability that the t value could happen by chance, so it is considered significant at the $p < 0.05$ level if this index is less than 0.05.

Table 5.13 shows the results of regression coefficients. The first variable (constant) represents constant called as 'Y' intercept which is the predicted value of a dependent variable when all other variables are 0. The t-values of all the variables in the model are statistically important as their significant values lie below 0.05. Thus, it can be safely concluded that the analysis predicts fitness of the model.

The following regression equation was derived based on the regression output:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 \dots\dots\dots (9)$$

Where,

Y=Perceived successful implementation of the system (SI) (Dependent variable)

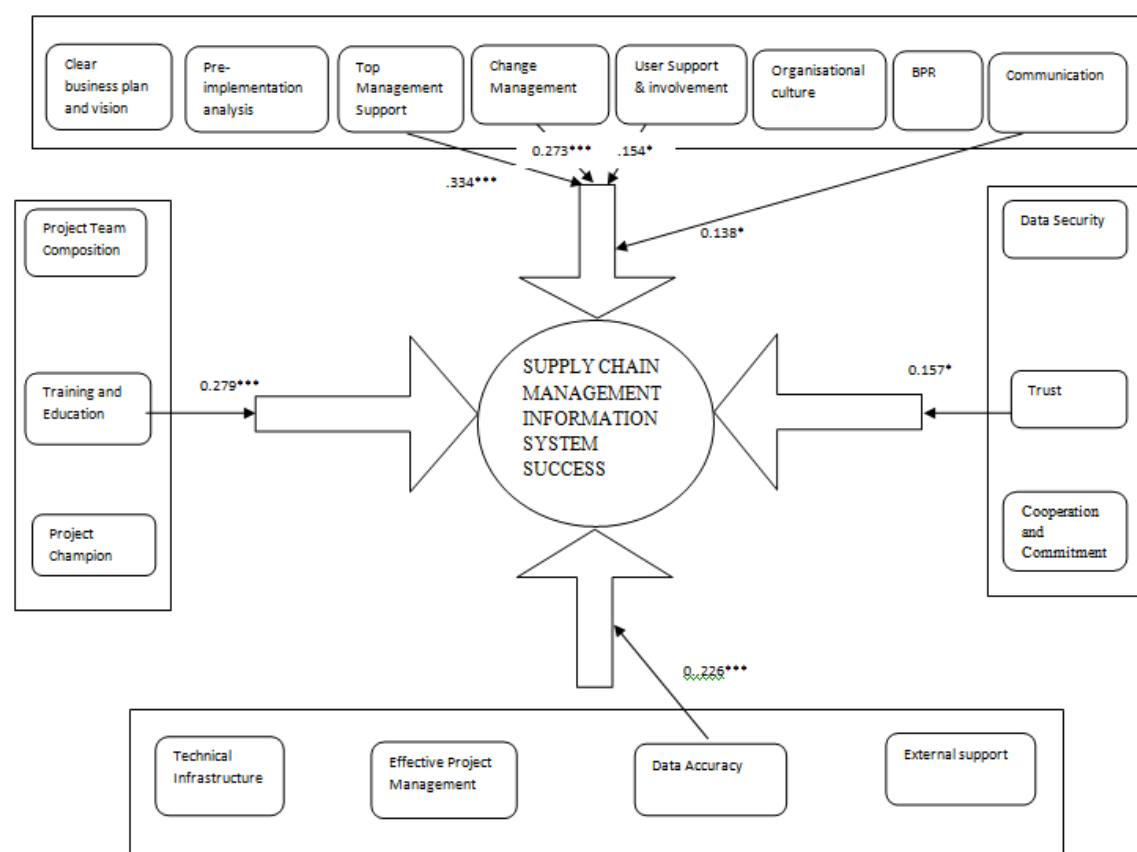
X=CSVs (Independent variable)

$$SI = b_0 + b_1TM + b_2TRA + b_3CM + b_4DA + b_5TRU + b_6US + b_7Co \dots\dots\dots (10)$$

Thus,

$$SI = -2.236 + 0.334TM + 0.279TRA + 0.273CM + 0.226DA + 0.157TRU + 0.154US + 0.138Co... \quad (11)$$

The equation shows the value of beta to be 0.216 for top management support and 0.228 for training and education, which is significant at $p < .05$. Further, Beta value for change management is 0.218, for data accuracy is 0.165, for trust is 0.129 and for communication is 0.120. The regression results are also shown in Figure 5.9. Thus, the above regression model confirms that these CSVs has a significant impact and in order to have a successful implementation of SCMIS, change management, top management support, trust, training , user support and involvement, data accuracy, and communication are most critical.



*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Figure 5.9: SCMIS success model with regression weights

The objective of this part of the research was to identify CSFs and propose a process model for the successful implementation of SCMIS in the automotive industry in India. The research identified 18 success factors from literature review and experts' opinions,

and proposes a model for the successful implementation, which can give the organization an edge over their competitors. Exploratory factor analysis was used to analyze the data collected through the questionnaire from the executives of two automotive companies, their suppliers and distributors in the Northern capital region of India. The hypotheses established were tested for significance using regression analysis. The findings of the research support the hypothesis that top management involvement has a positive impact on successful implementation of SCMIS (H2c). Many previous researches had also concluded that top management plays a significant role in the IS implementation (Ngai et al., 2004; Dwivedi et al., 2013). So, an increase in support of top management will lead to more successful SCMIS implementation. The top management is responsible to provide necessary financial support for the implementation of the system. They also play an important role in reducing resistance to change. Formal and honest communication from top management leads to reduction in the resistance to change. The management can facilitate team-spirit by empowering the employees and also create a conducive environment for the employees to accept change.

Next, the findings support the proposed hypothesis that training and knowledge transfer has a positive influence on the successful implementation of SCMIS (H2q). This is a similar finding to research conducted by Ngai et al. (2004); Nah et al. (2001). Accordingly, organization should arrange effective training for the end users of SCMIS for smooth implementation of the system. Effective training should be provided to the user so that he becomes comfortable with the system. A formal training program should be developed to meet the requirements of the users and proper allocation of resources for the training should be done. Huge funds are spent on the training of the users so the proper monitoring and evaluation should be done to ensure that the employees have received the appropriate training.

Research findings also support the proposed hypothesis that initiatives for smooth change management have a positive impact on SCMIS implementation success (H2d). This is supported by the findings of Nah et al. (2001); Shah et al. (2011) which supports the significance of change management for the successful implementation of IS. Thus, organization should manage the change at every level and highlight all successful change initiatives starting from the top. For most of the change initiatives, it is very important to

engage and motivate employees in the process towards change. Further, it should be implemented in a phased manner with enough time for the process of change to set in.

The findings of the research support the proposed hypothesis that accuracy of data during conversion has a positive impact (H2m), it is very important to realize that executive's don't underestimate the importance of accurate data. The research conducted by Soja (2006); Somers and Nelson (2004) also leads to the same conclusion. It is vital to have accurate data during conversion period; otherwise, the employees will continue to run parallel system which is not good for the implementation.

The proposed hypothesis that mutual trust among trading members has a positive impact on the implementation of SCMIS is supported by the findings of the research. The implementation of integrated e-SCM requires a mutual trust of a higher order among the partners since such systems integrate strategies' of the participating firms as well. This support for the hypothesis is in accordance with the results obtained by Sahay (2003); Nah et al. (2001) in their research.

Next, the study supported the proposed hypothesis that user involvement has a positive impact on the implementation of SCMIS (H2e), so increase in user involvement will lead to more successful implementation. The various studies conducted by the researchers (Francoise, 2009; Garcia-Sanchez, 2007) stresses on the significance of user involvement and support for a successful implementation of IS. The users who participate in the planning and implementing stage of the system are less likely to resist the change. Users' participation can improve information quality by knowing exactly the information requirements. The users should be asked to give their suggestions and feedback in the process of implementation, which will improve user understanding of the system. Thus it is very important to keep the users and other stakeholders motivated and actively involved.

Lastly, the findings support the proposed hypothesis that communication has a positive impact on SCMIS implementation success (H2h), so as organizations move towards integration with the outside world. Proper communication is imperative between the users, top management, project management team and leader. Proper communication should ensure that the users understand the need and the benefits associated with the adoption of the inter-organizational system. Communication should be two way as well as

open where employees are free to express themselves and give their feedback. The importance of communication was also highlighted in their studies by Ngai et al. (2004); Somers and Nelson (2004). Communication will reduce the uncertainty with the adoption of the information system and would diminish the concern about the threat of job, power or status.

5.4 DEVELOPMENT OF THE MODEL

The third objective of the study was to develop a model based on dimensions chosen in the first objective to evaluate the effectiveness of SCM systems.

5.4.1 Factor Analysis

For developing the model, firstly the study applied factor analysis using SPSS software to explore the latent factors for the successful implementation of SCMIS. Factor analysis method is used to extract latent dimensions for successful implementation of SCMIS. Factor analysis is a statistical technique which removes redundancy or duplication from a set of correlated variables and results in reducing data complexity to a few manageable factors. The analysis does not differentiate between dependent and independent variable but instead analyze all variables under investigation to extract the underlined factors. The factors so formed are relatively independent of one another.

Factor analysis is an ideal method for creating an easy understanding of the framework by identifying groups of related variables. Principal component analysis is generally considered the best method for practical purposes of data reduction. Factor analysis was carried out on all the 18 success factors using varimax rotation and principal component analysis. Bartlett's test of sphericity, was significant, ($\chi^2 (153) = 1154.60$, $p < 0.001$), indicating it was appropriate to use the factor analytic model on the set of data.

The examination of KMO measure of sampling adequacy indicated the strength of the relationship among the variables was high (KMO = 0.893), thus it was acceptable to proceed for the analysis. The result of the factor analysis is shown in Table 5.14.

Table 5.14: Final Exploratory Factor Solution—Varimax Rotation

ITEMS	LOADINGS			
	ORGANISATIONAL	TECHNICAL	HUMAN	INTERORG
TM	.752	.157	.315	.076
CM	.749	.162	.043	.132
CT	.745	-.196	.046	-.051
BPR	.738	.065	.130	.228
US	.706	.163	.284	.185
VB	.652	.311	.282	.215
Co	.612	.191	.205	.236
PRE	.537	.275	.282	.261
TI	-.047	.821	.179	-.079
PM	.219	.765	.117	.221
DA	.263	.741	.106	.094
ES	.071	.663	.137	.329
PC	.228	.130	.776	.138
TC	.163	.179	.774	.069
TRA	.323	.168	.724	.195
DS	.101	.148	-.052	.830
TRU	.268	.135	.261	.771
CC	.237	.108	.283	.702
Alpha	0.89	0.80	0.77	0.78
KMO sampling adequacy			0.893	
Bartlett's Test of Sphericity	Chi square			1154.60
	Degree of freedom			153

Four factors were extracted based on Eigen value greater than 1 and scree plot. The first factor had an Eigen value of 7.067, and it accounts for 39.26% of the variance in data.

Factor two had an Eigen value of 2.014 and accounted for 11.19% of the variance. The Eigen values for factors three and four were 1.359 and 1.170 respectively, together accounting for a further 14.05% of the total variance. Factor analysis grouped the 18 CSFs into four critical dimensions which were named as organizational, technical, human, and inter organizational.

5.4.2 Proposed Model and Evaluation

Next second order model which hypothesizes four first-order factors and one second-order factor was proposed as shown in Figure 5.10. A second order factor model of implementation process success consists of four first-order factors (organizational, technical, human, and inter-organizational) measured by 18 items and one second order factor which was interpreted as process success.

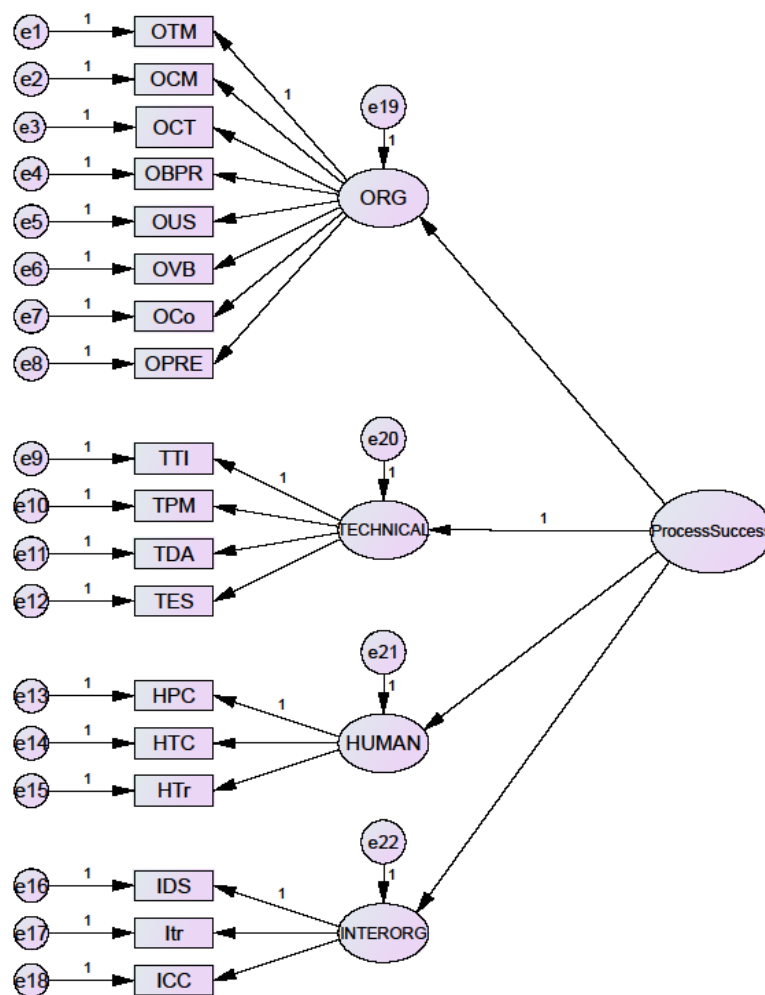


Figure 5.10: Model 2 Four First-order Factors One Second-order Factor

Model Evaluation Criteria: Goodness of Fit

The model fitting process involves determining the goodness-of fit between the proposed model and the sample data. To evaluate the fit of CFA model various goodness of fit (GOF) indices are employed. Absolute fit indices included in the study are the Chi-Square test, RMSEA, GFI, AGFI and RMR. The model was modified to improve overall fitness and the refinement was done according to the modification indices provided by the AMOSS software. Thus final model shows reasonable model-data fit, as indicated by absolute indexes (GFI, AGFI, and RMSR)

Table 5.15: Goodness of fit (GOF) indices for initial and final framework

Evaluation Index	GOF Indices	Threshold	Initial model	Final model
Absolute fit index	Pearson chi-square (χ^2)	The least	194.038	130.763
	Degrees of freedom		131	114
	CMIN/DF	<3 good <5 sometimes permissible	1.481	1.147
	P value	>0.05	0.000	0.135
	RMR value	<0.05	0.015	0.012
	RMSEA value	<0.05	0.059	0.033
	GFI value	>0.9	0.868	0.903
Relative fit index	NFI value	>0.9	0.840	0.884
	IFI value	>0.9	0.942	0.983
	TLI value	>0.9	0.931	0.980
	CFI value	>0.9	0.941	0.983

The results shown in Table 5.15 provide a quick overview of the model fit, which includes the value of χ^2 (130.763), together with its degrees of freedom (114). A low value of χ^2 supports the proposed theoretical model being tested. Although χ^2 seems good but the value of χ^2/DOF is a better indicator as χ^2 is sensitive to sample size. The recommended value for this GOF indices is less than 5 and for the present model the value of χ^2/DOF is 1.147 ($\chi^2= 130.763$ and $\text{DOF}=114$), suggesting acceptable model fit. Values of other model fit measures are 0.903 for Goodness of Fit index (GFI), as against

the threshold value of above 0.90 , Comparative Fit index (CFI) has a value of 0.983, incremental fit index (IFI) and Tucker Lewis Index (TLI) are 0.983, 0.980 respectively as against the threshold value of above 0.90.

The value of RMSEA is 0.033 and RMR has a value of .012 which is well below the recommended limit of 0.05. Hence the model shows an overall acceptable fit.

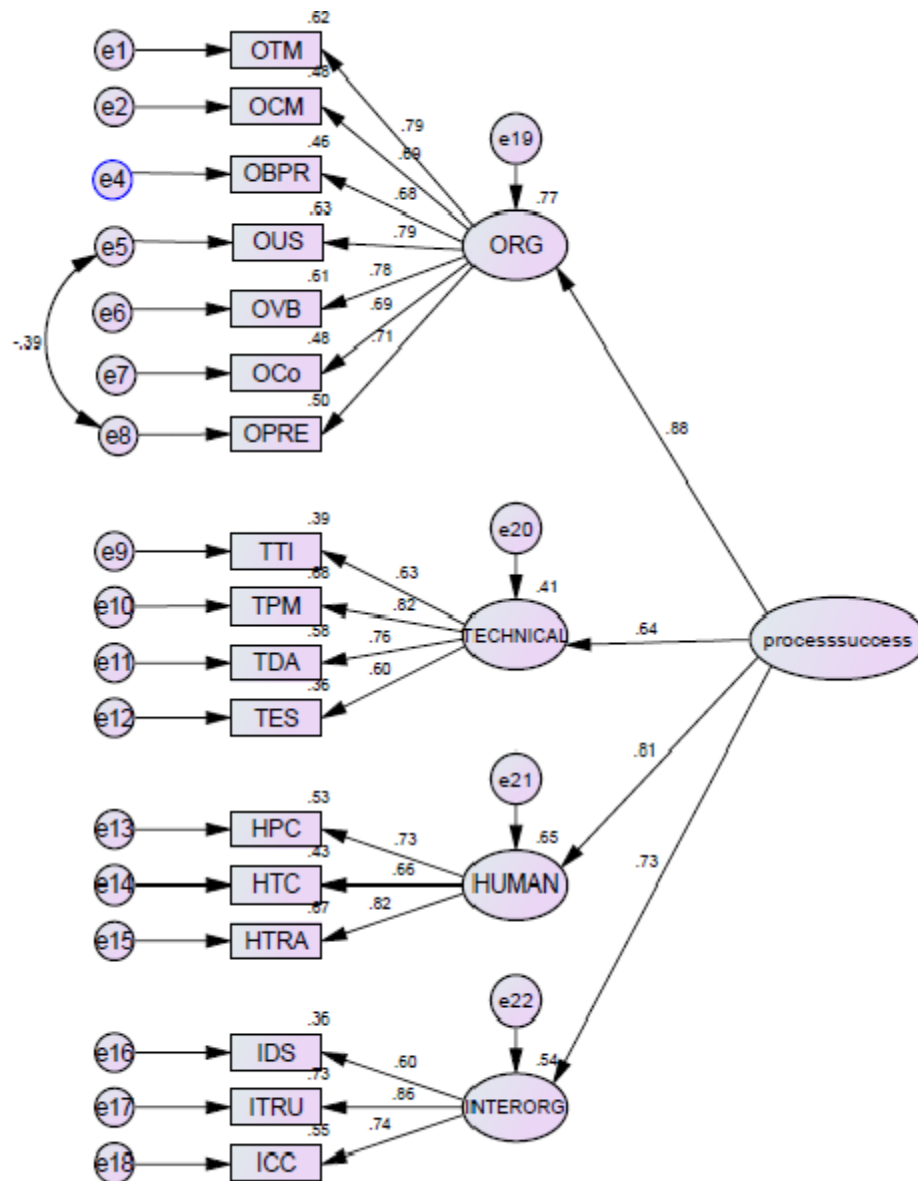


Figure 5.11: Model 2 One Second-order Factor & Four First-order Factors

Finally Table 5.16 presents the standardized regression estimates for the model. The values are significant at $p < .001$

Table 5.16: Standardized regression weights for the model

			Estimate
ORG	<---	Process success	.878
TECHNICAL	<---	Process success	.641
HUMAN	<---	Process success	.809
INTERORG	<---	Process success	.732
TM	<---	ORG	.787
CM	<---	ORG	.690
BPR	<---	ORG	.677
US	<---	ORG	.792
VB	<---	ORG	.784
Co	<---	ORG	.694
PRE	<---	ORG	.709
TI	<---	TECHNICAL	.625
PM	<---	TECHNICAL	.823
DA	<---	TECHNICAL	.758
ES	<---	TECHNICAL	.602
PC	<---	HUMAN	.726
TC	<---	HUMAN	.655
TRA	<---	HUMAN	.821
DS	<---	INTERORG	.601
TRU	<---	INTERORG	.856
CC	<---	INTERORG	.740

Values are significant at $p < 0.001$

5.5. VALIDATING THE PROPOSED MODEL IN SELECTED AUTOMOTIVE COMPANIES

This section deals with the last objective of the study i.e. to test and apply the proposed model in selected automotive companies.

Confirmatory factor analysis was conducted through software AMOS 18 to confirm the extracted factor structure through EFA. The testing of the model was done through model specification, data specification, and the calculation of parameter estimates within the framework of AMOS graphics. The framework tested is shown in Figure 5.12.

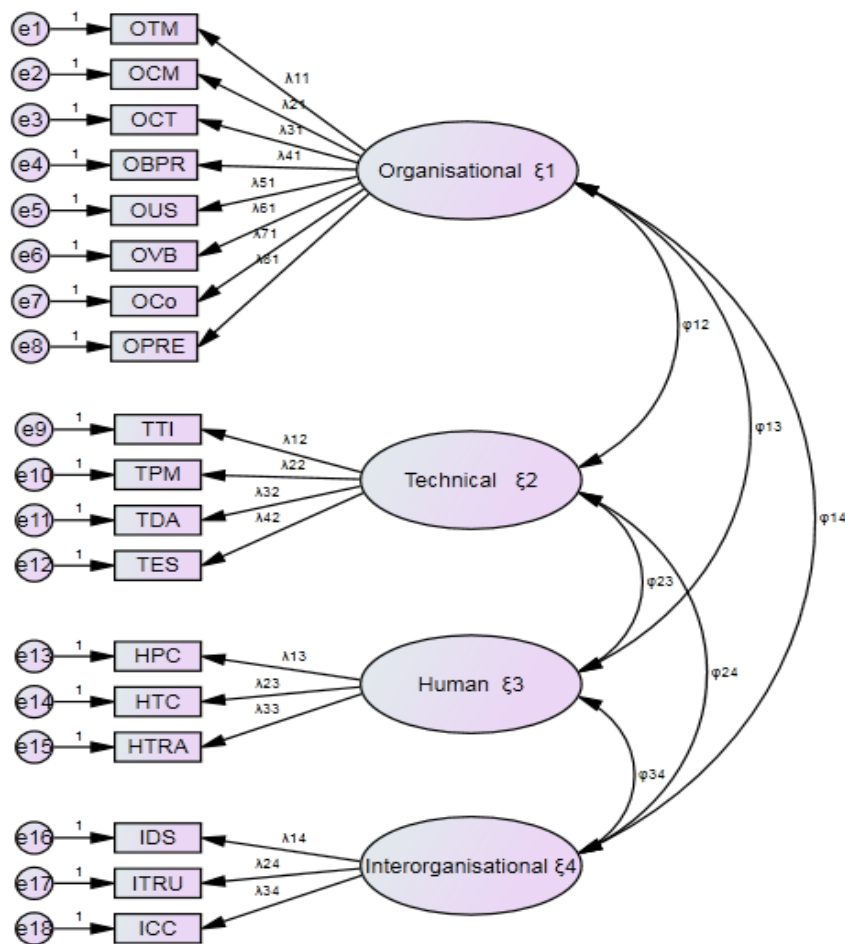


Figure 5.12: Framework for CFA

The framework was tested for validity and reliability. The discriminant and convergent validity as well as reliability were checked using Maximum Shared Variance (MSV), Composite Reliability (CR), Average Variance Extracted (AVE) and Average Shared Variance (ASV) measures. The values complied with the threshold values, as shown in the Table 5.17 and 5.18, hence, convergent and discriminant validity was established.

Table 5.17: Composite reliability, Convergent and Discriminant validity

Construct	Items	Factor loading	Composite reliability (CR)	Average variance extracted (AVE)	Maximum Shared Variance (MSV)	Average Shared Variance (ASV)
Organizational	TM	0.79	0.891	0.540	0.511	0.410
	CM	0.69				
	BPR	0.68				
	US	0.79				
	VB	0.78				
	Co	0.69				
	PRE	0.71				
Technical	TI	0.62	0.798	0.502	0.305	0.273
	PM	0.82				
	DA	0.76				
	ES	0.60				
Human	PC	0.73	0.780	0.544	0.511	0.372
	TC	0.66				
	TRA	0.82				
Inter-organizational	DS	0.60	0.781	0.547	0.415	0.330
	TRU	0.86				
	CC	0.74				

Table 5.18 Factor matrix showing discriminant validity

	Organizational	Technical	Human	Interorg
Organizational	0.735			
Technical	0.552	0.708		
Human	0.715	0.522	0.737	
Inter-organizational	0.644	0.491	0.577	0.740

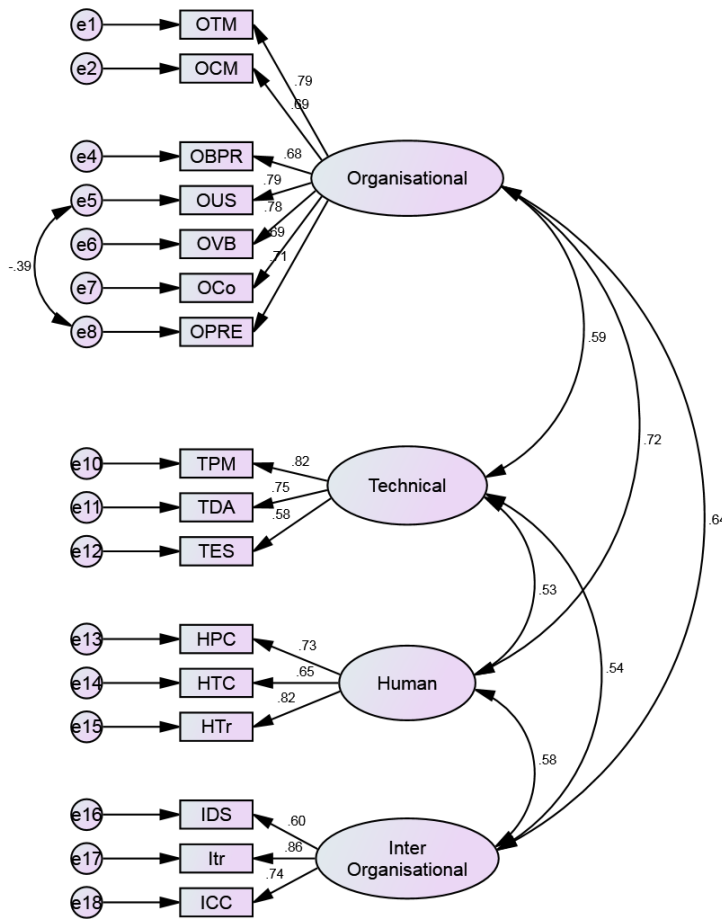


Figure 5.13 : Final SEM framework

The study concludes that apart from the technical there are other dimensions like organizational, inter organizational, human dimension and their factors that needs to be considered for successfully implementing SCMIS. Thus these systems should not be viewed as an IT implementation but instead as an organizational revolution which would transform the organization processes.

5.6 TO APPLY THE PROPOSED MODEL IN THE SELECTED AUTOMOTIVE COMPANIES

To apply the proposed model in the selected automotive companies multiple regression was used. The impact of four latent factors extracted through factor analysis in Section 5.4.1 on the success of the implementation process of SCMIS was calculated. The total score obtained from the sample consumers about the perception of the implementation success of the system is tested against all the four latent variables.

The equation tested is:

$$y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \dots\dots\dots (12)$$

where

y=Perceived successful implementation of the system (SI) (Dependent variable) and

X₁ – Latent variable 1 - Organizational

X₂ – Latent variable 2 -Technical

X₃ – Latent variable 3 -Human

X₄ – Latent variable 4 -Inter- organizational

5.6.1 Research Model

The proposed model was applied in the selected automotive companies. The model as given in Fig 5.14 shows that the latent factors would lead to successful implementation of the information system.

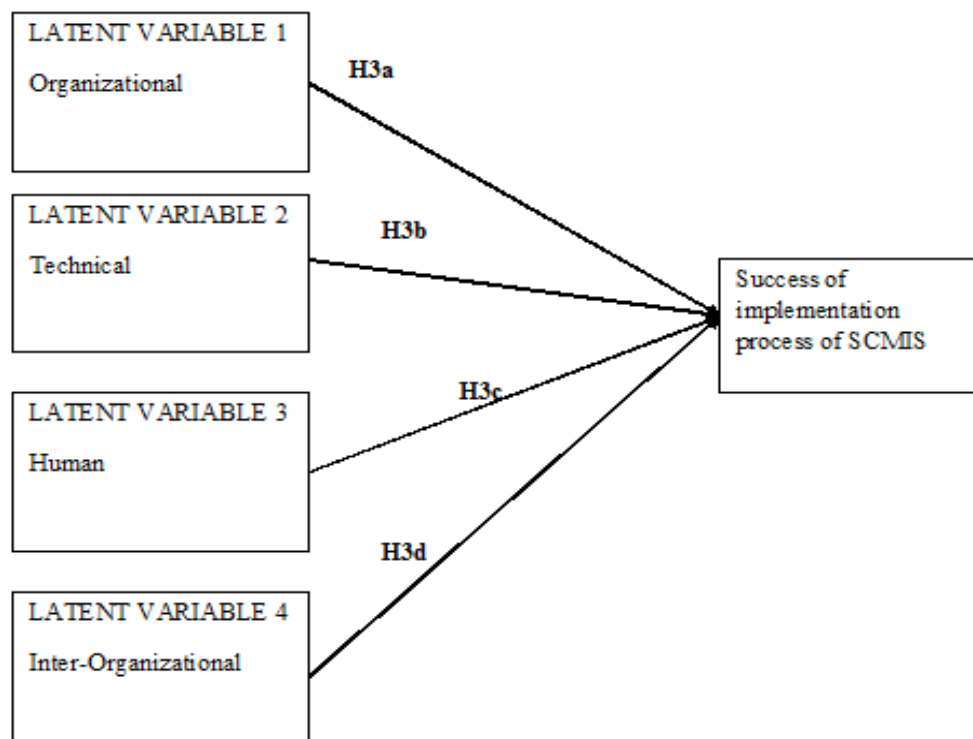


Figure 5.14: Research model

Hypotheses and testing using regression:

The following hypotheses were formulated based on the above addressed issues:

- H3a: Organizational factor has a positive impact on SCMIS implementation success.
- H3b: Technical factor has a positive impact on SCMIS implementation success.
- H3c: Human factor has a positive impact on SCMIS implementation success.
- H3d: Inter-organizational factor has a positive impact on SCMIS implementation success.

All the four latent factors were entered and step wise regression was performed. Table 5.19 shows the model summary; the predictors included in the model were Organizational, technical, human and inter-organizational. The value of R which is the square root of R-Squared is 0.845, which is more than the acceptable value of 0.6. Further, the table reveals the value of coefficient of determination R^2 as 0.714 which means that 71.4% of the total variation in the dependent variable is explained by the independent factors. The value of Adjusted R Square is 0.706 and the difference between R^2 and adjusted R^2 is less than 0.5 which indicates good model fit. The value of Std. Error of the Estimate is 0.292.

Table 5.19: Regression Model Summary: Impact of Latent variables on the successful implementation process of SCMIS.

MODEL	R	R ²	ADJUSTED R ²	Std Error Of Estimation	
1	.845	.714	.706	.292	
ANOVA	Sum Of Squares	Df	Mean Square	F	Significance
Regression	28.109	4	7.027	82.465	.000
Residual	11.248	132	.085		
Total	39.358	136			
Coefficients					
Variable	B	Standardized Coefficients	t- value	Significant Level	
(Constant)	4.109		164.774	.000***	
Organizational	0.338	0.629	13.512	.000***	
Human	0.195	0.362	7.786	.000***	
Technical	0.184	0.341	7.337	.000***	
Interorganizational	0.143	0.267	5.730	.000***	
Independent variable: Latent success factors					
Dependent Variable: Implementation success of SCMIS					

*** p<0.001

Table 5.19 indicates analysis of variance in which the total variance with value 39.358 is partitioned into the variance with value 28.109 which can be explained by the independent variables and the value of 11.248 which is not explained by the independent variables. The significance value refers to the test of the entire model (i.e. the entire collection of independent variables) as a whole. The general form of the hypothesis test is:

H₀: None of the independent variables are significant predictors of the dependent variable.

Thus the table shows $F(4,132) = 82.465$, $p < .001$ and therefore null hypothesis is rejected and which proves the alternative hypothesis that at least one independent factor is a significant predictor of the dependent variable.

According to the results obtained through regression analysis for the successful implementation of SCMIS, all the latent factors have significant impact at 5% or higher level as shown in Table 5.19.

Table 5.19 shows the results of regression coefficients. The first variable (constant) represents constant called as 'Y' intercept which is the predicted value of a dependent variable when all other variables are 0. The t-values of all the variables in the model are statistically significant as their sig. values lie below 0.05, therefore it can be safely concluded that the analysis predicts fitness of the model.

Thus the following regression equation was derived based on the regression output:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \dots\dots\dots (13)$$

Where,

Y=Perceived successful implementation of the system (SI) (Dependent variable)

X=latent factors (Independent variable)

SI= $b_0 + b_1\text{Organisational} + b_2\text{Human} + b_3\text{Technical} + b_4\text{Interorganisational}$

Thus

$$SI = 4.109 + 0.338\text{Organisational} + 0.195\text{Human} + 0.184\text{Techincal} + 0.143\text{Interorg} \dots\dots (14)$$

The equation shows the value of beta to be 0.338 for organizational factor and 0.195 for human which is significant at $p < .05$. Further Beta values for technical and inter-organizational are 0.184 and 0.143 respectively. The regression results are shown in following figure.

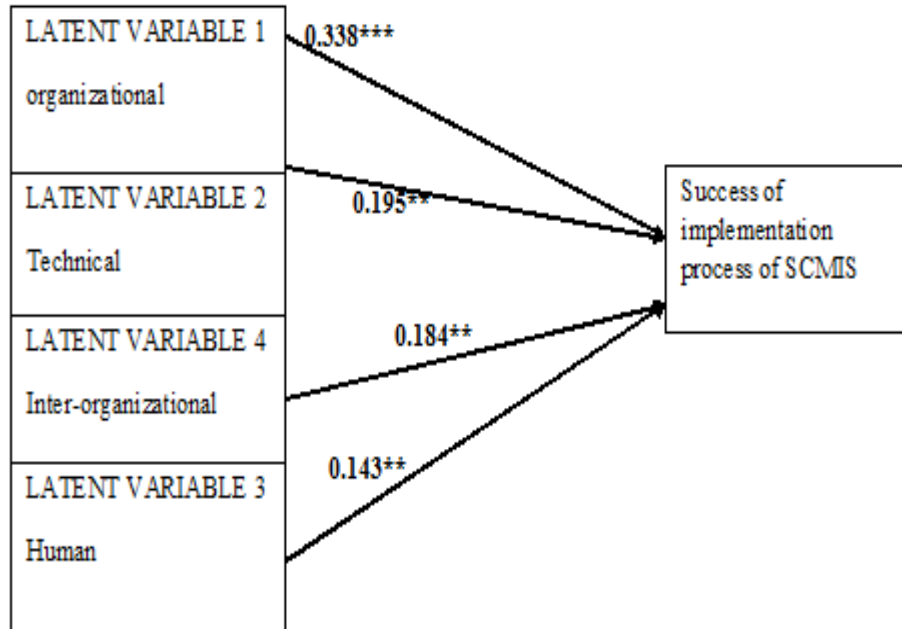


Figure 5.15: Results of regression

The table 5.19 shows that organizational factors which consist of top management support, change management, BPR, organizational culture, communication, pre implementation analysis, user support and involvement and Clear Business plan and vision and are significant for the successful implementation of SCMIS. This was followed by human factors which consist of project champion, training to the users and project team constituents.

Therefore, as has already been established from review of literature that SCMIS implementation is not only a technological exercise but an "organizational revolution."

5.7 DEMOGRAPHIC PROFILE OF THE RESPONDENTS FOR PROCESS DIMENSION

Although not a major objective of the study, demographic factors were analyzed to check if there were any significant differences in the perception of the respondents regarding critical latent success factors.

The present section describes the demographic profile of the survey respondents for analyzing critical success factors. The descriptive statistics of the respondents' demographic characteristics is presented in Table 5.20. The demographic data pertaining to the company, gender, total work experience, and functional area was gathered using the

questionnaire. Table 5.20 shows 47.45% of respondents are from Maruti Suzuki India Limited and 52.55% from Honda Cars India limited. The majority of the respondents were males as revealed by Table 5.20.

Table5.20: Demographics profile of Respondents for process dimension

Organization	Number of respondents	Percentage of respondents	Cumulative percentage
Maruti Suzuki India Limited, their suppliers and distributors	65	47.45	47.45
Honda cars India Limited, their suppliers and distributors	72	52.55	100.00
Gender			
Male	109	79.56	79.56
Female	28	20.44	100.00
Total work experience			
Less than 5 years	38	27.74	27.74
5-10 years	57	41.61	69.35
More than 10 years	42	30.65	100.00
Department			
Production	17	12.41	12.41
Purchasing	12	08.75	21.16
Supply chain Management	63	45.98	67.14
IT	29	21.17	88.31
Finance	02	01.46	89.77
Marketing	14	10.23	100.00

Table 5.20 shows the frequencies for the respondents' total work experience. 41.61% of total respondents had working experience of 5 -10 years while 30.65% respondents had working experience of more than 10 years. Further Table 5.20 also presents information pertaining to the functional area of the respondents'. The maximum respondents (N = 63) work in the supply chain management department and represent 45.98% of the sample. IT (N =29) is the next highest functional area reported and accounts for 21.17% of the

sample. The table further indicates that around 10% each of the total respondents worked in Production, Marketing, and Purchase Departments. The record shows that the respondent were well educated and well experienced. Further they were aware about the supply chain management information system and its implementation. The respondents were therefore well informed to fill in the questionnaire.

Analysis on Demographic Characteristics of success factors

The key aim of the section is to analyze the social and demographic aspects of the respondents influencing their perception of the CSFs for the implementation of SCMIS. Therefore it was examined whether there exists any discrepancy in deciding the criticality of the success factors among different groups based on total work experience and the organization to which the respondent belongs. The analysis was performed using independent t-test and one way ANOVA for the selected demographic factors (organization and work experience).

Independent t-test – for the Organization Respondents are Working For

Problem 1: Do significant differences in the perceptions of the identified CSFs exist in dependence to the organization of the respondent

Hypothesis H4a: There exists a significant difference in the perception of respondents belonging to Maruti and HCIL for the identified CSFs.

Table 5.21: T-Test and independent sample test for CSFs – organization of the respondent

CSFs	Average values of responses from Maruti	Average values of responses from HCIL	T-test	Sig. (Significance)
Organizational factors	4.102	4.036	1.176	0.242
Human factors	4.059	4.082	-0.356	0.723
Technical factors	3.883	3.948	-1.099	0.274
Inter organizational factors	3.976	4.079	-1.641	0.103

According to the result obtained from SPSS as shown in Table 5.21 we infer that respondents from different organizations do not have a significant difference in

perception of the factors namely organizational, human, technical and inter-organizational. Thus, we can assume that the identified CSFs are relatively homogeneous across the companies.

ANOVA for Analyzing the Influence of Total Work Experience

While analyzing the influence of total work experience, respondents could select from three possible options: experience up to 5 years; 5-10 years, and above 10 years.

Problem 2: Do significant differences in the perceptions of the identified CSFs exist in dependence of the total work experience of the respondents

Hypothesis H4b: There exists a significant difference in the perception of respondents depending on the total work experience.

Table 5.22: Means and standard deviations for dependent measures by work experience

Dependent measures	Work experience	Mean	Std. deviation	N
Organizational factors	Less than 5 years	4.137	0.356	38
	5-10 years	4.105	0.283	57
	More than 10 years	3.953	0.339	42
	Total	4.067	0.329	137
Human factors	Less than 5 years	4.111	0.401	38
	5-10 years	4.098	0.378	57
	More than 10 years	3.999	0.374	42
	Total	4.071	0.384	137
Technical factors	Less than 5 years	3.935	0.342	38
	5-10 years	3.949	0.360	57
	More than 10 years	3.858	0.333	42
	Total	3.917	0.347	137
Inter organizational factors	Less than 5 years	4.056	0.371	38
	5-10 years	4.043	0.384	57
	More than 10 years	3.991	0.355	42
	Total	4.030	0.370	137

Table 5.22 shows the means and standard deviation for organizational, human, technical and inter-organizational factors based on different work experience of the respondents.

The varying work experience has been divided into three categories of less than 5 years, 5-10 years, and more than 10 years. The maximum number of respondents belongs to the category of 5-10 years of total work experience. To compare differences in the perceptions of the identified CSFs in dependence to the total work experience a one way ANOVA was conducted.

Table 5.23: ANOVA results for total work experience

		Sum of Squares	df	Mean Square	F	Sig.
Organizational factors	Between Groups	.816	2	.408	3.934	.022*
	Within Groups	13.897	134	.104		
	Total	14.713	136			
Human factors	Between Groups	.314	2	.157	1.068	.347
	Within Groups	19.724	134	.147		
	Total	20.039	136			
Technical factors	Between Groups	.220	2	.110	.911	.405
	Within Groups	16.164	134	.121		
	Total	16.384	136			
Inter-org factors	Between Groups	.098	2	.049	.353	.703
	Within Groups	18.521	134	.138		
	Total	18.618	136			

* $p < 0.05$

According to the result shown in Table 5.23 obtained from SPSS we infer that experience of the respondent carries a significant difference in perception of organizational factors identified for implementation of SCMIS at $p < 0.05$ for the three conditions ($F(2,134)=3.94$, $p=0.022$). While respondents do not have a significant difference in perception of the other factors namely human, technical and inter-organizational. Further post hoc test was conducted to compare each condition with all other conditions to report which one group is significantly different from others and Tukey post hoc test was selected. Post hoc comparisons using Tukey test indicated that the mean score for the respondents with work experience less than 5 years ($M=4.137, SD=0.356$) was significantly different than the ones with experience more than 10 years ($M=3.953, SD=0.339$). However, the respondents with 5-10 years work experience ($M=4.105, SD=0.283$) did not significantly differ from respondents with less than 5 years and more than 10 years work experience.

Specifically, the results suggest that respondents with less than 5 years of work experience give more importance to organizational factors for the successful implementation of SCMIS than the ones with more than 10 years of work experience.

5.8 CONCLUDING REMARKS

In this chapter the analysis of the data collected based on the frame of reference of this thesis is presented. The chapter analyses both the product-based review and process-based evaluation of SCMIS. The chapter also analyses and discusses the hindrance factors to the successful implementation of SCMIS. The chapter includes the model development, validating, and applying of the proposed model in selected automotive companies. The chapter concludes by analyzing the demographic influences on the perceptions of the identified CSFs.

CHAPTER- VI

CONCLUSION

The competition no longer exists between the companies, but it is between supply chains, this summarises the importance of supply chain in today's global competitive environment. The firm must be competitive enough to survive and technology is being used as a competitive tool in the form of implementation of SCMIS. The integration of supply chain is being embraced by the business firms in order to reduce cost and fulfill the market demand efficiently and effectively.

The implementation of highly integrated supply chain is a challenging task, as it requires huge amount of resources, cooperation from suppliers/partners, commitment from top management, organisational change, and technical infrastructure. There is a strong evidence in the literature that implementation of SCMIS projects were either not completed on time or didn't bring about the planned effects and even exceeded their estimated costs.

Therefore, the primary objective of the research is to identify and analyse product and process dimension so as to provide a guideline which helps practitioners for the successful implementation of SCMIS. The chapter deliberates on the experiences and observations that were gathered in the research, and reports the results of the study undertaken. Section 6.1 provides the major findings of the study, section 6.2 covers responses to the research questions by revisiting the objectives, and section 6.3 provides the implications of the study for practitioners, industry and academics. The limitations are reported in section 6.4, and the chapter ends with suggestions for future study.

6.1 MAJOR FINDINGS OF THE RESEARCH

The major findings are summarized below:

- Success of the information system can be viewed from two dimensions – product success and process success.
- For evaluation of the product success, six factors are considered: quality of the system, quality of the information, perceived importance of the system, satisfaction to the user, benefits to the individual and the organization.

- The analysis shows information quality positively contributes to user satisfaction. The quality of the information can be increased by the system in the form of relevance, conciseness/precision, timeliness, usefulness, clarity, and understandable information which in turn leads to an increase in user satisfaction.
- System quality includes ease of use, ease to learn, convenience of access, features as per the requirement, and the integration with the legacy systems; contributes positively to user satisfaction.
- User perception about the system importance also forms one of the antecedents of user satisfaction. Therefore, the study shows higher the perceived usefulness, importance, and self relevance to the user higher is the satisfaction user derives from SCMIS.
- Analysis also suggests that user satisfaction augments individual benefits; measured in the form of improvement in job performance, productivity, saving time in doing a job, and helping in decision making. The individual benefits in turn lead to enhancement in organizational benefits, better forecasting, decline in inventory level, reduction of lead time in production, better coordination with suppliers, and cost saving
- The product success model highlights the system quality, quality in information, and perceived importance of the system, resulting in 88% of the user satisfaction. The model explains that 66% of the organizational benefits can be derived from the successful implementation of the SCMIS system.
- Human barriers formed the major hindrance to the successful implementation of SCMIS. Therefore, the technical problems, howsoever large they may be, were not perceived as the main cause for unsuccessful implementation of SCMIS projects.
- Human barriers included lack of users participation, resistance to change, lack of sufficient training to end users, lack of employees motivation, ineffective communication with the users, and reluctance on the part of users to employ the system due to lack of understanding of the benefits that could be derived from the system.
- Among the human barriers, the most important was users' resistance to change.

- To prioritize the factors, weighted mean was calculated and the factor of Project champion had the highest weighted mean of 4.14. Other factors among the top five included user involvement (mean 4.13 and SD 0.46); top management support (mean 4.12 and SD 0.348), pre-implementation analysis (mean 4.12 and SD 0.471) and change management (mean 4.10 SD 0.429).
- The top management support trust, change management, user involvement, effective communication, data accuracy, training and education had a positive impact on SCMIS implementation success.
- The study backs the hypothesis that top management support had a positive influence on successful implementation of SCMIS. Thus, an increase in support of top management assists successful SCMIS implementation. The top management should provide the necessary financial support for the implementation of the system. The top management also plays an important role in reducing resistance to change. Formal and honest communication from the top management leads to reduction in the resistance to change. The management can facilitate team spirit by empowering the employees and this helps in creating a conducive environment for the employees to accept change.
- Next, the study supported the hypothesis that user involvement and support had a positive influence on successful implementation of SCMIS. This underscores that an increase in user involvement will direct successful implementation. The users who participate in the planning and implementing stage of the system are less likely to resist the change. Users' participation can improve information quality by knowing exactly the information requirements. The users should be asked to give their suggestions and feedback in the implementation process to improve user understanding of the system. Thus, it is imperative to keep the users and other stakeholders motivated and actively involved.
- The results from the study support the hypothesis that trust between trading partners had a positive impact on SCMIS implementation success. The need for mutual trust gets augmented in the case of integrated e-supply chain implementation.
- The next hypothesis that training and knowledge transfer had a positive impact on SCMIS implementation success is also supported by the results. This highlights that organization should arrange effective training for the end users of SCMIS for

smooth implementation of the system. A formal training program should be developed so that the users get effective training and becomes comfortable in using the system. It is imperative that proper allocation of resources for training should be done. In the ERP implementation one of the modules that require huge resources is imparting of training to the users therefore proper monitoring and evaluation should be done so as to ensure that the employees have received the appropriate, suitable and correct training.

- The findings also support the hypothesis that change management initiatives had a positive impact on SCMIS implementation success. These results indicate that organization should manage the change at every level and also highlights that all successful change initiatives start from the top. For most of the change initiatives it is very important to engage and motivate employees in the process towards change. Further, there is a need to implement in a phased manner with enough time for the process of change to set in.
- The study supports the hypothesis that data accuracy during conversion had a positive influence on the successful implementation of SCMIS. It is very important to realize that executives don't underestimate the importance of accurate data. For the system to function suitably accurate data is required. It is vital to have accurate data during conversion period otherwise the employees will continue to run parallel system which is not good for the implementation.
- Communication having a positive impact on SCMIS implementation success is also supported. For organizations to integrate with the outside world proper communication among the users, top management, project management team and leader is essential. Proper communication should ensure that the users understand the need and the benefits associated with the adoption of the inter-organizational system. Communication should be open two-way where employees are free to express themselves and give their feedback. Communication will reduce the uncertainty with the adoption of the information system and would diminish the concern about the threat of job, power or status.
- Four latent factors were extracted from the 18 success factors for the successful implementation of SCMIS. The four latent factors extracted were organizational, technical, human, and inter organizational.

- Organizational factor constituted of top management support, change management, BPR, communication, pre-implementation analysis, user support and involvement, Clear Business plan and vision and organizational culture are significant factors for implementing a successful system. This was followed by human factor represented by project champion, training and education for the users and project team constituents.

6.2 REVISITING THE OBJECTIVES

It is essential to know and understand whether the study is able to fulfill the objectives for which it was undertaken.

The first objective of the present research was:

O1: To identify various dimensions of SCM systems in selected organizations in the automotive sector.

Review of literature reveals the success of the information system can be viewed from two dimensions – product success and process evaluation.

- Product success measured the value the delivered system returns to the organisation. The focus in this dimension was on the product of SCMIS.
- Process evaluation focused on the processes which were followed in implementing the system.

For evaluation of the product success dimension, six factors were chosen based on Delone and Mclean model (1992, 2003). The factors chosen for the present study were: system quality, quality of the information, user satisfaction, benefits to the individual, perceived importance of the system and benefits to the organization. For designing a model SEM, AMOS18 were employed to test the hypotheses formulated. Table 6.1 shows the result of the hypotheses tested for this part of the research.

Table 6.1: Results of hypotheses testing for product dimension

	Hypotheses	Result
H _{1a}	User satisfaction is positively influenced by quality of information provided by the system	Accept
H _{1b}	User satisfaction is positively influenced by system quality	Accept
H _{1c}	Perceived importance of the system will positively contribute to user satisfaction	Accept
H _{1d}	User satisfaction leads to more individual benefits	Accept
H _{1e}	Individual benefits leads to more organisational benefits	Accept

Thus, it was concluded that system quality, quality of the information from the system and usefulness of the system to the users are antecedents to user satisfaction. Further user satisfaction will lead to benefits to the individual as well as to the organization.

The second objective of the research was:

O2: To analyse success and hindrance factors for SCM systems.

For the analysis of hindrance factors they were categorized into six main barriers: a) Financial barriers b) Human Barriers c) Organizational Barriers d) Project Management barriers e) Inter-organizational barriers and f) Technical barriers. Each impediment was analyzed on multiple dimensions and severity of each barrier was calculated. To measure the severity of the barriers, an un-weighted summated scale was used and was equal to the sum of all the responses of the dimensions for the related barrier by the respondent. For the comparison and ranking for each of the barrier severity was calculated using the formula given in the study by Chaturvedi & Goyal (2012).

Severity = $100 \left\{ \frac{(\text{Mean score} - \text{minimum possible score})}{(\text{Maximum possible score} - \text{minimum possible score})} \right\}$

Higher severity means high barrier to the successful implementation of SCMIS; therefore, it was given the highest ranking.

The Table 5.10 shows the severity score of organizational barrier as 71.83%, financial barrier has a score of 70.96%, technical barrier has 69.00% and human barrier has a

severity score of 77.34%. Further the highest rank with severity score of 77.34% was that of human barriers which formed the major hindrance to the successful implementation of SCMIS. The second rank with severity score of 71.83% was organizational barriers and which formed the next major hindrance to the implementation process.

Second objective also included analysis of critical success factors which helped in determining those factors that must go right to have a successful implementation of a project and succeed in achieving the requisite goals and objectives. For effectiveness of the process used in implementing SCMIS, eighteen success factors were identified from review of literature and discussion with the experts. The success factors considered as the contributors to SCMIS implementation effectiveness for the present study were:

1) Clear Business plan and vision, 2) Pre implementation analysis, 3) Top management support, 4) Change management, 5) User involvement, 6) Business process reengineering, 7) Communication, 8) Technical infrastructure, 9) Effective project management, 10) Project team composition, 11) Project champion, 12) Data accuracy and integrity, 13) External support, 14) Data security, 15) Trust, 16) Cooperation and Commitment of Trading Partners, 17) Organizational culture, and 18) Education and training .

To find the influence and the factors critical for successful implementing SCMIS a model was proposed as given in Figure 5.8. A regression analysis was used for testing of the established hypotheses. For the analysis, the dependent variable considered was perceived successful implementation of the system and the 18 success factors were entered as independent variables. Table 6.2 shows the results of the tested hypotheses.

Table 6.2: Results of hypotheses testing for process dimension based on CSFs

	Hypotheses	Result
H _{2a}	Clear Business Plan has a positive impact on SCMIS implementation success.	Reject
H _{2b}	Pre-implementation analysis has a positive impact on SCMIS implementation success.	Reject
H _{2c}	Top management support has a positive impact on SCMIS implementation success.	Accept
H _{2d}	Change Management initiatives have a positive impact on SCMIS implementation success.	Accept
H _{2e}	Involving user has a positive impact on SCMIS implementation success.	Accept
H _{2f}	Organizational culture has a positive impact on SCMIS implementation success.	Reject
H _{2g}	BPR has a positive impact on SCMIS implementation success.	Reject
H _{2h}	Effective communication has a positive impact on SCMIS implementation success.	Accept
H _{2i}	Data security has a positive impact on SCMIS implementation success.	Reject
H _{2j}	Trust among trading members has a positive impact on SCMIS implementation success	Accept
H _{2k}	Cooperation And Commitment of Trading Partners has a positive impact on SCMIS implementation success.	Reject
H _{2l}	External support has a positive impact on SCMIS implementation success.	Reject
H _{2m}	Data accuracy during conversion has a positive impact on SCMIS implementation success.	Accept
H _{2n}	Effective project management has a positive impact on SCMIS implementation success.	Reject
H _{2o}	Technical infrastructure has a positive impact on SCMIS implementation success.	Reject
H _{2p}	Project champion has a positive impact on SCMIS implementation success.	Reject
H _{2q}	Training and education has a positive impact on SCMIS implementation success.	Accept
H _{2r}	Project team composition has a positive impact on SCMIS implementation success.	Reject

Hypotheses 2c, 2d, 2e, 2h, 2j, 2m and 2q were accepted thus showed top management support, change management, user involvement, effective communication, trust, data accuracy, training and education had a positive influence on the successful implementation of SCMIS.

The third objective of the study was:

O3: To develop a model based on dimensions chosen in the first objective to evaluate the effectiveness of SCM systems.

For developing the model, the study applied factor analysis using SPSS software to explore the latent factors for the successful SCMIS implementation. Factor analysis grouped the 18 success factors into four critical dimensions which were named as organizational, technical, human, and inter-organizational as shown in Table 5.14. Four factors were extracted based on Eigen value greater than 1 and scree plot. The first factor accounting for 39.26% of the variance in the data had an Eigen value of 7.067. Factor two had an Eigen value of 2.014 and accounted for further 11.19% of the variance. The Eigen values for factors three and four were 1.359 and 1.170, respectively, together accounting for a further 14.05% of the total variance.

The model was developed for the process success of implementing SCMIS. Model as shown in Figure 5.10 hypothesizes four factors of first-order and one factor of second-order. A second order factor model of process success consists of four first-order dimensions (organizational, technical, human, and inter-organizational) measured by 18 items is proposed. The second order factor is interpreted as process success.

To evaluate the model various fit indices are used .Absolute fit indices included in the study are the Chi-Square test, RMSEA, GFI, AGFI and RMR. The final model shows reasonable model-data fit, as indicated by absolute indexes (GFI, AGFI, and RMSR) given in Table 5.15.

The fourth objective of the present research was:

O4: To test and apply the proposed model in selected automotive companies

Confirmatory factor analysis was conducted through software AMOS 18 to confirm the extracted factor structure through EFA. The testing of the model was done through model specification, data specification, and the calculation of parameter estimates within the framework of AMOS Graphics. The initial framework developed was shown in Figure 5.12. Validity and reliability checks were established. The convergent and divergent validity, as well as reliability was checked using composite reliability, average shared

variance, maximum shared variance and average variance extracted measures. The values complied with the threshold values, hence convergent, discriminant, and validity was established.

Further CFA was carried out to determine the goodness-of-fit between the proposed model and the sample data. To evaluate the fit of CFA model, various goodness-of-fit (GOF) indices are employed. The initial framework improvement was performed over several iterations using modification indices and theoretical justification to reach a final satisfactory framework as shown in Figure 5.13. Finally, for the final model the values of the various indices shows an overall acceptable fit.

The proposed model was applied for the selected automotive companies. The model applied is as shown in Figure 5.14. The hypotheses established were tested for significance using regression and the Table 6.3 shows the results of the hypotheses testing.

Table 6.3: Results of hypotheses testing for evaluating effectiveness of SCMIS

	Hypotheses	Result
H _{3a}	For the successful implementation of SCMIS organizational factors have a positive impact.	Accept
H _{3b}	For the successful implementation of SCMIS technical factors have a positive impact.	Accept
H _{3c}	For the successful implementation of SCMIS human factors have a positive impact.	Accept
H _{3d}	For the successful implementation of SCMIS inter-organizational factors have a positive impact.	Accept

According to the results obtained through regression analysis for the successful implementation of SCMIS, all the latent factors have significant impact at 5% or higher level and therefore all the hypotheses were accepted. Thus organizational, technical, human and inter-organizational factors all have a positive influence on successful implementation of SCMIS. It should not be taken as a technical endeavor but instead an organizational transformation to have a competitive advantage.

Lastly, it was examined whether any discrepancy exist in deciding the criticality of the success factors among different groups based on total work experience and the company to which the respondent belongs. The analysis was performed using independent t-test and one way ANOVA. Table 6.4 shows the results of the hypotheses testing for demographic characteristics.

Table 6.4: Results of hypotheses testing for demographic characteristics

	Hypotheses	Result
H _{4a}	There exists a significant difference in the perception of respondents belonging to Maruti and HCIL for the identified CSFs.	Reject
H _{4b}	There exists a significant difference in the perception of respondents depending on the total work experience	Partially Accepted

According to the result obtained from SPSS it was inferred that respondents from different organizations do not have a significant difference in perception of the factors namely organizational, human, technical and inter-organizational. Thus we can assume that the identified CSFs are relatively homogeneous across the companies.

From the results it was further inferred that experience of the respondent carries a significant difference in perception of organizational factors identified for implementation of SCMIS at $p < 0.05$. On the other hand, respondents do not have a significant difference in perception of the other factors namely human, technical and inter-organizational.

6.3 IMPLICATIONS OF THE STUDY

The contributions of the study are important for industry practitioners, researchers and policy makers. The implementation requires huge investment and intensive research. Industry practitioners have not fully recognized the importance of such research since the benefits and technologies are not well understood. The process model and critical success factors will provide a useful guide for industry practitioners who are planning to implement SCMIS in their organizations. The study can help them to improve decision making for successful implementation of SCMIS right from inception and subsequent realization of the enormous benefits like reduction of inventories, minimization of bull whip effect, cost saving, quality improvement, better coordination with the suppliers, more visibility of the information across the supply chain and greater competitive

advantage that will accrue with right implementation. Managers should streamline the business processes and manage the change carefully so that they are able to implement the system successfully and achieve the desired results.

For the academic researchers, the study forms the basis of a more detailed examination of the subject related to the implementation of SCMIS. The proposed model can form the basis of deriving ‘performance metrics’ to give organizations a clearer picture of the benefits accruing from SCMIS. This study can encourage and enlighten policy makers to establish new training institutes and formulate policies in favor of SCMIS in the wider interest of the industries and improve the overall economy.

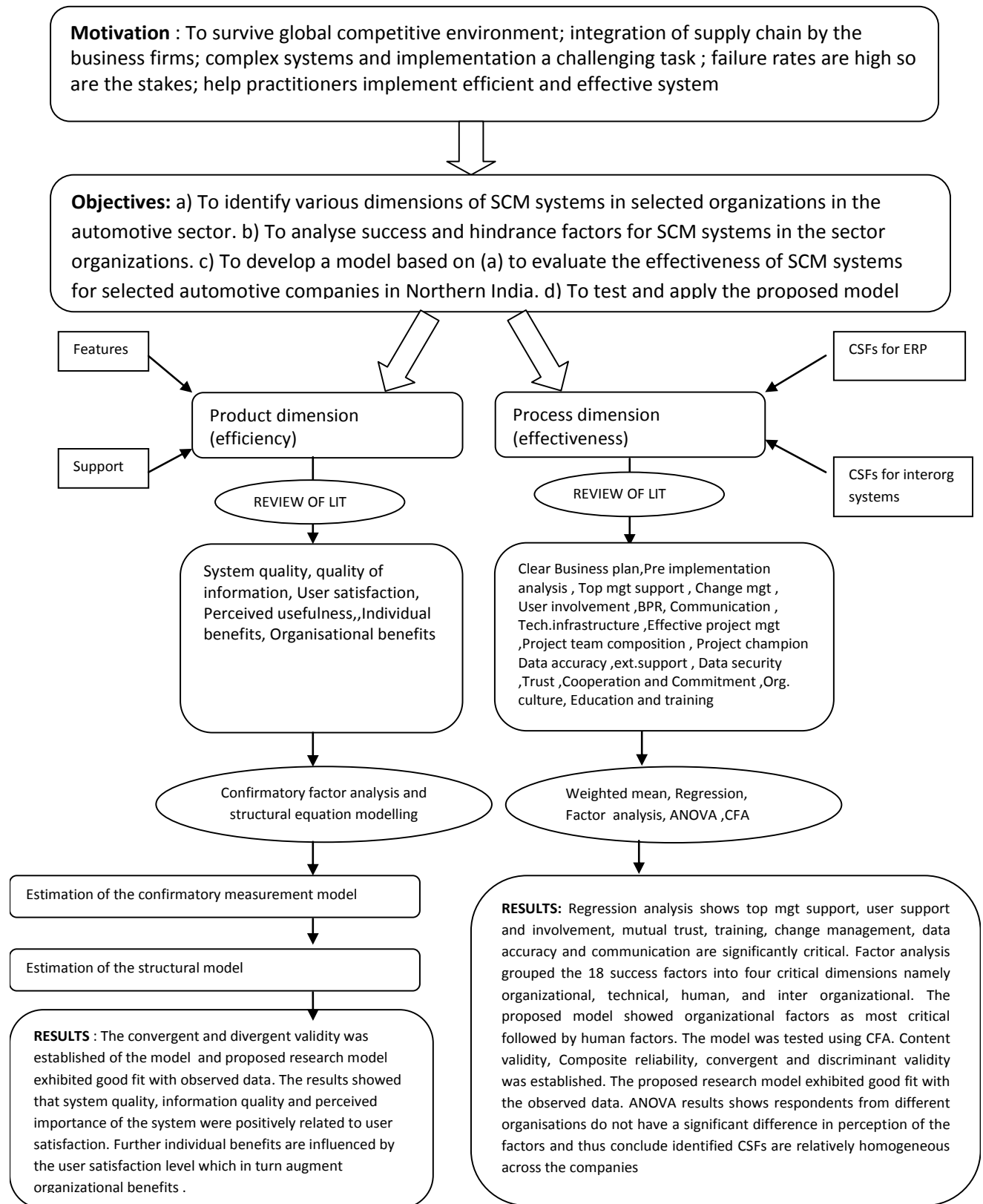


Figure 6.1: Complete view of research

6.4 RECOMMENDATIONS

The recommendations for the executives so as to improve the success rate of SCMIS implementation in automotive industry are:

- For successful implementation the focus should be on both product and process dimensions. Product dimension defines the efficiency of the system and process dimension provides the effectiveness of implementation process.
- A thorough ground work should be done in the form of pre-implementation analysis before starting the process of implementation of the system. The analysis should include defining clear objectives and scope, right product selection, formation of project management team, study of organisational culture and organisational readiness.
- Organisation should define project management in terms of a formal implementation plan, well defined scope, realistic time-frame, an effective project champion and project team members. This would help in completing the project on time and within resources.
- Organisation should effectively manage the change and all efforts should be made to make a smooth transition from the traditional to integrated systems across the organisations. For the smooth transition the change should be managed at individual, workgroup and organizational levels.
- People form the biggest hindrance to the successful implementation, therefore the organisation need to minimize the resistance to change. Companies should adopt strategies such as clear communication, user participation, user involvement, and proper training to overcome this resistance to change.
- Organization should ensure that the users understand the need and the benefits associated with the adoption of the inter-organizational system through clear and proper communication.
- The users and other stakeholders should be motivated and actively involved in the process of implementation. User should be involved in defining SCMIS needs. Thus, user involvement will help get the user requirements, improvement in system quality and finally lead to the increase in system usage.

- Organisations must develop a formal training program so as to impart an effective training to the users of the system. The management should allocate proper resources for the training to be imparted to the users so that the user becomes comfortable with the system. The training should be organized in-house or at the training centre where consultants could transfer knowledge to the technical personnel and end-users.
- The top management support is very critical for successful implementation of SCMIS and they should not view it as a technological endeavor. Top management should assign sufficient resources and facilitate team spirit by empowering the employees and also create a positive environment for the employees to accept change.

6.5 LIMITATIONS OF THE STUDY AND FURTHER SCOPE OF RESEARCH

The major limitation of this study is its generalizability since the study was limited to two major players of the automotive sector, their suppliers and dealers of the NCR Region, India. The sample may not support the automobile industry of India in general. Secondly, the study does not include the views, opinions, and perceptions of software experts that are involved in the development of SCMIS from organizations like IBM, Oracle, and SAP. Thirdly, SCMIS implementation success was measured using perceptual measures because the factual data was not available from the participating organisations. These limitations create ample scope of future research. It is recommended that similar research studies should be conducted by taking a larger sample of organizations in automotive industry from other parts of India so as to include any other dimension whatsoever that might have been left out in this study. Similar research should be undertaken for different sectors like retailing, pharmaceuticals, and petroleum as well for various organisational sizes like small, medium and large. It would be beneficial if in future, research is conducted to find CSFs and CFFs that are more industry-specific since certain CSFs like BPR, change management, top management support, etc. are general factors of success for the implementation of any IS. Further case studies can be undertaken in which longitudinal research should be done before and after the implementation of the system. This is to know the exact benefits the organisation derives from the system. Future research can be undertaken where critical success and failure factors are linked to tangible

benefits arising out of the system so that a clear ROI can be calculated for the system being implemented.

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QUESTIONNAIRE

Subject: Request for filling up the “QUESTIONNAIRE”

Dear Sir,

The supply chain management information system (SCMIS) has become a new buzzword of success in today's challenging business environment. In today's environment, there is a growing demand of consumers, shrinking product life cycle, high buying power and competitiveness eroding profit margins. Therefore it is not sufficient for a manufacturer to merely produce high quality products and ward off the competition. Now they are forced to compete on the basis of the company's supply chain strategies.

I hereby seek your support in the successful conduct of the proposed work and humbly request you to kindly take some time out from your invaluable and precious time, and fill up the “QUESTIONNAIRE” enclosed herewith and oblige.

Further I assure you that the data provided by you shall be treated as be extremely confidential and will be used for the purpose of research work only. Your contributions in this regard will help me go a long way in completing my research work

Thanking you in anticipation and hoping for a favorable and prompt reply.

With Kind Regards

(MANISHA SETH)

PART A

PERSONAL INFORMATION

1. Name (Optional) -----
2. Sex : Male ----- Female -----
3. Organisation : ☐ Maruti ☐ Honda
☐ Supplier (Name) -----
☐ Distributor (Name) -----
4. Designation -----
5. Total Work Experience :
☐ Less than 5 years ☐ 5-10 years ☐ More than 10 years
6. Department
☐ Purchasing ☐ Production ☐ IT ☐ Finance ☐ Marketing ☐
 others -----

PART B

CRITICAL SUCCESS FACTORS FOR PROCESS DIMENSION

In this stage of the research, the statements given below identified from the literature for the implementation success of SCMIS is to evaluate the degree of criticality . Please mark the appropriate responses using the following scale. 1 least critical to 5 most critical

1. Pre implementation Analysis	1	2	3	4	5
1a Determination of business process rationale for SCM system					
1b Determination of various costs					
1c Conducting technical feasibility					
1d.Inputs from all relevant functional areas for strategic SCMIS planning					
2.TOP MANAGEMENT COMMITMENT					
2a.Understanding by the top management about how the implementation of new technology will benefit the enterprise.					
2b. Recognition about the need for long-term support and leading from the front by the top management for the implementation of new technology					
2c. involvement of the management in the implementation of new technology and identifying it as a top priority					
2d.Reinforcement about the commitment of all the employees to the implementation of new technology by the top management					
2e.Willingness to assigns resources as they are needed by the top management to facilitate the implementation of new technology					
3.PROJECT MANAGEMENT FOR THE SYSTEM IMPLEMENTATION					
3a.Clarity of the scope of SCMIS project					
3b. Having a formal implementation plan					
3c.Deciding a realistic time frame					
3d.Conducting periodic project status meetings					
3e.Forming of a Project team with members who are stakeholders					
4. PROJECT LEADER					
4a.Experience of the SCMIS project leader in project management.					
4b.Adequate authority of the project leader in the organization					
4c. Having an effective project leader who is also a champion					
5. SCMIS PROJECT TEAM COMPOSITION, COMPETENCE and COMPENSATION					
5a. Formation of cross functional team for SCMIS projects					
5b. Proficiency of selected team members in technical and business knowledge.					

5c. Empowerment of the implementation team to make decisions relating to the project					
5d. Full time working for the implementation by project team members					
5e. Providing sufficient Incentive and compensation to the team members					
6. BUSINESS PROCESS REENGINEERING(BPR)					
6a. Company's willingness to reengineering					
6b. Company's readiness for change					
6c. Company's capability of reengineering					
7. THE ROLE OF COMMUNICATION IN THE SCM SYSTEM IMPLEMENTATION PROCESS.					
7a. Open and honest communication throughout the supply chain facilitates the SC MIS system implementation process.					
7b. Managing user input in the communication process results in greater understanding of organizational needs and quicker acceptance of the SC MIS system.					
7c. To maintain accurate and timely communication in the supply chain					
7d.To maintain easy communication between the customers and supply chains					
8. THE ROLE OF ORGANIZATIONAL CULTURE IN THE SCM SYSTEM IMPLEMENTATION PROCESS.					
8a. Corporate culture compatibility for collaboration successfulness					
8b. Corporate culture of sharing information					
8c Corporate culture makes easy adaptability of the new system by the people.					
8d Cultural fit of shared beliefs between organisations					
9. CHANGE MANAGEMENT					
9a. Recognizing the need for change					
9b. Organisations commitment and determination to change					
9c. Understanding the reasons for users' resistance and managing the conflicts					
9d. Monitoring and evaluation of change management strategies					
10. USER SUPPORT AND INVOLVEMENT IN THE SC MIS SYSTEM.					
10a. User involvement in the stage of defining the need of SC MIS in the company					
10b.User participation in the implementation of the SC MIS system.					
11. TRAINING FOR EFFECTIVE SCM SYSTEM USE.					
11a. Extensive training and instructions on system implementation					
11b.Identification of specific user training needs and appointing qualified personnel to execute training					
11c.Development of a formal training program and educating the users on new business processes.					

11d.Scheduling hands -on- training of the implemented SCMIS					
12.Trust					
12a. In the relationships with supply chain members, both the supply chain members and the organization have high integrity.					
12b.In the relationships with supply chain members, both the supply chain members and the organization have confidence in each other.					
12c.In the relationships with supply chain members, both the supply chain members and the organization are reliable. (					
12d.In the relationships with supply chain members, both supply chain members and the organization are honest and truthful.					
12e.In the relationships with supply chain members, both the supply chain members and the organization are trustworthy.					
13. Data security					
13a.Availability of secure modes in the SCMIS for transmitting information					
13b.A cost-effective security system in the SCMIS					
13c.Security of transactions across the SCMIS					
13d.The effectiveness of SCMIS in handling sensitive information					
14. DATA ACCURACY IN THE SCMIS SYSTEM.					
14a. Ensuring data robustness (no loss of data) between the business processes.					
14b. Ensuring data accuracy (no change of data) between the business processes					
14c. Data integrity in the SCMIS system affects the quality of the business decisions.					
14d. Understanding by all the employees about the concept and the value of integrated data available from the SCMIS .					
15. External support					
15a. Service response time of the software vendor					
15b.Consultants qualification and knowledgeability in both enterprises' business processes and information technology					
15c. Vendor's participation in the system implementation					
16. Cooperation and commitment					
16a. Favoring of long term relationships by the company					
16b.The company should have common partner goals					
16c.Realignment of goals and partners willingness to participate.					
16d.The technical compatibility with the partners					
16e. Requisite of technical expertise of the partners					
17. Clear business plan and vision					

17a Feasibility-evaluation of SCMIS project					
17b. Clear goals and objectives					
17c. Linking SCMIS project to business strategy.					
17d. Clear vision statement and adequate business plan					
17e. Clear desired outcomes					
18. Technical infrastructure					
18a. Reliable hardware and software in SCMIS					
18b. Support of technical team for the software and hardware of SCMIS					
18c. The performance of the internet and response time of the server					
HOW SUCCESSFUL HAS THE SCMIS BEEN IN MEETING THE OVERALL GOALS OF YOUR ORGANISATION					
HOW WOULD YOU RATE THE OVERALL SATISFACTION WITH THE SCMIS IN YOUR ORGANISATION					

PART C

Given below are the barriers / hindrance factors for the implementation of SCMIS.

Please mark the appropriate responses using the following scale.

1. No problem at all and 5. Serious problem

	No problem at all (1)	Little problem (2)	Some problem (3)	Significant problem (4)	Serious problem (5)
1.ORGANISATIONAL BARRIERS					
1. Lack of top management support	1	2	3	4	5
2. Lack of alignment between IT and organizational objectives.	1	2	3	4	5
3. Organization not committed to change	1	2	3	4	5
4. Poor BPR – failure to redesign business process	1	2	3	4	5
5. Absence of readiness assessment before implementation					
6. Poor middle management support					
7. Perspective of SCMIS as just a technical system					
8. Unrealistic expectation					
9. Inexperienced consultants					
2.FINANCIAL BARRIERS					
1. Huge investment	1	2	3	4	5
2. Unclear ROI	1	2	3	4	5
3. Financial constraints for high cost of maintenance	1	2	3	4	5
3.TECHNOLOGICAL BARRIERS					
1. Inappropriate system integration	1	2	3	4	5
2. Over reliance on heavy customization	1	2	3	4	5
3. Poor data quality	1	2	3	4	5
4. Lack of data standards	1	2	3	4	5
5. Poor product selection					
6. Poor quality of testing					
7. Poor IT infrastructure					
8. Lack of data and information	1	2	3	4	5

security					
4.HUMAN BARRIERS					
1. Lack of users participation	1	2	3	4	5
2. Resistance to change					
3. Lack of sufficient training to end users					
4. Inadequate employee involvement					
5. Lack of employees motivation					
6. Lack of understanding about the benefits of the system					
7. Ineffective communication with the users.	1	2	3	4	5
8. Reluctance to use the system	1	2	3	4	5
5.PROJECT MANAGEMENT BARRIERS					
1. Lack of effective project management methodology	1	2	3	4	5
2. Lack of agreement on project goals					
3. Lack of full time and balanced project team					
4. High attrition rate of project team members	1	2	3	4	5
5. Lack of a project champion/ establishment of an inexperienced project mgr	1	2	3	4	5
6. Too tight project schedule	1	2	3	4	5
6.INTER ORGANISATIONAL BARRIERS					
1. Lack of trust between members	1	2	3	4	5
2. Lack of willingness to collaborate.					
3. Technological incompetence's within trading partners					
4. Culture of the partner not supporting sharing of the information	1	2	3	4	5
5. Lack of data standard consistency	1	2	3	4	5
6. Lack of long term relationship among chain members	1	2	3	4	5

PART D

PERFORMANCE MEASURES FOR PRODUCT DIMENSION

The questionnaire below evaluates the Supply chain management information system (SCMIS) in your organisation. Please tick the appropriate responses for this question using the scale:

1 Strongly Disagree to 5 Strongly agree

	1	2	3	4	5
1. SYSTEM QUALITY					
SQ1 Do you think that SCMIS is easy to use					
SQ2 Do you think that SCMIS is user friendly/easy to learn					
SQ3 You find it easy to get SCMIS to do what you want it to do i.e easy accessibility					
SQ4 Is SCMIS cumbersome to use.					
SQ5 Are the system features as per the requirement					
SQ6 Has the system integrated well with the legacy (existing) systems					
2.INFORMATION QUALITY					
IQ1 Do you think the output is presented in a useful format?					
IQ2 Is the information clear and understandable					
IQ3 Does the system provide sufficient information					
IQ4 Do you get the information you need in time?					
IQ5 Does the system provide reports that seem to be just about exactly what you need? (relevance)					
IQ6 Does the system provide the precise information you need ?(conciseness, precision)					
3 INDIVIDUAL BENEFITS					
IB1 Using SCMIS improves your job performance					
IB2 Using SCMIS in the job improves your productivity					
IB3 Using SCMIS makes it easier to do the job					
IB4 SCMIS acts as decision support system					
IB5 Using SCMIS saves times for individual tasks and duties					
4. PERCEIVED USEFULNESS/ IMPORTANCE					
IMP1: The degree to which you perceive that using the system is important.					

IMP2 The degree to which you perceive that using the system is self relevant					
IMP3 The degree to which you perceive that using the system increases your effectiveness in the job.					
IMP4 The degree to which you perceive that the system will be useful/needed in your job					
5 USER SATISFACTION					
US1How satisfied are you with the system quality					
US2 The degree to which you enjoy working on SCMIS.					
US3 Overall are you satisfied with your experience with SCMIS	Dissatisfied				highly satisfied
6 ORGANISATIONAL IMPACT/ NET BENEFITS					
OB1 Does SCMIS leads to better forecasting?					
OB2 Does SCMIS leads to better resource planning?					
OB3 Does SCMIS leads to reduction in inventory level?					
OB4 Does SCMIS leads to reduction of lead time in production?					
OB5 Does SCMIS leads to improving supplier on time delivery?					
OB6 Does SCMIS leads to improving order management?					
OB7 Does SCMIS leads to improvement in customer relationship?					
OB8 Does SCMIS increases coordination with suppliers?					
OB9 Does SCMIS leads to cost saving?					

APPENDIX II

TABLES SHOWING REGRESSION RESULTS

Model Summary ^h										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.698 ^a	.488	.484	.38649	.488	128.486	1	135	.000	
2	.768 ^b	.590	.584	.34692	.103	33.548	1	134	.000	
3	.817 ^c	.668	.660	.31360	.077	30.992	1	133	.000	
4	.838 ^d	.702	.693	.29787	.035	15.419	1	132	.000	
5	.850 ^e	.723	.712	.28868	.020	9.533	1	131	.002	
6	.856 ^f	.733	.721	.28423	.011	5.141	1	130	.025	
7	.861 ^g	.741	.727	.28103	.008	3.976	1	129	.048	

a. Predictors: (Constant), OTM

b. Predictors: (Constant), OTM, HTRA

c. Predictors: (Constant), OTM, HTRA, OCM

d. Predictors: (Constant), OTM, HTRA, OCM, TDA

e. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU

f. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU, OUS

g. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU, OUS, OCo

h. Dependent Variable: success

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.192	1	19.192	128.486	.000 ^b
	Residual	20.165	135	.149		
	Total	39.358	136			
2	Regression	23.230	2	11.615	96.506	.000 ^c
	Residual	16.128	134	.120		
	Total	39.358	136			
3	Regression	26.278	3	8.759	89.067	.000 ^d
	Residual	13.080	133	.098		
	Total	39.358	136			
4	Regression	27.646	4	6.911	77.897	.000 ^e
	Residual	11.712	132	.089		
	Total	39.358	136			
5	Regression	28.440	5	5.688	68.253	.000 ^f
	Residual	10.917	131	.083		
	Total	39.358	136			
6	Regression	28.856	6	4.809	59.532	.000 ^g
	Residual	10.502	130	.081		
	Total	39.358	136			
7	Regression	29.170	7	4.167	52.764	.000 ^h
	Residual	10.188	129	.079		
	Total	39.358	136			

a. Dependent Variable: success

b. Predictors: (Constant), OTM

c. Predictors: (Constant), OTM, HTRA

d. Predictors: (Constant), OTM, HTRA, OCM

e. Predictors: (Constant), OTM, HTRA, OCM, TDA

f. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU

g. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU, OUS

h. Predictors: (Constant), OTM, HTRA, OCM, TDA, ITRU, OUS, OCo

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.331	.393		-.843	.401
	OTM	1.078	.095	.698	11.335	.000
2	(Constant)	-1.007	.372		-2.708	.008
	OTM	.795	.098	.515	8.091	.000
	HTRA	.451	.078	.369	5.792	.000
3	(Constant)	-1.523	.349		-4.370	.000
	OTM	.530	.101	.343	5.251	.000
	HTRA	.427	.071	.349	6.052	.000
	OCM	.417	.075	.333	5.567	.000
4	(Constant)	-2.099	.362		-5.797	.000
	OTM	.472	.097	.306	4.871	.000
	HTRA	.383	.068	.314	5.647	.000
	OCM	.393	.071	.314	5.501	.000
	TDA	.276	.070	.201	3.927	.000
5	(Constant)	-2.316	.358		-6.472	.000
	OTM	.446	.094	.289	4.726	.000
	HTRA	.324	.069	.265	4.716	.000
	OCM	.360	.070	.287	5.130	.000
	TDA	.250	.069	.182	3.647	.000
	ITRU	.201	.065	.165	3.088	.002
6	(Constant)	-2.265	.353		-6.416	.000
	OTM	.391	.096	.253	4.078	.000
	HTRA	.290	.069	.237	4.191	.000
	OCM	.303	.073	.242	4.135	.000
	TDA	.230	.068	.168	3.381	.001
	ITRU	.184	.065	.151	2.852	.005
	OUS	.166	.073	.144	2.267	.025
7	(Constant)	-2.236	.349		-6.398	.000
	OTM	.334	.099	.216	3.368	.001
	HTRA	.279	.069	.228	4.071	.000
	OCM	.273	.074	.218	3.683	.000
	TDA	.226	.067	.165	3.356	.001
	ITRU	.157	.065	.129	2.410	.017
	OUS	.154	.073	.132	2.106	.037
	OCo	.138	.069	.120	1.994	.048

a. Dependent Variable: success

APPENDIX III

TABLE SHOWING POST HOC TEST RESULTS
Multiple Comparisons

Tukey HSD

Dependent Variable	(I) EXP	(J) EXP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
INTERORG	1.00 Less than 5 years	2.00 5-10years	.01306	.07786	.985	-.1715	.1976
		3.00 More than 10 years	.06455	.08323	.719	-.1327	.2618
	2.00 5-10years	1.00 Less than 5 years	-.01306	.07786	.985	-.1976	.1715
		3.00 More than 10 years	.05149	.07560	.775	-.1277	.2307
	3.00 More than 10 years	1.00 Less than 5 years	-.06455	.08323	.719	-.2618	.1327
		2.00 5-10years	-.05149	.07560	.775	-.2307	.1277
HUMAN	1.00 Less than 5 years	2.00 5-10years	.01365	.08035	.984	-.1768	.2041
		3.00 More than 10 years	.11138	.08590	.400	-.0922	.3150
	2.00 5-10years	1.00 Less than 5 years	-.01365	.08035	.984	-.2041	.1768
		3.00 More than 10 years	.09773	.07802	.425	-.0872	.2826
	3.00 More than 10 years	1.00 Less than 5 years	-.11138	.08590	.400	-.3150	.0922
		2.00 5-10years	-.09773	.07802	.425	-.2826	.0872
TECHNICAL	1.00 Less than 5 years	2.00 5-10years	-.01389	.07274	.980	-.1863	.1585
		3.00 More than 10 years	.07767	.07776	.579	-.1066	.2620
	2.00 5-10years	1.00 Less than 5 years	.01389	.07274	.980	-.1585	.1863
		3.00 More than 10 years	.09156	.07063	.400	-.0758	.2589
	3.00 More than 10 years	1.00 Less than 5 years	-.07767	.07776	.579	-.2620	.1066
		2.00 5-10years	-.09156	.07063	.400	-.2589	.0758

ORG	1.00 Less than 5 years	2.00 5-10years	.03253	.06744	.880	-.1273	.1924
		3.00 More than 10 years	.18441 *	.07210	.031	.0135	.3553
	2.00 5-10years	1.00 Less than 5 years	-.03253	.06744	.880	-.1924	.1273
		3.00 More than 10 years	.15188	.06549	.057	-.0033	.3071
	3.00 More than 10 years	1.00 Less than 5 years	-.18441 *	.07210	.031	-.3553	-.0135
		2.00 5-10years	-.15188	.06549	.057	-.3071	.0033

*. The mean difference is significant at the 0.05 level.

LIST OF PUBLICATIONS

S.No	Title of the paper	Authors	Name of journal and publisher
1.	Development of a model for successful implementation of supply chain management information system in Indian automotive industry	Er Manisha Seth Dr (Ms) Ravi Kiran Dr. D.P.Goyal	Vision : The Journal of Business Perspective
2.	Identification of critical success factors for the implementation of supply chain management information system through SEM Approach	Er Manisha Seth Dr (Ms) Ravi Kiran Dr D.P. Goyal	Global Journal of Management and Business Research
3.	Waning the Challenges in the Implementation of Supply Chain Management Information System: A Study of the Indian Automobile Industry.	Er Manisha Seth Dr (Ms) Ravi Kiran Dr D.P. Goyal	In Managing in Recovering Markets (pp. 473-484). Springer India.
4.	Implementation of supply chain management information system and organisational success factors: An empirical analysis of the Indian automotive Industry.	Er Manisha Seth Dr (Ms) Ravi Kiran Dr. D.P.Goyal	Indraprastha Journal of Management 3(1) , 21-33

PAPER PRESENTED IN NATIONAL/INTERNATIONAL CONFERENCES

S.No	Title of the paper	Authors	CONFERENCE
1.	Critical Success Factors in Implementation of SCM Information Systems: A Theoretical Perspective.	Er Manisha Seth Dr (Ms) Ravi Kiran Dr. D.P.Goyal	<i>National Conference on Changing Perspective and Paradigms in Business and Behavioral Sciences</i> April 27-28 2012,

2.	Waning the challenges in implementation of supply chain management information system – a study of Indian automobile industry.	Er Manisha Seth Dr (Ms) Ravi Kiran Dr D.P. Goyal	<i>Global Conference On Managing In Recovering Markets March 5-7, 2014</i>
3.	Managing the implementation of supply chain management information system through critical success factors framework in Indian automotive industry.	Er Manisha Seth Dr (Ms) Ravi Kiran Dr D.P. Goyal	<i>International Conference on Changing Perspective and Paradigms in Business and Behavioral Sciences March 28-29 2014</i>