ENHANCING THE COMPETITIVENESS OF MANUFACTURING SECTOR THROUGH SUPPLY CHAINS IN INDIA

Ph.D. THESIS

by

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A THESIS

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled "**Enhancing the Competitiveness of Manufacturing Sector Through Supply Chains in India**", in partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy and submitted in the Department of Management Studies of the Indian Institute of Technology Roorkee, Roorkee is an authentic record of my own work carried out during a period from January, 2013 to January, 2016 under the supervision of Dr. Rajat Agrawal, Associate Professor, Department of Management Studies, Indian Institute of Technology Roorkee, Roorkee.

The matter presented in the thesis has not been submitted by me for the award of any other degree of this or any other Institute.

(Devendra Kumar Dewangan)

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

(**RAJAT AGRAWAL**)

S**upervisor (s)**

The Ph. D. Viva-Voce Examination of **Mr. Devendra Kumar Dewangan**, Research Scholar, has been held on .....

Chairman, SRC **Signature of External Examiner**

This is to certify that the student has made all the corrections in the thesis.

Signature of Supervisor (s) **Head of the Department**

Date: 12 / 07 /2016

ABSTRACT

In today's globalized world, manufacturing competitiveness has become a part of a company's vision and policies. The companies strive to enhance their manufacturing competitiveness and publish competitive reports based on different guidelines and indicators. They highlight their efforts to achieve manufacturing competitiveness at the global level. Therefore, the issue of measurement of manufacturing competitiveness is an important part of the working of any organization. Moreover, the investigation of the relationship between the supply chain management performance (SCM performance) and manufacturing competitiveness of companies is an important topic for the academicians, researchers and policy makers. In the last couple of decades, a vast amount of literature has come up on the SCM performance and manufacturing competitiveness. It has been observed that managers face challenges in determining how far their manufacturing competitiveness is profitable. This gives rise to two crucial questions: First, how to measure the manufacturing competitiveness? And second, what is the impact of the SCM performance on the manufacturing competitiveness of an organization?

To get answers to these questions, this study carries out a deep analysis and investigation to come up with a proposed model of manufacturing competitiveness in terms of the theoretical foundations and their implications for organizations, based on an empirical research. The existing literature on the subject contains several indices developed by different authors and researchers, using various dimensions, to measure manufacturing competitiveness. However, very few of them have used the new dimensions relevant to the manufacturing competitiveness of the Indian manufacturing industry. Hence, there is a need to pay attention to measuring manufacturing competitiveness using the new dimensions, and develop a scale or index for the measurement of manufacturing competitiveness in the specific context of the Indian manufacturing sector. The existing literature in the field shows various studies to explore the relationship between the SCM performance and competitive advantage, but the research on the relationship between the two using the new dimensions is still inconclusive in nature.

The Indian manufacturing sector plays an important role in terms of both, contribution to the GDP and employment generation. The Government of India has recently focused on manufacturing

competitiveness and a substantial literature has come up in this regard. However, the available literature has several gaps that need to be addressed, most notably, the need to examine the relationship between the SCM performance and the manufacturing competitiveness of companies in the manufacturing sector. The present study evaluates this relationship in the context of the Indian manufacturing industry. Based on the existing literature, it develops a conceptual framework that includes six factors of manufacturing competitiveness. The main objective of the research is to identify the SCM performance and measure its impact on manufacturing competitiveness. Data have been collected for the purpose through various brainstorming sessions and personal interviews with the academicians, industry experts and policy makers. Based on this data, both qualitative and quantitative models have been developed to analyze and measure the manufacturing competitiveness of the manufacturing companies.

The study proposes a conceptual model to cover the measurement issues of manufacturing competitiveness. To achieve the objective of measuring manufacturing competitiveness, a scale has been developed using six factors. The development of the scale has passed through the three phases of pilot study, scale refinement and validation. To develop the scale, data have been collected from the upper and middle level managers working with various manufacturing companies in India. The research attempts to make a major contribution to the existing literature on the subject. The main contributions of this research to the existing body of literature are as follows:

- The study presents a comprehensive literature review and taxonomical classification of the available literature. In particular, it discusses the theoretical background to the SCM performance, eco-innovation, supplier selection and manufacturing competitiveness.
- The study develops a model covering two aspects: measurement of manufacturing competitiveness in the manufacturing industry, and evaluation of the relationship between the SCM performance and manufacturing competitiveness. To find out this relationship, a scale has been developed in two stages, i.e., item generation and selection, and scale refinement and validation.
- At the primary stage, the items related to various factors have been extracted from the available literature. Different techniques, like content analysis, production of the primary pool of items, and evaluation of content and face validity through expert judgment have been applied for the purpose. Further, a pilot survey has been conducted for item analysis, and the exploratory factor analysis (EFA) and reliability test have been performed.

- An initial refinement process has been done for the purification of the items. For this purpose, a confirmatory factor analysis (CFA), and unidimensionality, convergent and discriminant validity assessments have been conducted. This scale has been developed for the measurement of manufacturing competitiveness of the Indian manufacturing industry.
- Further, hypothesis testing has been performed using the structural equation modelling (AMOS). After testing, it has been hypothesized that there is a positive impact of the SCM performance on manufacturing competitiveness in the context of the Indian manufacturing sector.
- In this way, the research fills the major gaps in the existing literature in the field of manufacturing competitiveness measurement. It has applied a modelling technique and developed a reliable and valid measurement scale for manufacturing competitiveness measurement. A scale comparable to the scale developed by this study has not been developed yet by any study in the available literature.

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Devendra Kumar Dewangan

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LIST OF ABBREVIATIONS

Abbreviations	Full Name
SCM	Supply Chain Management
EU	Environmental Uncertainty
TU	Technology Uncertainty
DU	Demand Uncertainty
SU	Supply Uncertainty
SCMPR	Supply Chain Management Practices
CR	Customer Relationships
IS	Information Sharing
IQ	Information Quality
SCI	Supply Chain Integration
ECO	Eco-Innovation
SCMP	Supply Chain Management Performance
CRs	Customer Responsiveness
SCE	Supply Chain Efficiency
SS	Supplier Selection
MC	Manufacturing Competitiveness
P/C	Price/Cost
CI	Continuous Improvement
NPD	New Product Development
MF	Manufacturing Flexibility
R&D	Research & Development
CA	Competitive Advantage
CEO	Chief Executive Officer
GDP	Gross Domestic Product
INR	Indian Rupee
CMIE	Centre for Monitoring Indian Economy Pvt. Ltd
NMCC	National Manufacturing Competitiveness Council
IBEF	India Brand Equity Foundation
H	Hypothesis
IT	Information Technology
OEM	Original equipment manufacturer

CITC	Corrected Item-Total Correlation
KMO	Kaiser-Meyer Olkin
Std. Deviation	Standard Deviation
FA	Factor Analysis
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
$\chi 2$	Chi Square
GFI	Goodness-of-Fit Index
CFI	Comparative Fit Index
NFI	Normal Fit Index
IFI	Incremental Fit Index
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean Square Residual
SEM	Structural Equation Modeling
SPSS	IBM Statistical Package for the Social Sciences
AMOS 20	Analysis of Moment Structures
CMB	Test of Common Method Bias
CMV	Common Method Variance
CV	Convergent Validity
DV	Discriminant Validity
CR	Composite Reliability
AVE	Average Variance Extracted
MSV	Maximum Shared Variance
ASV	Average Shared Variance
SMEs	Small Medium Enterprises
MCDM	Multiple Criteria Decision Making
ANP	Analytic Network Process
FANP	Fuzzy Analytic Network Process
AHP	Analytic Hierarchy Process
FAHP	Fuzzy Analytic Hierarchy Process
FAD	Fuzzy Axiomatic Design
QFD	Quality Function Deployment
FQFD	Fuzzy Quality Function Deployment
TOPSIS	Technique for Order of Preference by Similarity to Ideal Solution

CHAPTER – 1
INTRODUCTION

Preview

This chapter deals with major trends of Indian economy of manufacturing sector in India. The supply chain of manufacturing sector in India is very important to sustain in the global market. The present chapter also deals with leading examples of manufacturing sector prosperity through the supply chain (global). It begins with the enumeration of the problem statement, motivation for the research, research questions and research objectives. In the end, a brief outline of the ensuing chapters of the thesis is given.

1. Indian Economy (Major Trends)

Indian economy presently is passing from a very important phase. The global economic scenario is not very attractive and most of the reputed economic institutions have predicted a very promising future for Indian economy (NMCC report, 2014). But the advantage of these promising reports is only possible when all the sectors, Indian economy mainly agriculture, manufacturing and services, etc. contributes to the best of their potentials. We have seen a tremendous growth of the service sector in the Indian economy and presenting the contribution of the service sector to the national GDP is 60% (Delloitte, 2014). The contribution of manufacturing sector to the nation GDP is around 15-16%. Since by and it is almost stagnated at this level. The contribution of agriculture sector is also not very encouraging, though India is primarily known as agrarian economy.

The Indian economy is growing at a better rate than many other countries (Deloitte, 2014). India is adopting a global approach to become an important player on an international platform. The main focus of India's growth strategy is on self-reliance (Trivedi et al., 2011). This sector is very critical for the growth of any economy (IBEF, 2013) and has lots of potential for the future. Since the economic reform in 1990s, the main focus areas are fast economic growth, more export, higher foreign exchange reserve and, growth in foreign direct investment. According to Ahluwalia (2002), these reforms facilitated the positive shift in growth rate and output of the economy and manufacturing sector. Even during the recession, Indian economy remains stabilized due to its strong focus on the manufacturing sector. This sector provides jobs to the less skill and uneducated

workforce. This fact is very important for the emerging economies like India, where education level is very low.

Currently, this sector is providing jobs for 45 million people that are 12 percent of the country's labor force (IBEF, 2013). Although service sector is taking place an important role in the knowledge economy (Bahl et al., 2011), this sector provides a transitional opportunity to the labor from agriculture. In addition, this sector shows the multiplication effect for creating jobs in the service sector. According to National manufacturing policy (2011), manufacturing sector creates two-three additional jobs in the service sector for every job created in the manufacturing sector (IBEF, 2013). Currently the Indian manufacturing sector contributes 15% to the country's GDP (Indian Express, 2013). According to an estimation contribution of Indian manufacturing sector in the country's GDP will be 25% by 2022 (Business Standard, 2013).

Government of India is eyeing towards the manufacturing sector in a major engine for growth of Indian economy. Therefore, the government has kept target of 20% contribution from the manufacturing sector in India GDP 20-20 (Deloitte, 2014). Further, the government of India has also initiated various initiates like make in India, start of India, zero defect and zero effect, etc. All these initiates are directly or indirectly attached to manufacturing sector.

The Indian economy has a certain important milestones in past 100 years. Before independence 1947 economy was mainly based on agriculture and manufacturing (IBEF report, 2015). After independence the first Prime Minister of India, Pandit Jawaharlal Nehru realized the importance of industrialization in the economic growth of the country. Pandit Jawaharlal Nehru created the concept of Public undertaking action frame and be used to that there is big factories were poor, temple of model India (IBEF report, 2015).

Under the vision of Pandit Jawaharlal Nehru, mainly public sector enterprises were created and their factories were established in different remote part of the country. So that a balanced development of the nation can take place. During the initial periods after independence, only few limited private sector companies were presented and most of those companies like Tata's, Birla's, and Modi's, etc.

During these periods an Indian economy was highly protected quota system and licensed raj was prevalent. Therefore, Indian companies weather the public or private sector could not think about global competitiveness. Just to quote of the scenario of the time, people and to say that when a daughter was born in a family, father used to booked a buying scooter, so that delivery of that

scooter could be ensured at the time of the marriage of that daughter in the form of dowry. Under this type of scenario, where possibility almost absent even production volume was decided by the quota system. India manufacturing system was located in almost all the dimensions of modern competing theories.

Then, comes the period of liberalization, globalization and privatization in the last decades of the 20th century. This created a new wave in the Indian economy. When multinational companies with state of the art technology and advanced manufacturing management came to Indian market, Indian companies started facing the music of the day. In order to achieve similar competitiveness, Indian manufacturing industries also adapting the best technology and modern management principles.

The Indian economy which is expected to be one of the largest and fastest growing economy in coming time. In a ray of hope for not only Indian companies, but for many multinational companies also as it offers, certain unique advantages in a term of low cost of labors, large availability of natural resources, a stable democracy, independent judiciary, well enforced law and order system, highly competitiveness market and one of the biggest consumer market itself.

1.1. Manufacturing Sector of India

The manufacturing sector is the main engine of economic growth and wealth creation, of a country; it creates sustainable economy, encourages investments, creates jobs and builds the nation (NMCC report, 2014). With the changing landscape of manufacturing dominance, shift of markets from the west to the east and the ability of the manufacturer to be located in any part of the world has made the competition among nations to create and maintain their manufacturing sector very competitive. According, to McKinsey and Co, Indian manufacturing industry will create 90 million jobs by 2025. According, to Global manufacturing competitive index, 2013, India is placed on the second rank in terms of competitiveness five years down the line (Deloitte, 2014).

In the next decade, the economy of India becomes the world's 3rd largest economy, and one of the mid-century (World Bank Report, 2014). An Indian manufacturing sector is an important contributor to the GDP of the nation. India has the one of fastest growing service sectors in the world with an annual growth rate of above 9% since 2001, which contributed to 57% of GDP in 2012-13. The Industry sector has held a constant share of its economic contribution (26% of GDP in 2013-14). The Indian automobile industry is one of the largest in the world with an annual

production of 21.48 million vehicles (mostly two and three wheelers) in FY 2013-14 (NMCC report, 2014). However, the contribution of manufacturing in the GDP of the neighboring nation, like China, Thailand, Vietnam, Japan, etc. is much more than Indian figures. Following figure represents the contribution of manufacturing in the GDP of various eastern economics. The GDP of various countries like India 14%, China 32%, Thailand 34%, Vietnam 17%, Japan 19%, etc. (World Bank Report, 2014). Therefore, there is largest need for attention to increase the contribution of the manufacturing sector in GDP. The Indian manufacturing sector comprises of 17% categories of industries (NMCC report, 2014).

According to the various international and national series, there is a vast potential of improving the competitiveness was an Indian manufacturing sector. Many Indian companies are now showing there trends also. One of the major of competitiveness can be business excellence award particularly Deming price from Japan. A list of Deming price winners from India in the last 12 years are as follows: RSB Transmissions(I) Limited, Rane Brake Lining Limited, SRF Limited, Mahindra & Mahindra Limited, Rane Engine Valve Ltd, Krishna Maruti Ltd, Indo Gulf Fertilizers Ltd, LUCAS TVS, Tata, TVS Motor Company, (former Japan Quality Medal report, January 2015), etc. The list of Deming Price Winners Companies are shown in Table 1.1

Table 1.1 Deming Price Winners Companies

S. No.	Year	Name of Companies
1.	2013	RSB Transmissions (I) Limited Auto Division (Jamshedpur) Pune, (India)
2.	2013	Rane Brake Lining Limited (India)
3.	2012	SRF Limited, Chemicals Business (India)
4.	2012	Mahindra & Mahindra Limited (India)
5.	2011	Sanden Vikas (India) Limited, (India)
6.	2010	National Engineering Industries Ltd. (India)
7.	2008	Tata Steel, (India)
8.	2007	Rane (Madras) Ltd., (India)
9.	2005	Rane Engine Valve Ltd, (India)
10.	2005	Rane TRW Steering Systems Ltd. (SGD), (India)
11.	2005	Krishna Maruti Ltd., Seat Division, (India)
12.	2004	Indo Gulf Fertilisers Ltd., (India)
13.	2004	LUCAS TVS, (India)
14.	2004	SRF limited, (India)
15.	2003	Mahindra & Mahindra Ltd, (India)
16.	2003	Rane Brake Lining Ltd., (India)
17.	2003	Sona Koyo Steering Systems Ltd., (India)
18.	2002	TVS Motor Company (TVSMC), (India)

Source: https://www.juse.or.jp/upload/files/Deming_prize_EN/list/LIST_Deming_Grand_Prize.pdf. (former Japan Quality Medal report, January 2015)

As clearly evident from the above Table 1.1 that numbers of Deming prize winner for India are increasing. Therefore, it can be concluded that Indian companies are adopting modern management principles and looking forward to the globally competitive.

Similarly, other aspects of competitiveness can be a global market expansion. Now-a-days many automobile companies are exporting their products to the large number of African, South Asian, South American, etc. countries. To give examples one of the leading auto companies, like Bajaj Auto, TVS motors, Honda, and Hero Motocorp (Delloitte, 2014), etc. This shows that the global market is also starting to realize the competitiveness of Indian products.

1.2. Supply Chain of Manufacturing Sector in India

In the present competitive scenario, supply chain management plays a significant role and calls for serious research attention, as companies are challenged with lots of finding ways to fulfill the customers' expectations at manageable costs. The successful companies are those who maintained all the nodes of supply chains from their supplier's to their customer's. (Lummus and Vokurka, 1999). It is expected that the present research, by addressing SCM performance that contribute towards manufacturing competitiveness, will help academicians, practitioners and researchers to better understand the scope and activities associated with SCM performance and manufacturing competitiveness that creates enhanced levels of today's competitive environment with new dimensions, and which has not been empirically tested in previous studies. Nowadays, the organizations much more interested to adopt modularity based manufacturing practices and process architectures to cope-up with the demand uncertainty environment.

The supply chain is a considered to be an important driver of success (Dewangan et al., 2015d). Even manufacturing activities are also considered as a subset of supply chains. We have some examples were supply chain is instrumented in the success of companies like Wal-Mart, Seven Eleven, Dell, Amul, Asian Paints, etc. Supply chain which is also known as value chain and provides required products to the customer in the most optimum manner. The chapter-2 of this thesis will discuss some of the important definitions of supply chains in general and supply chain for manufacturing industry in particular.

Supply chain of manufacturing sector in India has a very wide scope of improvement. Because of geographical constraint suppliers and customers are located at far flung places.

Therefore, in the supply chain of manufacturing sector, many practices of modern management are difficult to adopt. The supply chain of manufacturing sector has a large number of actors where many of them don't add any significant value to the products.

The supply chain of a manufacturing sector in India is very wide and very difficult to control also. The supply chain of Indian manufacturing setup is much differentiated from European or Japanese companies. The supply chain of Indian manufacturing sector may have a small supplier in the northern part of India. The vendor supplies product to an intermediaries, who then aggregates products from other suppliers and then supplies the complete setup to major equipment management and then in the downside of the supply chain also there may be many market intermediaries before the product reaches into the hands of final customers. These long supply chains increases the cost of the products and also increases the delivery lead time, which directly affects the competitiveness of the manufacturing sector.

India is a developing nation and manufacturing is a considered to be important drivers. Government of India is also pushing a lot of efforts for increasing the contribution of the manufacturing sector. But, there is a flip side also increased manufacturing activities, will put extra pressure on the natural resources of the land. More transportation activities increase the carbon emission in the environment as well as the logistics cost of the final products. However, industry experts favor increased transportation activities as it gives rise to the economy and employment to large population. So, increased supply chain activities, particularly logistics are a double edged sword for Indian economy.

Another feature of the supply chain for Indian scenario is related to infrastructure development. India sees large investment in infrastructure development, particularly in construction of new expressways, new highways and widening of existing roads. This investment is recovered through tool taxes. India is a country where the logistics cost is one of the highest among all neighboring nations. Therefore, supply chain and logistics would a direct and negative impact on the competitiveness of Indian manufacturing sector.

To follow some of the advanced principles, like JIT, etc. supply chain certainty is very important, but in India, the supply chain is very-very uncertain and delivery lead time is highest fluctuated. Therefore, to take care uncertainties of inventories is kept at each stage of the supply chain which can be directly converted into monetary terms. This again leads to poor competitiveness of Indian manufacturing sector (NMCC report, 2014).

The Modern supply chain is highly dependent on I.T. infrastructure. The success of some of the best supply chain, like Wal-Mart, Seven Eleven Japan, Dell, Amul, Asian Paints, and Maruti Suzuki, etc. is attributed to other I.T. infrastructure (Delloitte, 2014). In India, I.T. infrastructure plays an important role. The use of the internet is also increasing and users of smart phone are also increasing.

But, we are using I.T. infrastructure for basic services like email and chatting. The use of this I.T. infrastructure was vast presented in real time information sharing is possible and that will actually change the entire supply chain working of Indian manufacturing sector.

In India, manufacturing industries have different supply chain issues, which is lacking global competitiveness because of many factors, including like lack of advanced technology, lack of capital, lack of willingness and some supply chain issues are also contributing to the poor performance. The few issues of supply chains are delayed supply, unwarranted cost escalation, building production capabilities, distribution networks and retail outlets, etc. would adversely impact the credibility and business potential of the Indian industry. To overcome these issues, Indian companies have must recognize the difference between supply chain execution and supply chain optimization as well as focus efforts on optimizing operations to become more efficient (Dewangan et al., 2015d). Amongst many difficulties faced by Indian manufacturers, supply chain disruption management is a major issue, which can result in large tangible and non-tangible losses. In the current study, lots of research has been done to understand the supply chain management is and how it will enhance the competitiveness of the manufacturing sector in today's global competitive environment. Similarly, there are many other issues in the supply chain of Indian manufacturing, which will be discussed in chapter-2 which is from available literature.

1.3. Leading Examples of Manufacturing Sector Prosperity through Supply Chain (Global)

As discussed previously, some of the companies have achieved global success because of their supply chain initiatives or supply chain strategy. Countries like the United States, Japan, China, Singapore and Europe, etc. are the best examples of the supply chain management. The international companies like Wal-Mart (United States), Dell Computer (United States), Seven-Eleven (Japan), and China Mobile Communications Corporation, Singapore Technologies Engineering (Singapore), Volkswagen (Germany), BMW (Germany), Bosch (Germany), etc. and

Indian companies like Amul, Mumbai Dabbawala, Indian Post, Asian Paints and Maruti Suzuki, etc. are the leading examples of manufacturing sector prosperity through the supply chain (globally). The few companies like, Wal-Mart (United States), Dell Computer (United States), Seven-Eleven (Japan), have described below:

Wal-Mart (United States)

Wal-Mart is one of the fortune 500 companies which is at the top of the list since 1962, years (World Bank Report, 2014). The Wal-Mart is known for everyday low pricing strategy (World Bank Report, 2014). The everyday low pricing is only possible when carefully controls the inventory. It is said that Wal-Mart turns its inventory 11 to 12 times a year (World Bank Report, 2014). This high inventory turn is possible with a well designed supply chain. The supply chain network of Wal-Mart. Wal-Mart in all to achieve a high level of supply chain integration right from the point of sells to its vendors. Wal-Mart is un-doubtable is a leading example of business performance through supply chain performance.

Dell (United States)

Dell is one of the leading company which is at the top of listed company since 1983. The corporate headquarters of Dell's is located in Round Rock, Texas, near Austin, which is also home to Dell Americas, the regional business unit for both North and South America. The Dell Company has three additional regional head regional headquarters: Dell Europe, Middle East and Africa in Bracknell, U.K., Dell Japan in Kawasaki, Japan, and Dell Asia-Pacific in Hong Kong. In the year 1991, Dell had sales offices in 33 countries and sold its products in more than 170 countries and territories (World Bank Report, 2014). Dell Company has good supply chain to deliver their products to customers within the time frame. The supply of Dell Company is shown in Figure 1.1.

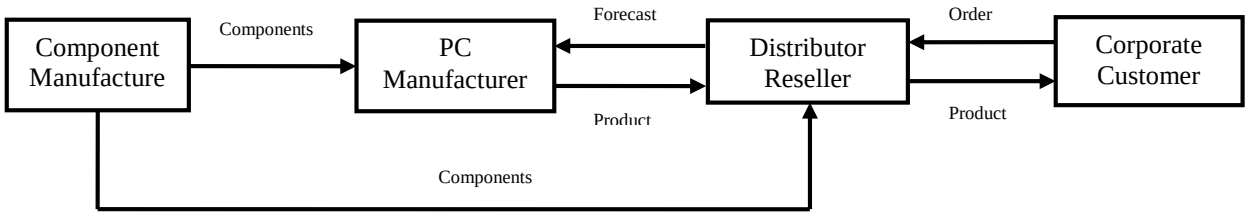


Figure 1.1. Dell's Company Supply Chain

Seven-Eleven (Japan Company)

The Seven Eleven is a Japanese company and it was established in the year1973. The company was set up his first store in Koto-Ku, Tokyo, in May 1974. The distribution system of Seven Eleven is tightly linked the entire supply chain for all product categories (World Bank Report, 2014). The company has their own distribution system to deliver their products. The distribution system was flexible, so that it is very helpful to the end customers.

1.4. Problem Statement

Over the past three decades, manufacturing sectors relied merely on the competitiveness based on the traditional dimensions such as cost, quality, services, flexibility, etc., (Singh *et al*., 2008; Carpinetti *et al*., 2000; Dacko, 2000). Most of the literature shows that these traditional dimensions are not much sufficient to obtain the competitive performance in today's environment (Liu, 2013). A variety of integrated systems have been proposed to overcome the limitations of the traditional competitive dimensions, but these traditional competitive dimensions have not fulfilled the requirements for present scenario of manufacturing competitive environment in the global market (Liu, 2013). Relatively, manufacturing companies focused on monitoring and controlling to optimize the overall competitiveness and simultaneously addressing the dynamic change of the competitive environment (Liu, 2013). As a result, many of the researchers and practitioners are suggesting new manufacturing competitive performance dimensions. In the field of business studies, the competitiveness of manufacturing sector is one of the most important themes.

Supply chain management is one of the important elements in the success of any company. The best examples of International companies like Wal-Mart (United States), Dell Computer (United States), Seven-Eleven (Japan), and China Mobile Communications Corporation, etc., and Indian companies like Amul, Mumbai Dubbawala, Indian Post, Asian Paints and Maruti, etc., have already proved the efficiency of supply chain performance. India's supply chain infrastructure consisting of surface transportation, warehouses, and other facilities are being always under question. This is also affecting performance and competitiveness of Indian manufacturing sector. Development of manufacturing sector only in a limited part of the country is because of poor supply chain management infrastructure in other parts of the country. It is, therefore, proposed to do a detailed study around enhancing competitiveness of Indian manufacturing through better supply chain management. The main research problem studied in this thesis can be defined as

"***Does being to enhance the manufacturing competitiveness is profitable in Indian context"*** ? Hence, the research proposal is presented to serve this issue as follows:

- To investigate the supply chain management (SCM) performance factors, by identifying the factors to measure the SCM performance, the priorities of these factors can be identified in the context of the manufacturing sector.
- To investigate the manufacturing competitiveness factors, by identifying the factors to measure the manufacturing competitiveness, the priorities of these factors can be identified in the context of the manufacturing sector.
- To develop a model for SCM performance, to measure the SCM performance in context of the Indian manufacturing sector.
- To measure the impact of SCM performance on manufacturing competitiveness. The proposal of this research will definitely help for the practitioners, academicians, decision makers, and research scholars in the field of manufacturing competitiveness. The root cause for the same are as follows:
- First, this research helps to contribute to the body of literature.
- Second, this research provides the literature and fill the gaps in the existing literature.
- Third, this research will give the directions for practitioners, academicians, decision makers, and research scholars, etc., who wants to improve SCM performance and to enhance the manufacturing competitiveness with different dimensions in the company.
- Fourth, it will be given the transparent and crisp guidelines to set the benchmark for the manufacturing sector.

1.5. Motivation for Research

The manufacturing sector is considered as spinal column of the Indian economy, because the economic strength of a country is measured by the development of manufacturing sectors. The manufacturing sector contributes 15.24 per cent of the country's Gross Domestic Product (GDP), and provides employment to over 6 million persons (NMCC, report 2014). Nowadays Government of India try to enhance the competitiveness of the manufacturing sector, including identification of manufacturing sectors which have the potential for global competitiveness; current strengths and constraints of identifying sectors, and recommend National level industry/sector specific policy initiatives as may be required for augmenting the growth of the manufacturing sector. The main

aim is that to enhance the manufacturing competitiveness through a number of involvement that help these enterprises to modernize and become competitive in global markets.

1.6. Why Manufacturing Sector?

The manufacturing sector is considered the backbone of Indian economy. The major sectors include textiles, capital goods, metals, chemicals, tires, cement, electronics, automotive, leather & footwear, machine tools, Food, Ceramics, Textiles, Machinery, etc. The economic potential of any country is measured by the development of manufacturing sectors. Why the manufacturing sector is a spinal column of development in general and economic development in India? According to NMCC report (2014), the same causes are as follows:

- Manufacturing industries help in modernizing agriculture, which forms the backbone of our Indian economy.
- Manufacturing industries also reduce the heavy dependence of people on agricultural income by providing them jobs in secondary and tertiary sectors.
- Industrial development is a precondition for elimination of unemployment and poverty from our country.
- Countries that transform their raw materials into a wide variety of finished goods of higher value are prosperous.
- Industry sector contributes 27 % of GDP out of its manufacturing accounts for 17 %.

1.7. Research Questions

Research Question: How supply chain performance is effecting the enhancement of competitiveness of the manufacturing sector in India?

On the basis of this research question, five sub research questions have been formulated. These research questions, provide the proper direction to attain the objectives of the study. These research questions are:

***RQ 1*:** What are the various factors and items considered by the company while choosing supply chains?

RQ 2: What are the various factors and items considered by the company while choosing manufacturing competitiveness

***RQ 3*:** What is the relationship and priority level of the factors and dimensions of supply chain performance in context of the manufacturing sector?

***RQ 4*:** How these identified factors influence to enhance the manufacturing competitiveness?

***RQ 5*:** What is the impact of supply chain performance on manufacturing competitiveness?

To achieve the objective of these research questions some objectives have been formulated as follows in the next section.

1.8. Research Objectives

In the present scenario, the growing importance of the manufacturing competitiveness issue in a gradually changing business environment, the assessment of supply chain management and its impact on manufacturing competitiveness has been identified as an important issue that needs to be studied. From the rigorous literature review, various gaps have been identified in supply chain management and manufacturing competitiveness, the topic of the present study is finalized as "*Enhancing the competitiveness of manufacturing sector through supply chains in India* ". This research is based on six main objectives. These are as follows:

Objective1: To analyze the supply chain management related issues in the context of the manufacturing sector.

Objective 2: To analyze the manufacturing competitiveness related issues in the context of the manufacturing sector.

Objective 3: To analyze the eco-innovation related issues in the context of the manufacturing sector.

Objective 4: To analyze the supplier selection related issues in the context of the manufacturing sector.

Objective 5: To develop a model for measuring the manufacturing competitiveness in the Indian manufacturing sector.

Objective 6: To investigate the impact of supply chain performance on manufacturing competitiveness in Indian manufacturing companies.

1.9. Thesis Organization

The section represents the organization of the present research work, it has been enclosed in seven chapters as shown in Figure 1.2. A brief flow of chapters has been described under as follows:

Chapter 1

This first chapter provides a background of the present study. It also gives provides the information regarding the SCM performance and its impact on manufacturing competitiveness. Further, this chapter provides a problem statement, research objectives and research questions, motivation for research, brief outlines of the research methodology adopted, and finally it provides the overview of research. This chapter gives the brief outlines of the research work followed by the conclusion of the chapter.

Chapter 2

This chapter provides the extensive literature review in the field of SCM performance and its relationship with manufacturing competitiveness related to both Indian and global scenario. The present chapter deals with various latent factors and their sub-factors like environmental uncertainty, factors of SCM Practices, eco-innovation, factors of SCM performance, supplier selection and factors of manufacturing competitiveness, etc. The literature review also gives the strong foundation for conducting the present study and other related areas that need to be explored. This chapter provides, the taxonomical classification of existing research in this field of study. Further, different gaps from the literature, which gives the objectives of this study. For the achievement of the different objectives, this chapter provides a novel methodology and finally end with a conclusion.

Chapter 3

This chapter deals with the combination of comprehensive SCM performance and manufacturing competitiveness model designed for enabling better and more well-organized. To better understand the phenomenon of SCM performance and manufacturing competitiveness, a theoretical framework has been drawn, and it helps to predict the relationships between SCM performance and manufacturing competitiveness. Finally, a research model has been obtained, which is more significant to enhance the manufacturing competitiveness of an organization.

Chapter 4

This chapter provides a knowledge of developing the scale to measure the manufacturing competitiveness in Indian context. This chapter deals with the outlines of a quantitative research, conducted for measurement of manufacturing competitiveness. The research question, research hypothesis, and research methodology adopted has been discussed. Finally, research methodology which includes research design, sample design, data collection method, scale development, pilot testing, data collection and analysis process and an overview of proposed statistical techniques was discussed.

Chapter 5

This chapter provides the procedure of data collection via, a large-scale survey after item generation, and structured interview. The collected data from a large-scale survey is useful for the validation of the instrument development, and to test the hypothesized relationships among variables in the research model. The research methodology for the large-scale survey, research design, data collection methods, questionnaire design, sampling design, data analysis procedure and demographic profile of the respondents and companies has been discussed. Further, data analysis has been performed with different steps like, check for the discriminant and convergent validity, test of reliability, and exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of all reflective scales in the model.

Chapter 6

This chapter presents a brief background causal model and hypothesis testing. To explore the significance of these hypothesized relationships, a structural equation modeling (SEM) has been used for testing the hypotheses (Joreskog, 1993). A proposed structural model has been tested and the overall goodness-of-fit of the entire structural equation model will be assessed as well.

Chapter 7

This chapter provides a comprehensive overview of the research work conducted and the major findings along with the contribution, of the present study in the existing set of literature. In addition, this chapter also provides the managerial implication of the present study. Finally, it provides the limitation of the study followed by the future scope of this field study. The organization of the thesis with the help of flow diagram has been presented as shown in Figure 1.2.

1.10. Conclusion

In the changing business environment, companies understand the importance of the manufacturing competitiveness issues. To enhance the manufacturing competitiveness practices is always creating a dilemma for the academics and practitioners. The impact of SCM performance on manufacturing competitiveness with new dimensions are still inconclusive in the existing literature. In the present scenario, there is need of attention to make further assessment, which may help to both academicians and practitioners and research scholar, to analyze the various aspects of SCM performance and its impact on manufacturing competitiveness with new dimensions in Indian context. The outline of the present study has been provided in this chapter. The chapter started with the background of the present study, which is related to various dimensions of supply chain management and manufacturing competitiveness, and the problem statement, motivation for research has been discussed. The various research gaps in existing literature have been outlined. In this chapter, research objectives and questions followed by the methodology adopted and overview of research has been provided. In the last section of this chapter, the thesis organization with the help of flow diagram has been presented. Hence, the sections presented in this chapter have been discussed further in details in the subsequent chapters of the thesis.

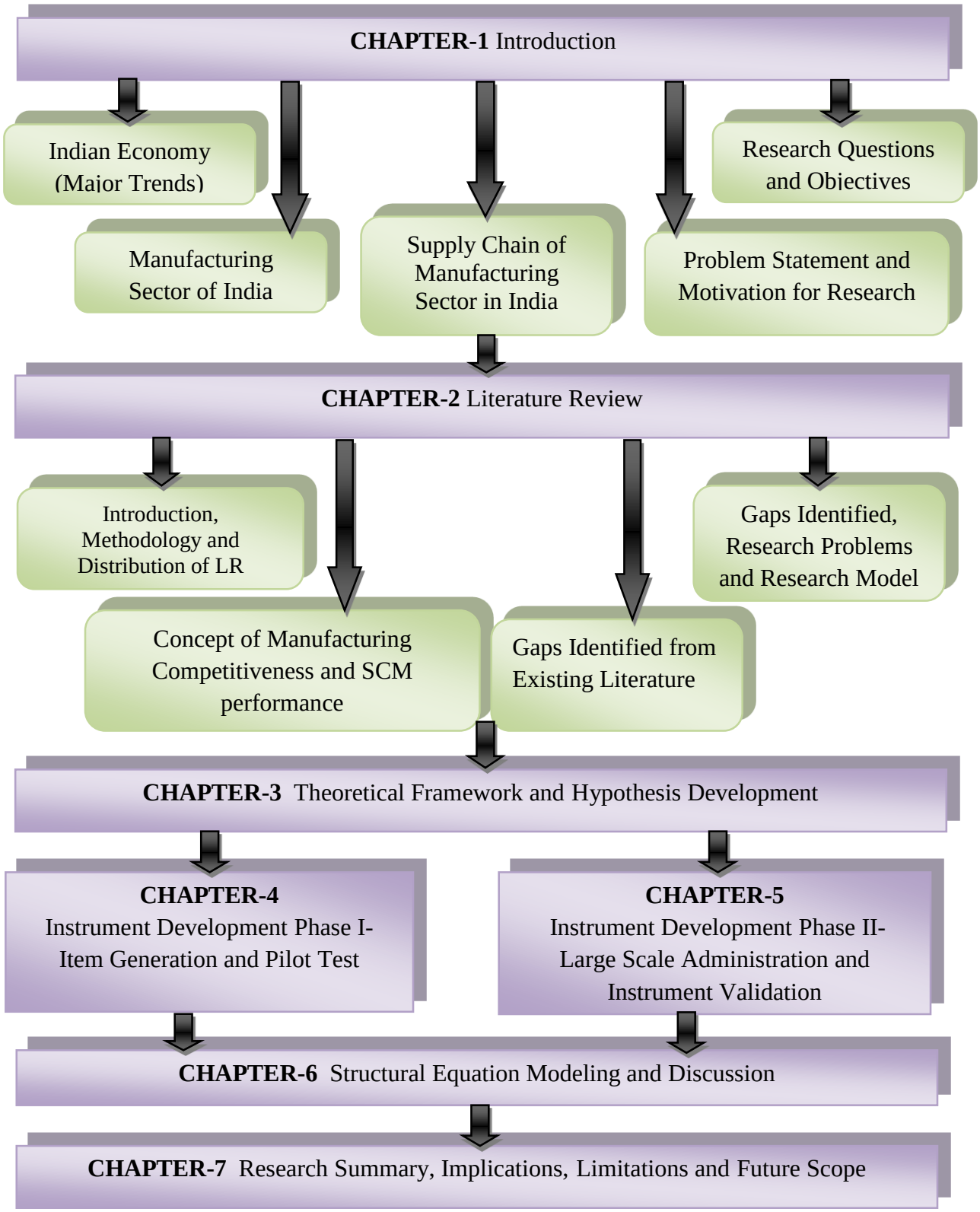


Figure 1.2 Organization of Thesis

CHAPTER – 2
LITERATURE REVIEW

Preview

Literature Review is a backbone if a sound research. A systematic literature review is a prerequisite for defining the research problems to various into various smaller problems.

Presently, with the availability database of various publishing houses, literature review has become quite convenient. But, the field of supply chain management thousands and thousands papers are available. So, it is very important to identify right papers for a particular study. Here, it is also important, not to miss any important research in the area.

The present chapter deals with various issues like Environmental Uncertainty, factors of SCM Practices, Eco-Innovation, factors of SCM performance, Supplier Selection and factors of Manufacturing Competitiveness, etc. the research approach, and avenues for future research. This review will also provide a strong foundation for conducting the present study and other areas that need to be explored.

2. Introduction

This chapter presents a systematic literature review of various aspects of supply chain management, which affects the competitiveness of the manufacturing sector. Some of the factors which are considered for identification of the right kind of papers are environmental uncertainty, SCM Practices, eco-innovation, SCM performance, supplier selection and manufacturing competitiveness, etc. Similarly, this chapter also presents the view of various researches and experts in the field of manufacturing competitiveness.

With the changing landscape of manufacturing dominance, shift of markets from the west to the east and the ability of the manufacturer to be located in any part of the world has made the competition among nations to create and maintain their manufacturing sector very competitive. The business environment is continuously changing due to increasing global inter-connectivity, growing demand for innovation (Raymond et al., 2014; Lau et al., 2013; Heaton, 2008) and technology (Rahman, 2001; Kleindl, 2000), new product development (Bruch et al., 2014; Schrettle et al., 2014; Suárez-Ortega and Alamo-Vera, 2005) rapidly dropping cost of key technologies, shifting basis of competition and unemployment. The need of the hour is for innovation (Raymond et al., 2014; Lau et al., 2013; Yam et al., 2011; Rahman, 2001), effective

technologies (Liu, 2013), manufacturing flexibility (Hung et al., 2014) and reconfiguration of capabilities in the manufacturing sectors (Chengen, 2000). Amoako-Gyampah (2003) argued that the manufacturing function should be strategized at the corporate level rather than the operational level.

The competitiveness of the manufacturing sector has been always an important priority for the top management of every organization. During the period of the industrial revolution, competitiveness was measured against high volume of production and a lot of focus was given, to maintain the activities in the organizations for manufacturing competitiveness (NMCC report, 2014).

Then, Japanese manufacturing sector given a new dimension of competitiveness (Cleveland et al., 1989). This new dimension was primarily around quality, excellence and later on there was a complete system of Japanese manufacturing management, where industrial revolution is about superior quality, reduced based, reduced inventory, better co-ordination with vendors, etc. Japanese were very open to document their management practices and soon these sound practices of competitiveness were adopted by many American and European companies. Later, a new wave of manufacturing competitiveness came from the Chinese manufacturing sector. The Chinese manufacturing sector found on low cost dimensions for competitiveness and throughout the globe. Their strategy of low cost and new production has benefited them to increase their manufacturing output.

But, as Japanese practices are well documented same is not true for Chinese case. Presently, the manufacturing sector is passing through a tough time where on one hand, they have to fulfill the customer expectations and on the other hand manufacturing should environmental friendly to minimize the negative effects of production processes. Therefore, it is a need for attention to understand the important factors affecting the competitiveness of manufacturing sectors in the present scenario.

Supply chain management is basically transferring of goods, services, information and finances between various strategies of the supply chain. But, as we are moving more and more towards the competitive environment. Supply chains can offer a competitive advantage for the firm. Therefore, systematic literature review of the supply chain is required.

A steady stream of research, mainly conceptual in nature, followed Skinner's article. From last two decades, It has been observed that a huge quantity of research has strengthened with growing sophistication. Skinner (1969) arguments and refined their conceptualization on a large number of literature on manufacturing strategy (Swamidass and Newell, 1987; Gupta and

Somers, 1996; Ward and Durray, 2000; Dangayach and Deshmukh, 2001a). In addition, a taxonomic classification of literature is provided to understand the growth of literature in this field of study.

2.1 Literature Review at a Glance

An extensive literature review has been carried out, to gain insights in the area of manufacturing competitiveness in the context of Indian manufacturing sector. The literature is broadly classified into nine main categories: (a) background (b) methodology of literature review (c) final selection of identified papers (d) distribution of articles (e) concept of manufacturing competitiveness (f) evolution of supply chain (g) supply chain management theory (h) supply chain definition (i) supply chain in the 21st century (j) constructs of SCM and manufacturing competitiveness (k) gaps identified from literature (l) research problems (m) research model. These broad classifications were further sub classified according to the structure shown in Figure 2.1. Based on the findings of the literature review, a research model has been proposed for future research. This complete literature review provides an overview of the various aspects of manufacturing competitiveness and supply chain performance to help both researchers and practitioners.

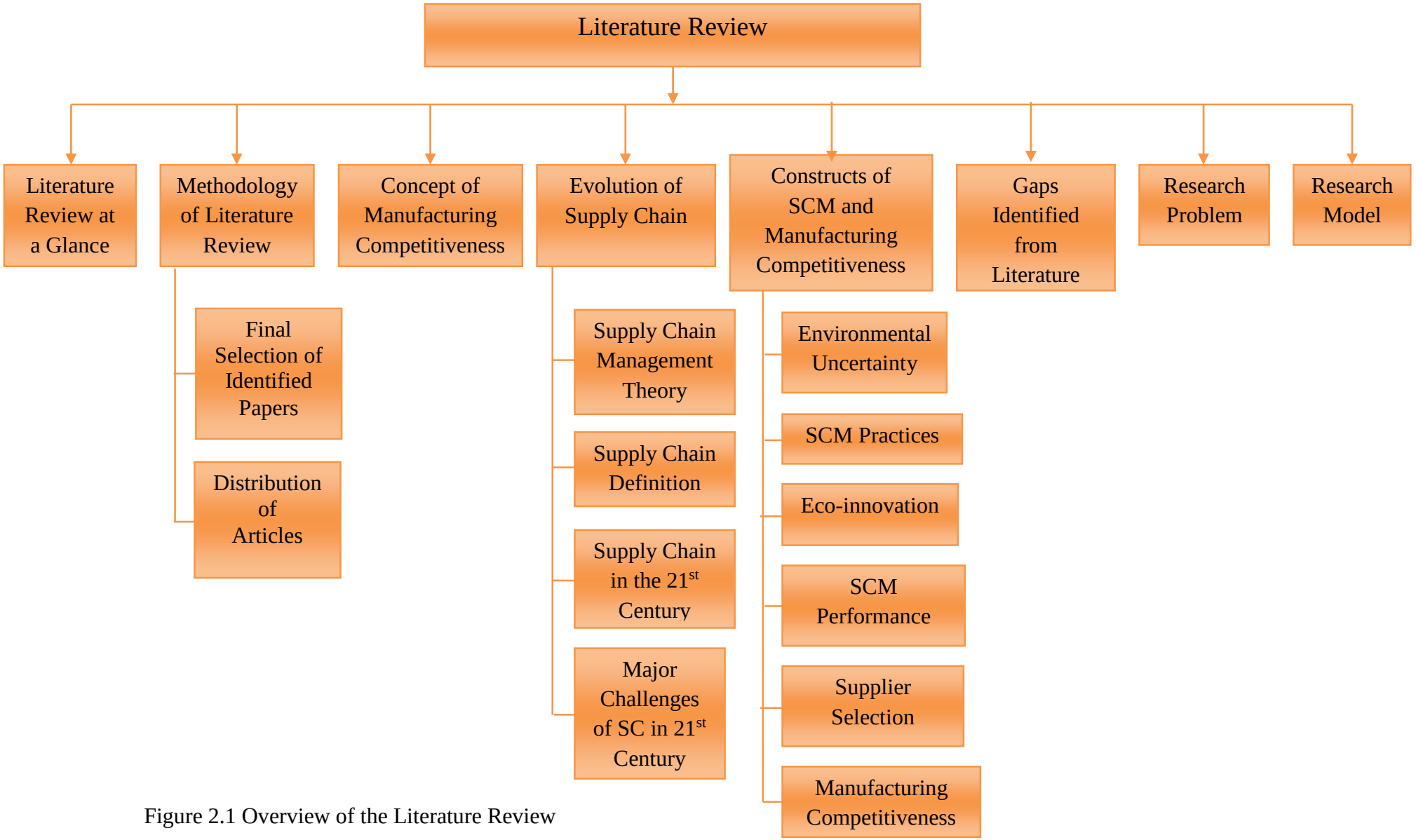


Figure 2.1 Overview of the Literature Review

2.2 Methodology of Literature Review

For, getting the derived result from literature review, various electronic databases were searched. According to Ngai (2005), maximum number of people, including both practitioner and an academician, use journals to gather the information. In order to collect the research papers for the review, a rigorous search was carried out using the following online databases:

- EBSCO Business Source Premier
- Elsevier (www.sciencedirect.com)
- Emerald Full Text (www.emeraldinsight.com)
- Inderscience (www.inderscience.com)
- John Wiley Publication (www.wiley.com)
- JSTOR
- Sage Publications
- Scopus (www.scopus.com)
- Springer (www.springerlink.com)
- Taylor and Francis (www.tandfonline.com)

In this research, content analysis is used for systematic literature review. Content analysis is defined as "the objective, systematic, and quantitative description of the manifest content of a communication" (Malhotra and Dash, 2009).

For the purpose of the literature review, not only papers above database were used, but also various reports, publications, various consultancy papers, textbook, master and doctoral dissertation and government reports, etc. were also considered (Garg et al., 2011; Nord and Nord, 1995).

A period search was restricted from 1990s to March, 2015. The reason for taking 1990 as the starting period is very simple, this way the time when the Indian manufacturing sector becomes liberalized, globalized and issues related to competitiveness (Garg et al., 2011). Indian manufacturing started testing serious discussion of competitiveness of the manufacturing sector. The government of India in the year 2000 started the sign of the most important infrastructure projects such as construction of golden quadrilateral, construction of new wide highways, etc. (references), started the boost the manufacturing sector through the supply chain.

An advance search, within the preview of present title, was carried out using different combination of words such as, 'Manufacturing', 'Manufacturing Strategy', 'Competitiveness',

'Competitive priorities', along with 'Manufacturing Strategy and Competitiveness ' for searching the papers. The research was further extended using keywords such as 'Manufacturing and Supply Chain Management' and 'Manufacturing and Supply Chain Operations', 'Supply Chain Performance', 'Supply Chain in 21st Century', were used.

2.2.1 Final Selection of Identified Papers

For a better exploration of the field, the references of the remaining papers were also taken into consideration according to the year of their publication. Subsequently, the outlines of the selected papers were thoroughly examined. Around, 380 research papers were identified using this research criteria. After identifying 380 research papers, it was a Herculean task to go through all these papers. Therefore, one more criteria to filter the papers was adopted. The minimum criteria of a paper 10 for its including in the current study. Accordingly, 113 papers were selected which have their citations equal to 10 or more than that. These papers has been tabulated for further classification as shown in Table 2.2.

After the selection of papers, full paper was thoroughly studied for further categorization. The analysis of literature paper is based on various parameters. All 113 papers were classified into the following four time periods of publication. The main cause of this distribution was to help in the longitudinal study of manufacturing competitiveness and supply chain management literature. These articles were analyzed on the basis of different criteria (as shown in the flow chart (Figure 2.2).

i. Period I: 1994-1999
ii. Period II: 2001-2005
iii. Period III: 2006-2010
iv. Period IV: 2011- July 2015

2.2.1.1 Distribution of Article in terms of Time Period

The distribution of articles in different time periods shows the growth of studies on manufacturing competitiveness in different time spans. This classification of articles on the basis of different time span is to understand the quantitative improvement in the research studies in the study phase. The flow chart of literature classification is shown in Figure 2.2. The distribution of published articles by period wise is shown in Figure 2.3. Out of total 113 articles only 3.81 % were published in the period between 1994 and 1999. The contribution increased in the next period (2000-2005) to a considerable level of 12.38 %. Publications in the next four

periods (2006-2010) are 24.76 %. The publications in the next four periods (2011-July, 2015) are 66.67 %. It has been observed in the literature, healthy growth in the number of publications in the first decade of the 21st century. Publication of volume in the time interval (2011-July, 2015) is more than approximately 17 times than the time interval 1994-1999 (Figure 2.3).

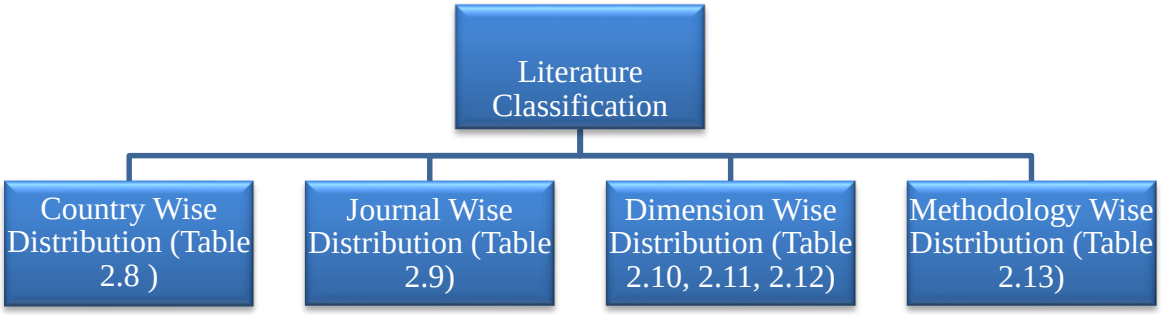


Figure 2.2 Flow Chart for Literature Classification

2.2.1.2 Period Wise Classification in terms of Country

The classification of literature by country wise is very crucial to identify the seriousness of the research for this critical issue across the globe. Future research could be focused on the unexploited part of the globe to sensitize the issue of manufacturing competitiveness. During the study period 1994-July, 2015 maximum number of articles related to manufacturing competitiveness and supply chain are publication of authors based in developing countries United States, United Kingdom, India, Taiwan, Malaysia, etc., as shown in Table 2.1. There is crunch of research studies related to manufacturing competitiveness and supply chain from other countries, especially developing countries like India (Mishra and Suar, 2010).

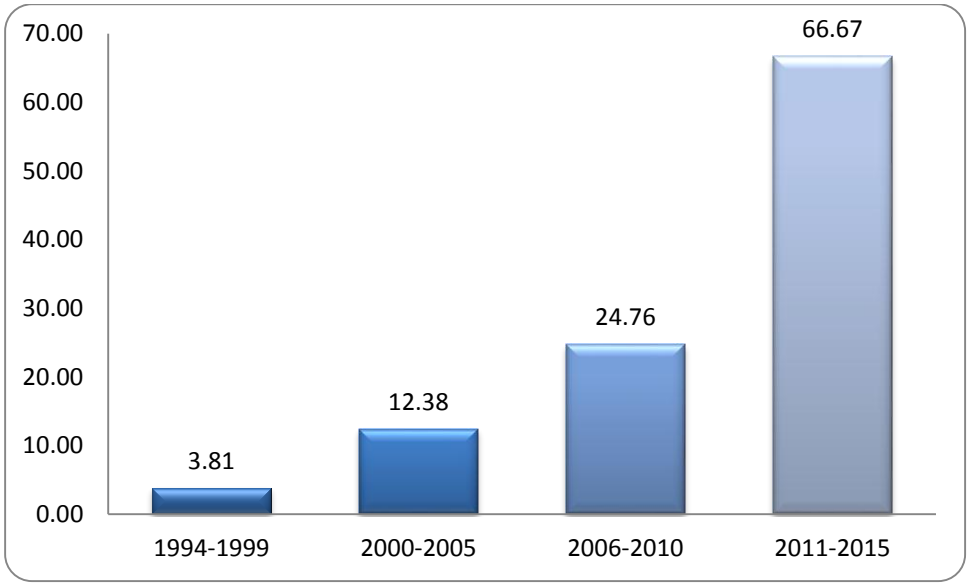


Figure 2.3 Distribution in Terms of Time Period

Table 2.1 Country Wise Distribution

Country	1994-1999	2000-2005	2006-2010	2011-2015	Total
Australia	....	....	4	1	5
Canada	....	....	3	....	3
China	....	....	6	....	6
Cuba	1	....	....	....	1
France	....	2	....	....	2
Germany	....	....	5	....	5
Hong Kong	....	....	6	....	6
India	....	....	....	8	8
Ireland	....	2	....	....	2
Italy	1	....	....	....	1
Japan	....	3	....	....	3
Malaysia	....	....	....	6	6
Mexico	....	1	....	....	1
Singapore	1	....	....	....	1
South Korea	....	3	....	....	3
Sweden	....	2	....	....	2
Switzerland	1	....	....	....	1
Taiwan	....	....	....	7	7
United Kingdom	....	....	2	16	18
United States	....	....	....	32	32
Total	4	13	26	70	**113**

2.2.1.3 Distribution of Articles in terms of Journals

The articles related to manufacturing competitiveness and supply chain are widely published in various reputed journals in earlier mentioned databases. There are total 61 journals have been published which are related to issues studied in the given time frame. Maximum numbers of journal papers are published in International Journal of Production Economics. The list of publications along with the number of articles as shown in the Table 2.2.

Table 2.2 Journal Wise Distribution

Source Title	No of Publications
Applied Economics	1
Applied Geography	1
Asian Textile Journal	2
Australian Journal of Basic and Applied Sciences	2
Benchmarking	1
Business Process Management Journal	1
Canadian Journal of Administrative Sciences	1
Colourage	1
Computers and Industrial Engineering	1
Economic Geography	2
Engineering Construction and Architectural Management	1
European Journal of Development Research	1
European Journal of Operational Research	3
European Planning Studies	2
Industrial Management and Data Systems	4
International Journal of Operational Research	1
International Journal for Quality Research	1
International Journal of Business Information Systems	1
International Journal of Business Performance Management	1
International Journal of Clothing Science and Technology	3
International Journal of Electronic Customer Relationship Management	1
International Journal of Information Management	1
International Journal of Innovation and Learning	1
International Journal of Lean Six Sigma	1

International Journal of Logistics Management	3
International Journal of Logistics Systems and Management	1
International Journal of Manufacturing Technology and Management	1
International Journal of Operations and Production Management	1
International Journal of Physical Distribution and Logistics Management	1
International Journal of Production Economics	11
International Journal of Production Research	9
International Journal of Risk Assessment and Management	1
International Journal of Service Industry Management	1
International Journal of Services and Operations Management	1
International Journal of Technology Management	3
Issues in Science and Technology	1
Journal Engineering Manufacture	1
Journal of Applied Sciences	2
Journal of Cleaner Production	3
Journal of Economic Studies	1
Journal of Enterprise Information Management	1
Journal of Fashion Marketing and Management	2
Journal of Industrial Engineering and Management	1
Journal of International Management	1
Journal of Japan Industrial Management Association	1
Journal of Manufacturing Science and Engineering	1
Journal of Manufacturing Technology Management	1
Journal of Operations Management	2
Journal of Product Innovation Management	1
Journal of Quality in Maintenance Engineering	1
Management Science	1
Omega	2
Production Planning and Control	3
Quality Access to Success	1
Research for Rural Development	1
Strategic Management Journal	1
Supply Chain Management	7

Technological Forecasting & Social Change	1
Technology in Society	1
Technovation	5
The International Journal of Management Science.	1
Transportation Journal	1
Total	**113**

2.2.1.4 Dimension Wise Classification in terms of Author and Year

It has been observed in previous literatures, manufacturing competitiveness dimensions are used by the different authors in different years. In this study author's are choosing those journal papers in which dimensions are used which is related to manufacturing competitiveness. The dimensions are commonly used during the time period from 1975 to 1995 are cost, quality, reliability and flexibility, etc., as shown in Table 2.3.

Table 2.3 Dimension wise Distribution-I

S. No.	Author's Name	Dimensions				
		Year	Cost	Quality	Reliability	Flexibility
1.	Utterback and Abernathy	1975				✓
2.	Skinner	1978	✓	✓	✓	✓
3.	Wheelwright	1978	✓	✓	✓	✓
4.	Buffa	1980	✓	✓	✓	✓
5.	Wheelwright	1984		✓		
6.	Fine & Hax	1985	✓	✓	✓	✓
7.	Hill	1985	✓		✓	✓
8.	Richardson et al.	1985	✓	✓	✓	✓
9.	Ferdows et al.	1986	✓	✓	✓	✓
10.	Schoeder et al	1986	✓	✓	✓	✓
11.	Swamidass	1986	✓	✓	✓	✓
12.	De Meyer & Ferdows	1987				✓
13.	Ferdows & Lindberg	1987				✓
14.	Horte et al.	1987		✓		
15.	Swamidas and Newell	1987	✓	✓	✓	
16.	Lindberg et al.	1988			✓	
17.	Miller & Roth	1988	✓	✓	✓	✓
18.	De Meyer et al.	1989	✓	✓		

19.	Shroeder et al.	1989				✓
20.	Ferdows & De Meyer	1990	✓	✓	✓	
21.	Galbraith	1990				✓
22.	Lindberg	1990				✓
23.	Marucheck	1990	✓			
24.	Reitsperger & Daneil	1990		✓		
25.	Tunalv	1990	✓	✓	✓	✓
26.	De Meyer & Ferdows	1991	✓	✓		
27.	Horte et al.	1991	✓	✓	✓	✓
28.	Lindberg & Trygg	1991			✓	
29.	Hum & Leow	1992	✓	✓	✓	✓
30.	Corbeet & Wassenhove	1993	✓	✓	✓	
31.	Garvin	1993		✓		
32.	Fry et al.	1994	✓	✓		
33.	Neely et al	1994	✓	✓	✓	✓
34.	Sweeney	1994	✓	✓	✓	✓
35.	Williams et al.	1995		✓	✓	✓

***Source**: Adapted from Fang and Wang (2006)*

Apart, from that the dimensions are commonly used during the time period from 1996 to 2011 are cost, quality, reliability, flexibility, delivery, innovation, time, services, dependability, speed, production range, new product, customer focus and efficiency, etc. Since, their analysis was limited to 1995, the most recent studies, starting from 1996 onward, were scanned to identify the manufacturing competitiveness dimensions currently being proposed in the literature. Hence, the authors used different new dimensions are delivering, innovation, time, services, dependability, speed, production range, new product, customer focus and efficiency, etc. The findings are given in Table 2.4.

After, the year 2011, there is a drastic change in the manufacturing dimensions, which are used by the different authors, the dimensions are effective technologies, new product development, information sharing, continuous improvement and competitive pressure, etc., But, it has been observed that the dimensions which are also commonly used in this year 2011 are cost, quality, flexibility and delivery, etc., as shown in Table 2.5.

Table 2.4 Dimension Wise Distribution-II

S. No.	Author's Name	Dimensions														
		Year	Cost	Quality	Reliability	Flexibility	Delivery	Innovation	Time	Service	Dependability	Speed	Product Range	New Product	Customer Focus	Efficiency
1.	Kim & Arnold	1996	✓	✓		✓	✓									
2.	Krajewski & Ritzman	1996	✓	✓		✓			✓							
3.	White, G. P.	1996	✓	✓		✓			✓							
4.	Morita, M. et al.	1997	✓	✓		✓			✓							
5.	Avella et al.	1998	✓	✓		✓	✓			✓						
6.	Joseph	1999	✓	✓		✓					✓	✓				
7.	Santos	2000	✓	✓		✓	✓									
8.	Boyer & Pagell	2000	✓	✓		✓	✓									
9.	Fernando C.A. Santos,	2000	✓	✓		✓	✓									
10.	Ward & Duray	2000	✓	✓		✓	✓									
11.	Ling X.	2000	✓	✓		✓	✓									
12.	Kathuria	2000	✓	✓		✓	✓									
13.	Ward and Duray	2000	✓	✓		✓	✓									
14.	Dangayach & Deshmukh	2001	✓	✓			✓									
15.	Devaraj et al.	2001	✓	✓	✓		✓						✓			
16.	Boyer and Lewis	2002	✓	✓	✓		✓						✓			
17.	Amoako-Gyampah	2003	✓	✓		✓	✓									
18.	Demeter	2003	✓	✓		✓	✓									
19.	Brown & Bessant	2003				✓	✓	✓								

20.	Dangayach & Deshmukh	2003	✓	✓		✓	✓						✓	✓		
21.	Fai Pun, K	2004	✓	✓		✓	✓				✓					
22.	Devaraj et al.	2004	✓	✓		✓	✓	✓								
23.	Chan and Chan	2005	✓	✓		✓	✓									
24.	Osmanagic, Prester, & Podrug	2005		✓			✓	✓		✓						
25.	Takala et al.	2006	✓	✓		✓	✓				✓	✓				
26.	Kazan, Ozer, & Cetin	2006	✓	✓		✓	✓									
27.	Hallgren & Olhager	2006	✓	✓		✓	✓	✓								
28.	Takala et al.	2007	✓	✓		✓									✓	
29.	Taps & Steger-Jensen	2007	✓	✓		✓	✓									
30.	Theodorou & Florou	2008	✓	✓		✓				✓						✓
31.	Amoako-Gyampah & Acquaah	2008	✓	✓		✓	✓									
32.	Kathuria et al.	2010	✓	✓		✓	✓									
33.	Kristal, M. M. et al.	2010	✓	✓		✓	✓									
34.	Hallgren et al.	2011	✓	✓		✓	✓									
35.	Peng and Lai	2011	✓	✓		✓	✓									

Source: By Authors

Table 2.5 Dimension Wise Classification-III

S. No.	Author's Name	Dimensions						
		Year	Innovation	Effective Technologies	New Product Development	Information Sharing	Continuous Improvement	Competitive Pressure
1.	Yam et al.	2011						✓
2.	Bloom et al.	2011	✓					✓
3.	Kristianto et al.	2012	✓		✓			
4.	Martin, Ben R.	2012	✓	✓	✓			
5.	Thorgren, et al.	2012	✓		✓			
6.	Geum et al.	2013		✓				
7.	Lau et al.	2013	✓	✓				
8.	Frésard et al.	2013	✓	✓			✓	
9.	Tripathy et al.	2013			✓	✓		
10.	Raymond et al.	2014	✓					
11.	Bruch et al.	2014	✓		✓			
12.	Schrettle et al.	2014	✓	✓	✓			
13.	Jaca et al.	2014		✓			✓	
14.	McLean et al.	2014		✓			✓	
15.	Huo et al.	2014				✓		

Source: By Authors

2.2.1.5 Distribution of Articles in terms of Methodology Adopted

The classification of articles in the terms of methodology is more transparency for the researches. This classification criteria will help the future practitioners and researchers to identify the with changes in the methodologies adopted for the manufacturing competitiveness. The articles have distributed in the terms of methodology adopted, it is found that there is a lack of theoretical research in all time intervals between 1994 and July, 2015 (Table 2.6). Very few studies are published on the aspect of conceptualization of manufacturing competitiveness and supply chain with new dimensions and its impact on both financial and non-financial performance of firms.

Table 2.6 Methodology Wise Distribution

		1994-1999	2000-2005	2006-2010	2011-2015
Empirical	Uni variate (%)	25	54.21	36.8	25.16
	Multi variate (%)	65	34.23	35.9	40.34
Theoretical (%)		10	11.56	27.3	34.5

Among the various articles, the authors identified, out of total 113 articles the empirical study, i.e., (uni variate - 25%), (multi variate - 65%) and theoretical 10% were only published in the period between 1994 and 1999. The contribution increased in the next period (2000-2005) to a considerable level of empirical study, i.e., (uni variate - 54.21%), (multi variate - 34.23%) and theoretical 11.56%. Publications in the next four periods (2006-2010) are of empirical study, i.e., (uni variate - 36.8%), (multi variate - 35.9%) and theoretical 27.3%. The publications in the next four periods (2011-July, 2015) are of empirical study, i.e., (uni variate - 25.16%), (multi variate - 40.34%) and theoretical 34.50%. This is shown in Figure 2.4.

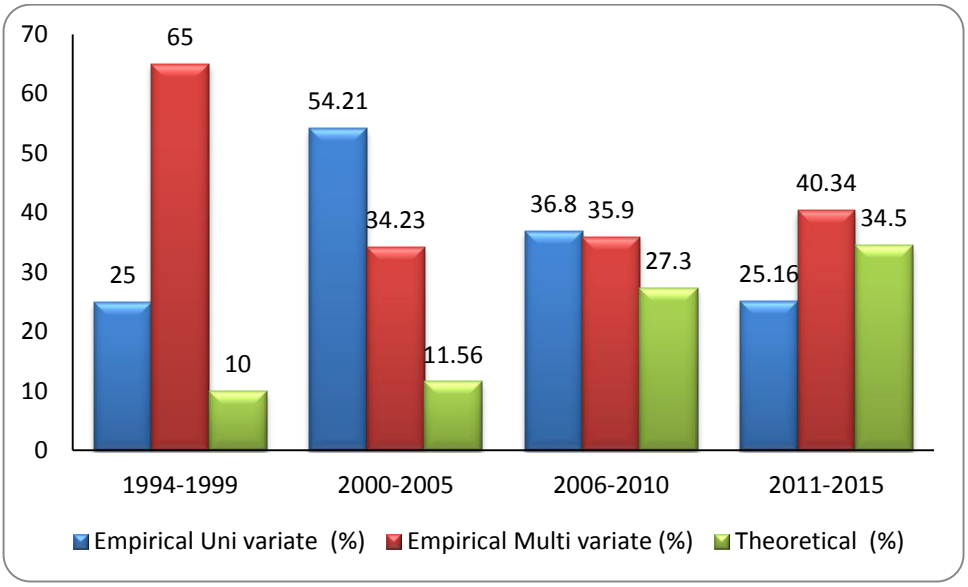


Figure 2.4 Distribution in Terms of Methodology

2.3 Concept of Manufacturing Competitiveness

The research on manufacturing competitiveness started debatably with the determining work on the competitiveness of nations by Porter (1996), who defined national competitiveness as an outcome of a nation's ability to innovate achieve, or maintain, an advantageous position over other nations in key industrial sectors. Competitiveness also provides the relationship between the productions of goods as well as better quality and services, so that the product and

services of the companies is standing in the global market. Some contributions on manufacturing competitiveness of the authors are described below:

Tefertiller and Ward (1995) presented the relationship between the competitiveness, productivity growth, quality differences, prices, cost of production and distributions, market's ability, etc. Boltho (1996), focused on differentiated between the short-run and long- run competitiveness of nations. He presented the short-run international competitiveness as the milestone of the genuine replacement tempo of internal and external balance with suitable policies of domestic, whereas the longer-run international competitiveness is the production of highest possible growth of well matched with exterior balance. Manufacturing competitiveness is totally depends upon the different industries, levels in the country, competing both in domestic and international markets, industry level competitiveness generally consigns to the capability of enlarging in size of the industries, and spread out its globally as well as profit share of the global market (Clark et al., 2005). In addition, many authors have focused on determining the national manufacturing competitiveness and other factors of competitiveness that can be affected to manufacturing industries to stabilize in the global market.

The literature shows that most of the researchers and practitioners have been debated on manufacturing strategy and defined the manufacturing strategy, some of the definitions are as follows: Manufacturing strategy is defined as "the competencies that a firm develops around the operations function" (Amoako-Gyampah, 2003). These competencies are meant to achieve competitive advantage (Anderson *et al.,* 1989). Skinner (1969) defined manufacturing strategy as the "set of manufacturing system design aspects managers (must) decide on" (Cagliano et al., 2005).

Hayes and Wheelwright (1984) define manufacturing strategy as "a consistent pattern of decision- making in the manufacturing function linked to the business strategy". Swamidass and Newell (1987) describe manufacturing strategy as "a tool for the effective use of manufacturing strengths as a competitive weapon for achievement of business and corporate goals."

Cox and Blackstone (1998) consider manufacturing strategy as "a collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources. To be most effective, the manufacturing strategy should act in support of overall strategic directions of the business and provide for competitive advantages."

Platts *et al.* (1998, p. 517) develop a working definition: "a pattern of decisions, both structural and infrastructural, which determine the capability of a manufacturing system and

specify how it will operate, in order to meet a set of manufacturing objectives which are consistent with the overall business objectives." A brief overview of the definitions of the manufacturing strategy proposed in the literature is given in (Table 2.7).

Table 2.7 Manufacturing Strategy Definitions

Skinner, 1969	Exploiting certain properties of the manufacturing function as a competitive weapon
Hayes and Wheelwright, 1984	A sequence of decisions that over time, enables a business unit to achieve a desired manufacturing structure, infrastructure and set of specific capabilities
Fine and Hax, (1985)	It is a critical part of the firm's corporate and business strategies, comprising a set of well-coordinated objectives and action programs aimed at securing a long-term sustainable advantage over competitors
Swamidass and Newell, 1987	The effective use of manufacturing strengths as a competitive weapon for the achievement of business and corporate goals
McGrath and Bequillard, 1989	The overall plan as to how the company should manufacture products on a worldwide basis to satisfy customer demand
Swink & Way, 1995	Decisions and plans affecting resources and policies directly related to sourcing, production, and delivery of tangible products
Berry *et al.* (1995)	The choice of the firm's investment in processes and infrastructure that enables it to make and supply its products to chosen markets
Cox and Blackstone, (1998)	A collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources. To be most effective, the manufacturing strategy should act in support of the overall strategic directions of the business and provide for competitive advantage
Brown, (1999)	A driving force for continual improvements in competitive requirements/priorities and enable the firm to satisfy a wide variety of requirements.
Ward and Duray, (2000)	Manufacturing-oriented dimensions that win orders
Cagliano *et al.* (2005)	The configuration of strategic priorities the manufacturing system does or will pursue
Miltenburg, (2008)	A plan for moving a company from where it is to where it wants to be.
Chung and Swink (2009),	The patterns of advanced manufacturing technology utilization and manufacturing capabilities is very useful to sustain in the global market.
Kathuria et al. (2010)	The unorganised manufacturing units use very low level of technology, which causes low productivity, low profits and stagnation of the sector. There is unanimous evidence to claim that the factor productivity in the unorganized manufacturing sector in India is very low.
Saikia, (2011)	The unorganised manufacturing sector of India is huge and quite diversified, including a wide range of manufacturing units, dispersed all over the country both in rural and urban areas.
Zhen, (2012)	The manufacturing implies with Service-Oriented Manufacturing (SOM).

	This strategy is a new manufacturing mode by integrating servitization with the traditional manufacturing industry. The advantages and importance of the SOM strategy are gradually recognized by more and more enterprises. The SOM helps in decision making within the suitable price scheme.
Kim et al. (2013).	The impact of manufacturing flexibility and technological dimensions of manufacturing strategy on responsiveness in the supply chain. Based on the theoretical background of dynamic capability, this study also examines the role of the business environment on the relationship between manufacturing flexibility and supply chain responsiveness.
Kara et al. (2014)	Improved environmental performance of products and services have lately become one of the main strategic and operational goals of manufacturers. This is due to influences from various stakeholders including government, consumers, societies and the business partners
Yusup et al. (2015).	Recognising the internal influences brought by lean in manufacturing practices, this article focuses on how the convergences in lean philosophies are able to contribute in establishing a sustainable manufacturing practice.

***Prepared By**: Authors*

2.4 Evolution of Supply chain

The supply chain concept was first introduced by J. W. Forrester in a 1958 article published in *Harvard Business Review*, who wrote "Management is on the verge of a major breakthrough in understanding how industrial company success depends on the interaction between the flows of information, materials, money, manpower, and capital equipment" (Forrester, 1958, p. 37).

Forrester's focused on the production distribution system, i.e., factory, to an inventory point, i.e., factory warehouse then to a distributor and retailer, which is finally viewed as a customer or end user which is shown in Figure 2.5. The material flow shown in solid lines, whereas information flow shown in dash lines.

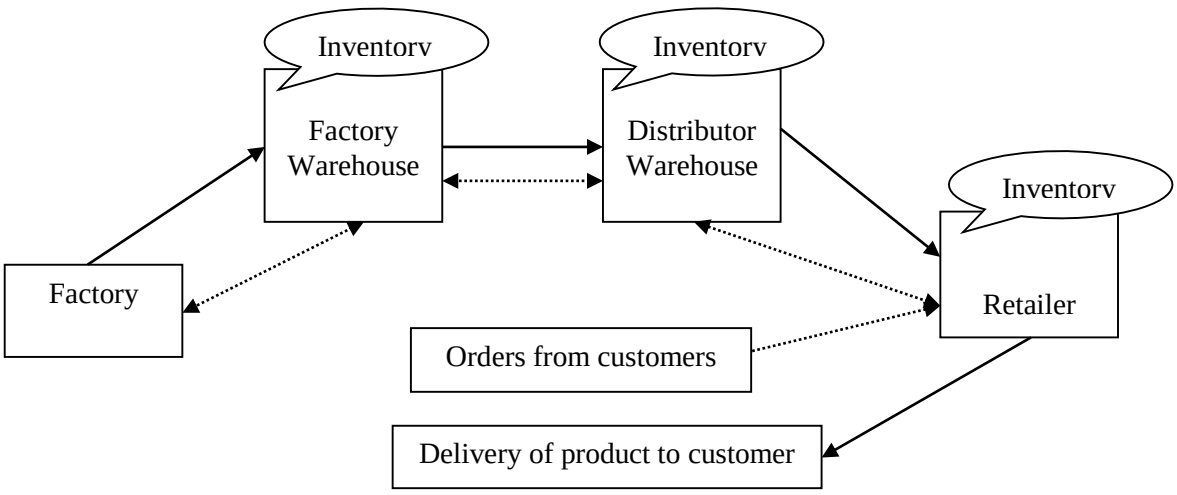


Figure 2.5 Organization of production-distribution system Adapted from "Industrial Dynamics" By Jay W. Forrester, 1958 Harvard Business Review, 37,p. 41.

Early supply chain view only on production, distribution, inventory placement, and information flows, not the delivery of material to produce the product. Forrester (1961) focused very specific point on his book that company success or failure, it totally depends upon the integration of the information flow, orders, materials, money, personnel, and capital equipment, etc. Quinn (1997) focused on the three phases of a supply chain, there are as follows:

Phase-1 is known as push period which focused on inventory and the physical distribution of finished product. The push period is occurrence from 1965 to 1975, in which companies sought to manage work-in-process and raw material levels. The output of manufacturing company was "pushed" with the objective of balancing the finished goods warehouses, production output as well as customer satisfactions.

Phase-2 is occurring from 1975 to 1990, during this phase the manufacturing company was objective to achieve an integration of operational activities within the organization. The company was more focused on the use of computer software packages to track their production system, inventory system, material flow system, and also concentrated on materials management systems. Apart from this company focused on the inventory products, in which inventory shifted from pushing products into the marketplace by allowing the market to pull material when it was needed.

Phase-3 is started later in 1980s, which is overlapping phase-2. In phase-3, most of the companies realize that productivity increases and efficiency required for the integration and management relationships, information flow and material flow outside of the organization. Hence, the efficient flow of commodities, services and information throughout the supply chain increases, customer satisfactions and economic values.

To illustrate the importance of SCM in the overall performance of the organization (Lummus & Vokurka, 1999), suggested the exchangeable of American Textile and Apparel industry. The industry was facing increased worldwide competition in the late 1980s. One of the problems was excessively high time to deliver the customer's order. Usually, it was testing 66 weeks to deliver customer order, out of which award around 44 weeks times was spent in the waiting at warehouses or in transit processes. This resulted in the excessively high cost of inventory and it impacted directly competitiveness of textile industry. To overcome, this situation system like quick reports was introduced. The quick response system was very effective as it was working with the collaboration with suppliers and retailers. Tools such as Universal Product Code Electronic Data Interchange (EDI), point of sales system, etc., were also installed to effectively achieve the result of quick response strategy. This helped industry

to reduce inventory levels in the supply chain up to 37% with a savings of 24 billion to 30 billion dollars.

This achievement of apparel industry initiated interest of many practitioners in different supply chain solution. Practitioners as well as academicians started giving practical and theoretical development of this field.

A supply chain is a network consisting of suppliers, manufacturers, distributors or intermediaries, and customers. Jain et al. (2010) reviewing 588 articles, which are related to supply chain management and provided a comprehensive definition of supply chain management.

This definition suggests, the need to combine activities within and between organizations as a part of the supply chain integration process (Alfalla-Luque, et al., 2013). In the last decades, organizations managed their supply chain by adopting the supply chain network, either performing backward integration with their upstream partners, forward integration with their downstream partners, or both (Simchi-Levi et al., 2003).

In the 1990s intensified and markets became global, so there are lots of challenges associated with getting a good product and service to the right place, at the right time at the cheapest cost. The organizations are realizing that it is not enough to improve efficiencies within an organization, but the whole supply chain has to be competitive. Hence, maintain close relationships, a long term-term for both customers and suppliers can take significant wastes out of the supply chain, and it is a very valuable way for securing competitive advantage (Porter, 1985; Spekman et al., 1998a). Nowadays understanding and practicing supply chain management has become an essential prerequisite to sustain in the competitive global market and to grow profitably (Garwood, 1999). The director of strategic planning of Hewlett-Packard Corporation stated by: “we need to become expert at working with partners efficiently to manage our assets. SCM skills are critical for us to achieve our profit growth and market share objectives” (O’Connell, 1999). The prime source of competitive advantage is to coordinate of complex global networks of the organizational activities in which suppliers and customers are interlinked throughout the supply chain network. Furthermore, understand the entire details of supply chain management, there are different theories have offered insights into how and why different supply chain management practices appear and for understanding the significance of these practices for the efficiency and competitive advantage of an organization. This chapter will first discuss the theories addressing the rationale of supply chain issues, followed by the identification and discussion of various constructs of supply chain management.

2.4.1 Supply Chain Management Theory

The theory of a subject is guiding principle for implementation of that philosophy (Chopra and Sunil, 2011, Fisher, 1997; Lamming, 1996). A supply chain consists of all stages involved, directly or indirectly, to fulfill the demand of the customers. The supply chain not only includes the manufacturer and suppliers, but also transporters warehouses, retailers, and customers themselves. A typical supply chain may involve a variety of stages such as:

- Customers
- Retailers
- Wholesalers/distributors
- Manufacturers
- Component/raw material suppliers.

The basic idea of SCM theory revolves around co-ordination between various actors of the supply chain. The various actors are vendors, OEM, whole seller, retailers and finally customers. To achieve the integration of various technologies, particularly information technology related solutions are now it is used. Now a day, there are mainly two actors are most important for supply chains, information technology (IT) and original equipment manufacturer (**OEM**).

Now a day's information technology (IT) is permeating to the entire the supply chain at each and every point. IT is transforming the accurate data and formed linkages among entire processes in the supply chain. To create an effective network within the supply chain the role of IT is very important (Van Hoek, 1998). IT also enhance the efficiency of the supply chain by providing real-time information regarding product availability, inventory level, shipment status, and production requirements (Verwijmeren et al., 1996). IT has a vast potential to facilitate collaborative planning among supply chain partners by sharing information on demand forecasts and production schedules that dictate supply chain activities (Van Hoek, 1998). IT has played an important role to replace the inventory with perfect information.

The original equipment manufacturer (**OEM**) converted the semi-finished product to the finished products that can be shipped to a distributor to customers, which is shown in figure 2.3 who then sell the finished products to the end user. The entire configuration shows that an integration of organizations to provide a material flow from raw material suppliers to OEMs and finally to the end users along with the related information flow. It is also very important

that information flow can focus on information from customers, such as customer forecasts, product returns and information on satisfactory or dissatisfactory related to the product. Meanwhile, OEMs can focus on information regarding demand, inventory levels, and change in designs, etc. It is also important to consider the information flow upstream and downstream in the entire supply chains. Stonebraker & Liao (2006) focused on information flow, OEMs and suppliers are interlinked and efficiencies, enhance through better planning and faster responses to changes.

The other school of thoughts of SCM is to create supply chains surplus. The supply chains surplus is difference of revenue generated from the supply chains, cost of offering the products or services. This school of thoughts focuses on cost reduction through the supply chain. The revenue cannot be altered much as revenues are directly proportional to the price of the product and which is governed by market mechanisms. This philosophy of supply chain incorporates integration of cost cutting by implementing the optimized inventory management, transit routing, collaborating forecasting.

The other way of understanding a supply chain process is push -pull system. In a supply chain, there are certain processes which can be started in anticipation, these are known as push process. There are few processes which are started after a particular incident or we can say that these are reactive in nature, these processes are pull processes. The push-pull of the supply chain are shown in Figure 2.6.

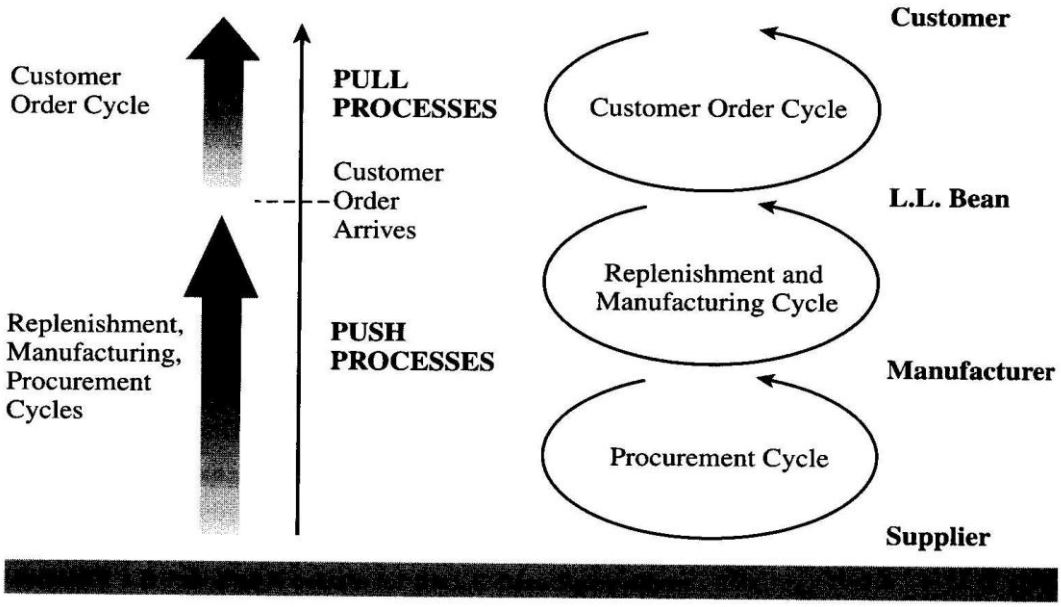


Figure 2.6 Push-Pull of Supply Chain

The other way of understanding the SCM is based on cyclic processes. Each stage of the supply chains can be considered as a series of activities are performed between any two stages

Process View of a Supply Chain

A supply chain is a sequence of processes and flows that take place within and between different supply chain stages and combine to fill a customer need for a product. There are different views of this process:

Cycle view: The cycle view of supply chain process is divided into a series of cycles, each performed at the interface between two successive stages of a supply chain. The following process is Cycle View of Supply Chain Process has following cycles

- Customer order cycle
- Replenishment cycle (at retailer/distributor)
- Manufacturing cycle (distributor/manufacturer)
- Procurement cycle (manufacturer/supplier)

The information flows from top to bottom and the product flow from bottom to top as shown in Figure 2.7.

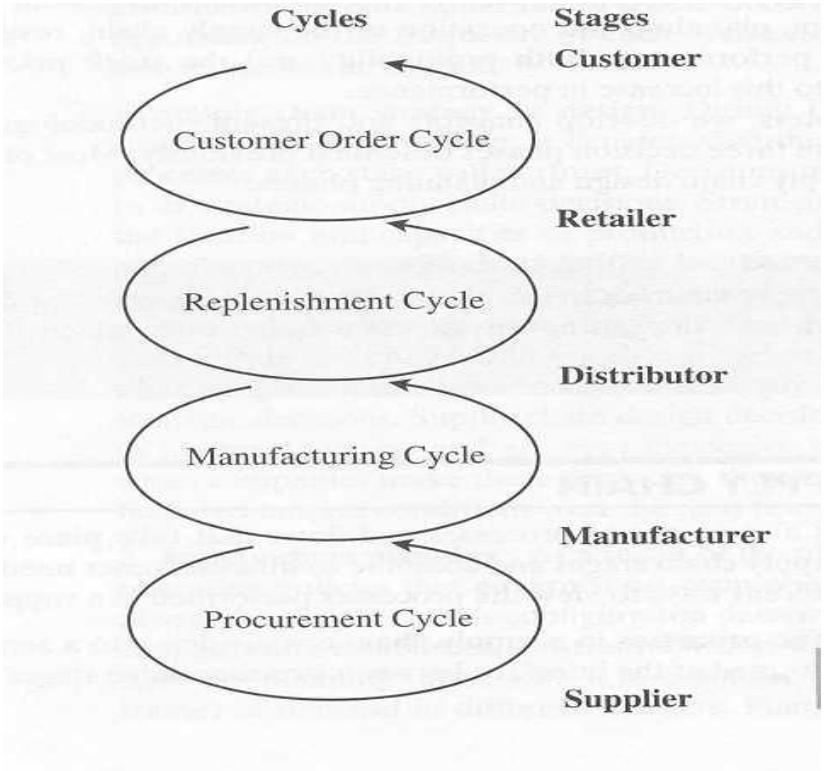


Figure 2.7 Cycle View of Supply Chain Process

From the above definition a comprehensive view of the supply chain can be developed as shown in Figure 2.8

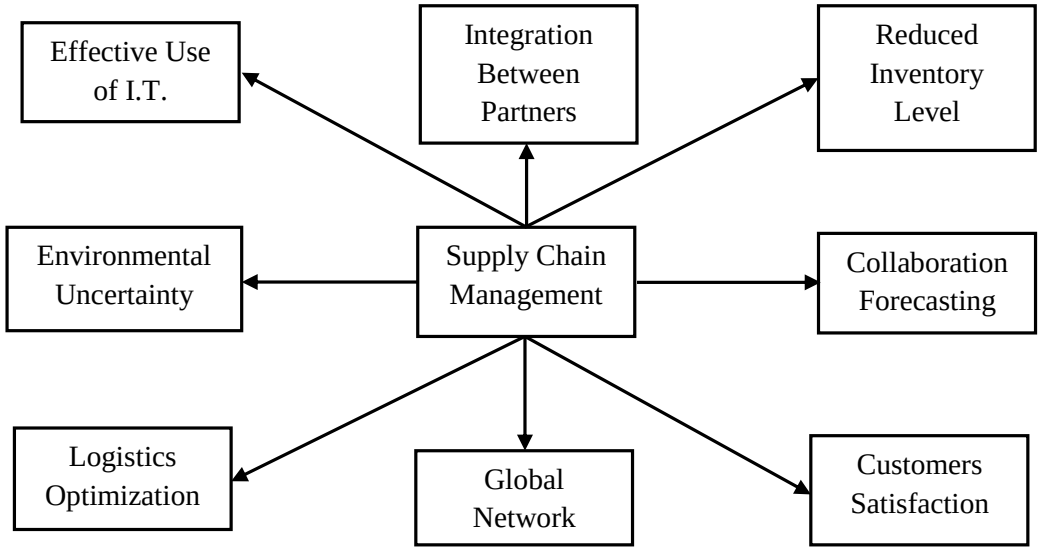


Figure 2.8 Comprehensive View of Supply Chain

2.4.2 Supply chain definition

This section provided definitions and a literature review of the supply chain. Literature shows that there are many and varied definitions of supply chain have been identified as shown in the Table 2.8.

Table 2.8. Supply Chain Definitions

Authors	Supply Chain Definitions
Jones and Riley (1985)	The planning and control of the flow of the material from suppliers to the end users are the integrative approach.
Ellram (1991)	The supply chain linkage plays an important role to deliver the product or services to fulfil the requirement of the customer demands.
Christopher (1992)	The supply chain network involved in the linkages of upstream and downstream, in different processes and activities for the production of products and services to satisfy the customer demands.
Lee and Billington (1992)	The network is also an important for the manufacturing and distribution processes to fulfil the demand of the end users.
La Londe and Masters (1994)	The supply chain is a network that passes materials from suppliers to manufacture, manufacturer to distributors and finally from distributor to end users.

Berry et al. (1994), Saunders (1994)	The main objective of supply chain management is to build the trust, information exchange, new product development, and supplier base reduction especially for OEM.
Lummus and Albers (1997)	The supply chain network is a network in which the materials are flowing from the supplier to the end customers.
Quinn (1997)	The supply chain network encompasses activities like moving of goods from suppliers to end customers. The supply chain includes sourcing and procurement of the raw materials, production scheduling, ordering and management of inventories, distributions and customer service.
Cooper et al. (1997)	The supply chain mainly defines about the products handling, physical goods, services and information.
Kopczak (1997)	The supply chain is a set of entities which includes suppliers, logistics service providers, manufacturer, distributors, products and flow of information.
Lee and Ng (1997)	The supply chain network starts with suppliers and end with the end customers. In the sight of the supply chain, information is also an important part.
Mabert and Venkataramanan (1998)	The set of supply chain is a network of facilities and activities that perform the new product development, raw materials procurement, manufacturing and distribution of finished to the end customers.
Tan et al. (1998)	The supply chain management encompasses basic raw materials to the final products. SCM directly associated with the optimum utilization of suppliers, technology and competitive advantage capability.
Lummus and Vokurka (1999)	All the activity of supply chains involved from supplier to the end customers. This process, including raw material purchasing, product manufacturing and assembling, distribution of products to the customers and most important is an information system for process monitoring.
Ballou et al. (2000)	The supply chain is directly associated with the activities like transformation of goods from suppliers to end customers.
Mentzer et al. (2001)	The supply chain is set of three entities which is directly associated with the flow of upstream and downstream of products and services, finances and right information to the end customers.
Lambert, Garcia-Dastugue, and Croxton (2005)	The composition of supply chain network is directly associated with inbound materials, inventory materials, finished goods, and distribution channels, etc.
Zacharia, Nix and, Lusch (2009)	The supply chain set is independent somewhere, but it is related to organizations share knowledge and skills to fulfil the customer needs.
Chopra and Meindl, (2010)	The activities of supply chain management are involved directly or indirectly to satisfy the customer requirements. The system includes suppliers, new product development, marketing, operations, distributions, finance and customers survives.

Wagner and Bode, (2006), Christopher et al. (2011)	The role of global supply chains was associated with interconnected with the suppliers and manufacturers, which led to higher dependency among the organizations.
Ghadge et al. (2012)	The supply chain faced different challenges like high demand variability, short product life cycle, and different expectations and by customers.
Alfalla-Luque, et al. (2013)	The supply chain integration is the best option to combine the activities with the organizations.
Roberta Pereira et al. (2014)	Due to increase the challenges of supply chains like high demand variability, less product cycle, etc. there is a need for attention to increases supply chain complexity.

***Prepared By**: Authors*

From the above definitions, the summary of supply chain appears: a supply chain is a global network of individual organizations that combine product and information, to deliver products or services, to an end customer.

2.4.3 Supply Chain in the 21st Century

During the last two decades, most of the manufacturing companies owned their own factories as well as their own production controlled. The companies had complete, detailed knowledge of the capacity, schedules, and costs of manufacturing, etc. The manufacturing companies could adapt quickly to changes in the marketplace and restore the supply/demand balance more easily.

2.4.4 Major Challenges of Supply Chain in the 21st Century

There are multiple major challenges of supply chain in 21st century. Some of few major challenges are as follows:

- Supply Chain Innovation
- New Product Development
- Environmental Pressure
- Terrorism

Supply Chain Innovation

Innovation is very important for any organizational sustainability (Drucker, 1985; Lee et al., 2011). There is a need for attention to supply chain innovation in the manufacturing sector and service sector for effective delivery of their products and services (Chapman et al., 2003; Howells and Tether, 2004). Innovation make easy for the creation of new technical skills and knowledge for the development of new products and/or services to fulfill for customers needs (Afuah, 1998). Some innovation type supply chain of are emerging for example

Alibaba.com, which is one the largest retail supply chain of the world. Similarly, companies like Uber, OLA, etc., are offering their taxi services without owning the single vehicle. The supply chain innovation consists of three major construct like supplier cooperation, supply chain efficiency, and quality management practice, etc., (Parnaby and Towill, 2008).

New Product Development (explained in section 2.5.6)

Environmental Pressure

The global phenomenon of increasing pollution is also great challenges (Thomas and Griffin, 1996; Sharma et al., 2008). It is a problem where manufacturing process processes and logistics system need to answer (Krause et al., 1998). The global community is trying to reduce the environmental pressure.

Terrorism

The present time is a time of global supply chains, where for making a mobile phone, raw materials may come from African companies. The production is done in China and product is sold in American markets. But the acts of terror create obstacle in free global trade. Presently, we see, a large part of oil producing countries are under the influence of terrorism acts, which is directly affected supply chain of crude oil at the global level. Because of acts of terror, India is not able to lay down the pipe from Iran via Afghanistan and Pakistan. There are many reported and unreported incidents of terror which affects the supply chain management.

From, the above discussions give the theoretical justification of supply chain management. The concept of SCM supports an effective and efficient form of organizing in today's competitive environment to sustain in the global market.

2.5 The Constructs of Supply Chain Management and Manufacturing Competitiveness

To better understand the antecedences and the consequences of SCM, five constructs of SCM and one construct of manufacturing competitiveness have been identified through a rigorous literature review. After, the comprehensive literature review, a research framework is then developed that illustrates the various causal relationships between these constructs. The five proposed construct of SCM and one construct of manufacturing competitiveness in this study has been described below:

i) **Environmental Uncertainty**: This construct identified as the external driving force for the SCM Practices. Due to the changing in the business environment, environmental uncertainty plays an important role for changing trends which create opportunities and threats for individual organizations.

ii) **Supply Chain Management Practices:** This construct is very important to enhance the efficiency of the SCM performance.

iii) **Eco-Innovation**

Nowadays, the business environment is rapidly changing because of the enhancing global inter-connectivity, a growing demand for innovation (Raymond et al., 2014; Lau et al., 2013) and technology (Rahman, 2001; Kleindl, 2000) and new product development (Bruch et al., 2014; Schrettle et al., 2014; Sonia and Francisca, 2005). An eco-innovation is a key driver for business success because it plays a critical role in creating and improving goods and services, developing market demand, meeting market expectations, and increasing shareholders' wealth. Hence, this construct is an important, to enhance the manufacturing competitiveness.

iv) **Supply Chain Management Performance:** This construct is very essential to enhance the overall competitiveness of manufacturing.

v) **Supplier Selection**

In today's global competitive scenario, supplier selection in the supply chain is very crucial for a competitive advantage in manufacturing sector in India. There are a wide variety of supplier selection and evaluation criteria in the supply chain for competitive advantage, due to the diversity of the purchasing context. This construct helps to enhance the manufacturing competitiveness in the Indian context.

vi) **Manufacturing Competitiveness:** This is the final construct of this study, which have an ability to achieve innovative, or maintain, an advantageous position over other nations in key industrial sectors.

All the five constructs of SCM and manufacturing competitiveness are summarized with their literature support as shown in Figure 2.1. Among all the constructs, except Eco-innovation and supplier selection, the other four constructs are higher-level constructs that are represented by various sub-constructs. The environmental uncertainty includes three sub-constructs (technology uncertainty, demand uncertainty and supply uncertainty), SCM Practices construct consists of four sub-constructs (customer relationship, information sharing, information quality, and supply chain integration), SCM performance contains two sub-

constructs (customer responsiveness and supply chain efficiency), and manufacturing competitiveness construct consists of four sub-constructs (price/cost, continuous improvement, new product development and manufacturing flexibility). The high-level constructs and sub-constructs are discussed later. Before developing measures for these variables and testing their causal relationship of the constructs, it is necessary to define and discuss these constructs in details. The following section will present a detailed existing literature review of the concerns of the six constructs proposed above. Further, on the basis of literature review nine research hypotheses have been developed, which will discuss later in the next chapter. The sixth proposed constructs and sub-construct in the model include:

a) Environmental Uncertainty
    - Technology Uncertainty
    - Demand Uncertainty
    - Supply Uncertainty
b) Supply Chain Management Practices
    - Customer Relationships
    - Information Sharing
    - Information Quality
    - Supply Chain Integration
c) Eco-Innovation
d) Supply Chain Management Performance
    - Customer Responsiveness
    - Supply Chain Efficiency
e) Supplier Selection
f) Manufacturing Competitiveness
    - Price/Cost
    - Continuous Improvement
    - New Product Development
    - Manufacturing Flexibility

The details discussion and literature review of these constructs are as shown in Table 2.9.

Table 2.9 Construct Definitions and Literature Support

S. No.	Construct	Definitions	Literature
i.	Environmental Uncertainty	Environmental uncertainty is directly associated with the creation of new opportunities and threats for the organizations	Lenz, (1980); Miller and Droge, (1986); Turner, (1993); Thomas & Griffin, (1996); Oswald et al. (1997); Burgess, (1998); Krause et al. (1998); Paswan et al. (1998); Milliken, (1987); Nahm, (2000); Fynes et al. (2004); Paulraj et al. (2007); Sharma et al. (2008);Wong et al. (2011)
ii.	SCM Practices	The SCM practices are the set of intra/inter-organization practices for the improvement of the overall performance of the supply chains within organizations.	Zielke and Pohl, (1996); Walton, (1996); Tan et al. (1998); Alvarado and Kotzad, (2001); Yew Wong et al. (2005); Wook Kim, S. (2006); Lenny et al. (2007); Sandberg et al. (2010); Talib et al. (2011); Tsireme, et al. (2012)
iii.	Eco-Innovation	The eco-innovation is directly associated with modified process, new product development, which gives effective advantage to sustain the environmental environment.	Rennings, (2000); Rennings and Zwick, (2002); Hellström, (2007); Kemp (2010); Kemp, R. (2010); Carrillo,H. et al. (2010) ; Dangelico & Remneland, (2011); Angelo, Jabbour, & Galina, (2012); Horbach et al. (2012); Lau et al. (2013); Raymond et al. (2014); Nandialath et al. (2014); Augusto et al. (2014)
iv.	SCM Performance	The overall efficiency and effectiveness of SCM.	Harland, (1996); Bechtel and Jayaram, (1997); Spekman et al. (1998); Beamon, (1999); Holmberg, (2000); Gunasekam et al. (2001); Gunasekaran, et al. (2004); Eng, T (2006); Won Lee et al. (2007); Sun, S. Y., Hsu et al. (2009); Arzu Akyuz et al. (2010)
v.	Supplier Selection	The selection of supplier is an important part in the supply chain and directly associated to enhance the manufacturing competitiveness	Dickson GW, (1966); Timmerman, E., (1986); Weber, C. et al. (1991); Ellram, L., (1995); Patton, (1996); Motwani and Youssef, (1999); Petroni and Braglia, (2000); Davidrajuh, (2003); Aissaoui et al. (2007); Chou and Chang, (2008); Andersen and Skjoett-Larsen,(2009); Ho. W, et al.(2010); Amid et al. (2011); Punniyamoorty, M et al.(2012); Kannan, D et al.(2013)
vi.	Manufacturing competitiveness	The manufacturing competitiveness has achieved, or maintain, an advantageous position over other nations in key industrial sectors.	Tefertiller and Ward, (1995); Porter,(1996); Boltho,(1996); Carpinetti et al.(2000); Dacko, (2000); Clark et al. (2005); Singh et al.(2008); Liu, (2013)

2.5.1 Environmental Uncertainty

In today's scenario, there is a drastic change in the global world and due to this customer are more demanding with better quality, higher reliability and faster deliver (Thomas and Griffin, 1996). The life of the product life cycle is shortening and product proliferation is expanding; technological developments are occurring at a faster pace, resulting in new product innovations (Pandya and Anand, 2008) and improvements in manufacturing processes. Environmental uncertainty is defined as the source of events and changing trends that create opportunities and threats for individual organizations (Sharma et al., 2008; Lenz, 1980; Turner, 1993). Hence, competitive environment needs new business and manufacturing strategies (Krause et al., 1998; Pandya et al., 1997). In the competitive environment, uncertain environment has increased the level of outsourcing and collaboration with customers and suppliers (Krause et al., 1998; Oswald et al.,1997). In the most of the operationalization, environmental uncertainty is rooted in the work (Aldrich, 1979). It has been observed from the literature, the various authors has been argued on uncertainty environment and classified the different dimensions, to measure the uncertainty environment. The different classification and their respective dimensions of the different authors are as follows:

According to the Aldrich there are five sub-dimensions of environmental uncertainty: a) capacity, b) homogeneity-heterogeneity, c) stability instability, d) concentration-dispersion, and e) turbulence. The environmental uncertainty has categorized into four sub-dimensions: diversity (among consumers), dynamism, concentration, and capability (Aldrich, 1979; Achrol and Stem, 1988; Paswan et al., 1998). After, the extending the work of Aldrich (1979), Milliken (1987) has proposed the environmental uncertainty with different dimensions like stable-turbulent, simple-complex, predictable-unpredictable, static-dynamic, non-threatening-threatening, exciting-dull, and certainly-uncertain, etc. Miller and Droge (1986) and Vickery et al. (1999) have included, volatility in marketing practices, product obsolescence rate, unpredictability of competitors, unpredictability of demands and tastes, and change in production or service modes to measure the environmental uncertainty. The factors which are responsible for the environmental uncertainties are (a) global competition increased, (b) continuous development of new technologies, (c) changing customer demand, which cause decreased product life cycles, and (d) increasing involvement of suppliers and customers in organizations (Gupta and Wilemon, 1990). Environmental uncertainty unexpected changes due to changing in technologies, competitors, suppliers and customers (Ettlie and Reza, 1992). The classification of environmental uncertainty is to identify and analyzing the impact of

uncertainty from each player in SCM Practices. Hence, environmental uncertainty is an important construct for SCM Practices. The sub-constructs for environmental uncertainty, along with their definitions and supporting literature, are as follows and shown in Table 2.10

Table 2.10 List of Sub-Constructs for Environmental Uncertainty

S. No.	Construct	Definition	Literature
a)	Technology Uncertainty	The extent of change and unpredictability of technology development in an organization's	Evan et al. (1993); Turner, J. R. (1993); Evan et al. (1993) Tan et al. (1998); Chizzo, S. A. (1998);Van Hoek et al. (1999); Tattum, (1999); Prasad & Tata, (2000)
b)	Demand Uncertainty	Demand Uncertainty associated with dynamic change and unpredictability of demand in the organizations	Lee, H. et al. (1992); Davis, (1993); Gerwin, (1993); Fisher, et al. (1997); Calantone, and Dröge, (1999). Dana, (2001); Boyaci and Gallego, (2002); Chopra, S. (2003); Alonso-Ayuso et al. (2005); Xiao and Yang, (2008); Kunnumkal and Topaloglu, (2008); Sodhi, M et al. (2009)
c)	Supply Uncertainty	Supply Uncertainty associated with dynamic change and unpredictability of supply in the organizations	Malone and Laubacher, (1999). Novack, R. et al. (1991); Davis, (1993); Parlar and Perry, (1995); Verwijmeren et al. (1996); Özekici & Parlar, (1999); Chandrasekar, S. et al. (2002); Tan, B., (2004)

The sub-constructs for environmental uncertainty has been described below:

a) Technology Uncertainty

The technology uncertainty is defined as the extent of change and unpredictability of technology development in an organization's. The development of information technology (IT) offers tremendous opportunities for organizations. The information technology plays an important role and worked as a fuel of SCM, a cause which the impact of SCM is more commanding (Chizzo, 1998). The implementation of information technology in the organization have more effective and efficient for the SCM implementation (Turner, 1993) and IT system reduced the transaction cost with respect to the flow of goods and quick fulfil the requirements of the customer's expectations. The information technology is one of the important cause to enhance the competitive advantage in the global market (Evan et al., 1993). Technology provides not just provides the opportunities, but also threats, for individual organizations. IT gives quicker response in the field of computer industry, hence many of the computer industries has invested huge of money in a new system (Prasad & Tata, 2000). The

one most useful things regarding IT is that this technology is changing the requirement of customers and changing the intimacy within the supply chain and enhance the customer expectation. Therefore, IT implies quick responsiveness and flexibility to fulfil the expectations of the customer's needs (Tattum, 1999). If companies want to survive in the global market, so they have to be changed to the new technology instead of old technology.

b) Demand Uncertainty

The demand uncertainty implies variations in customer demand and are also depends upon the source of supply-chain uncertainty. The demand uncertainty involves, unknowns associated with product characteristics or environmental factors, and this makes it difficult to predict and control the demand for a final product. In Fisher's view, the nature of the demand for the products, one's company supplies are the critical element in an analysis of demand uncertainty (Fisher, M. et al., 1997). It has been observed from earlier studies, the various authors and researchers have found the different dimensions to control the demand uncertainty within various situations, the few dimensions are as follows: the rate of new product introduction (Davis, 1993), product life cycle (Fisher, 1997; Calantone, R. et al., 1999), product variety (Fisher, 1997), lead-time from design to production (Davis, 1993; Fisher, 1997), variation of marketing product mix (Lee, H. et al., 1992), number of sales channels (Chopra, 2003), accuracy of demand forecasts (Davis, 1993; Fisher, 1997), and predictability of product demand (Chopra, 2003; Davis, 1993; Fisher, 1997; Gerwin, 1993; Calantone, R. et al., 1999).

Meanwhile, the demand of the global market becomes highly uncertain across many industries, and one of the main reasons of demand uncertainty is due to occasional factors or events. To maintain the demand uncertainty the operation managers and supply chain members have to make the decisions on the behalf of the price, production quantity, and investment based on the forecast demand (Xiao et al., 2008). The best examples, in the case of Dell, Intel provides processors for Dell PCs. An Intel company takes several weeks for manufacturing the processes, but Dell Company cannot wait that long after a customer order. The Intel Company bound to produce processors in advance. Thus, Dell and Intel Company have to make their business processes, i.e., ordering and production plans under demand uncertainty (Chopra and Meindl, 2007). The Dell and Intel Company have maintained their lead time, to maintain their business relationships. Retailers were often encouraged to place initial orders long before the products are introduced in the industries characterized by short product life cycles such as fashion apparel, toys, and computer hardware. The retail price of the products, demand of market, and cost of production is frequently uncertain when a company's determines the

decisions in product selection and plant dimensioning (Alonso-Ayuso et al., 2005). Literature shows that the retailer who bears the risk towards demand uncertainty plays a vital role in his decision on the basis of pricing, purchasing, and service investment. In the literature of economics on pricing, most assumed deterministic price-sensitive demand (Boyaci and Gallego, 2002).

c) Supply Uncertainty

By promoting coordination among several companies, supply chain management enables each of them to develop beyond what would be possible for them on their own as individual enterprises with limited resources. In the landscape of the manufacturing, supply uncertainty is the biggest problems within the supply chains. The procurement of the raw materials from suppliers or manufacturers is totally uncertain, sometimes, causes production process is affected. It has been observed from earlier studies, the manufacturers choose their suppliers on the basis of various factors like cost, quality, services, flexibility, etc. Now a day, manufacturer increases their ability to interact with a large number suppliers over the internet has considerably expanded the options available for purchasing the raw material or finished goods. The degree of uncertainty in the spot market supply is one of the main factors that should be taken into account in negotiating the capacity reservation contract. It is a very important decision for the manufacturer whether to procure the raw materials via a long-term supply chain contract with selected suppliers, or through existing spot markets without any long-term commitment. Although, manufacturer preferred long-term contract suppliers for just-in-time production and total quality management philosophies, but sometimes the manufacturer uses the existing spot markets for some immediate procurement of raw materials, so it may reduce the level of commitment. The uncertainty of supply of raw materials due to the changing in the market conditions, or delays in the suppliers' response. If the manufacturer confronted with the shortage of raw materials; they need to arrange from outside suppliers. When there is supply uncertainty of a particular raw materials or products, a manufacturer may be more willing to reserve future supplier capacity in advance and thus guarantee the availability of the input. Interruptions in supply inflows may adversely affect profitability through an increase in lost sales of the finished good. To overcome this problem, buyers can be expected to shift to long-term contracts and closer supplier relationships as the supply variability increases, as observed in the case of DuPont’s backward vertical integration with an oil supplier firm (Pyke, et al., 2003). A capacity reservation agreement between a manufacturer and a supplier involves the determination of two contract terms, i.e., capacity price and quantity. So, the manufacturer

reserves, supply capacity in advance, mainly to reduce procurement cost and delivery risk; suppliers enter these agreements because of expected increases in the utilization of their installed productive capacity. Meanwhile, the decisions of both buyers and suppliers are influenced by whether the supply of flows are reliable in the spot market, or there is some interruptions; this factor affects the resulting capacity reservation price and quantity. When the reliable source of purchasing the raw materials is the spot market, then the long -term supplier is pressured, to set a price below the spot market price. However, if the amount that can be obtained from the spot market is uncertain, the price pressure on the long-term supplier is reduced, and the contract negotiations occur under less favorable conditions for the buyer. The literature shows, the author's discussed on uncertainty in supply availability in the future. Parlar et al. (1995) focused on the model in which the probability of the supplier being available in a particular period depends on the availability status of the supplier in the previous period. Özekici and Parlar (1999) extend this model to the case of multiple supply environments with a different probability for supplier availability in each environment. Tan (2004) focused on the manufacturer-subcontracting system in which the subcontractor is unavailable to the manufacturer for a random duration. The literature reveals that the supply uncertainty is also due to the failure to deliver the customer requirements in time. It may be caused by a malfunctioning production process at the supplier, late delivery due to unexpected weather conditions, or unacceptable quality of the delivered products (Davis, 1993; Van der et al., 1996). The supply uncertainty is also related to unpredictable and uncontrollable factors in the supply of materials (Davis, 1993). Generalizing from the earlier studies, many facts in the supply process must be considered when determining supply uncertainties, such as frequency of changing suppliers of critical materials (Novack, R. et al., 1991; Reve, T. et al., 1982), complexity of critical materials (Lau, G. et al., 1999; Malone, T. et al., 1987; Van der et al., 1996), complexity of procurement technology for critical materials (Novack, R. et al., 1991), time specificity of materials procurement (Van der et al., 1996; Chandrasekar, S. et al., 2002), delivery frequency of critical materials (Novack, R. et al., 1991; Reve, T. et al., 1982), delayed delivery of critical materials (Davis, 1993; Novack, R. et al., 1991), and fluctuations in the selling price of critical materials (Lau, G. et al., 1999; Chandrasekar, S. et al., 2002).

2.5.2 Supply Chain Management Practices

Nowadays, the industries have erased the traditional corporate boundaries so, the organizations, distracted from their suppliers and customers. The organization realizes that if

they work closely with the suppliers and customers, they will get better opportunities for all concerned. SCM practices, focused on the new opportunities for differentiation and performance improvement (Nishat et al., 2006b; Zielke and Pohl, 1996). Walton (1996) presented the five basic dimensions of SCM partnership: Planning, sharing of benefits and burdens, asset specificity, operational information exchange, and extendedness. It has been argued that the various authors and practitioners are using different dimensions to measure the SCM practices, some of them are discussed below: Donlon (1996) focused on the latest evolution of SCM, which includes outsourcing, continuous process flow, cycle time compression, supplier partnership, and IT sharing. Tan et al. (1998) focused on the purchasing, quality, and customer relations to represent SCM practices in their empirical study. Alvarado and Kotzad (2001) presented an organization's improvement with respect to supply chain improvement is due to the following reason: evidence of duplication effects by concentrating on core competencies; use of inter-organizational systems such as EDI; and eliminate inventory levels which is unnecessary by postponing customization toward the end of the supply chain. The best supply chain practice involves in coordinating the flows of materials and information among suppliers, manufacturers and customers, and implementing product postponement and mass customization in the supply chain (Nishat F. et al., 2006a; Tan, 2001). In total, four major sub-construct of SCM practices are projected and discussed below. The list of four sub-construct of SCM practices along with their definitions and supporting literature are presented in Table 2.11.

Table 2.11 List of Sub-Constructs for SCM Practices

S. No.	Construct	Definitions	Literature
a)	Customer Relationships	The customer relationships implies to manage the complaints of customers, make a strong bond of relationship and to satisfy customer expectations.	Mandal, P. (2014); Mandal and Bhattacharya, (2013a; 2013b); Wines, (1996); Aggarwal, (1997); Noble, (1997); Tan et al. (1998); Magretta, (1998a); (1998b); Claycomb et al. (1999); Bommer et al. (2001)
b)	Information Sharing	The information sharing implies to manage the right information within the organizations and their trading partners.	Balsmeier and Voisin, (1996); Towill, (1997); Monczka et al. (1998); Vokurka & Lummus, (2000); Lancioni et al. (2000); Ballou et al. (2000); Mentzer, (2000); Yu et al. (2001); Humphreys et al. (2004); Chopra and Meindl, (2007); Zhou and Benton, (2007); Carr and Kaynak, (2008)

c)	Information Quality	The information sharing implies to manage the exchange of information quality with time and adequate and credible.	Berry et al. (1994); Alvarez, (1994); Metters, (1997); Lee et al. (1997); Mason-Jones and Towill, (1997); Monczka et al. (1998); Chizzo, (1998); Jarrel, (1998); Holmberg, (2000)
d)	Supply Chain Integration	The supply chain integration implies the composition of all activities like supplier, manufacturer, distributors and end customers.	Stock et al. (1998); Stevens, (1990); Wood, (1997); Frohlich & Westbrook, (2001); Narasimhan and Kim, (2002);

The sub-constructs SCM Practices has been described below:

a) Customer Relationships

Customer relationships implies the practices to manage complaints of customers, build up long-term relationship with customers, and enhance satisfactions of customer (Mandal and Bhattacharya, 2013a; Tan et al., 1998; Claycomb et al., 1999; Aggarwal, 1997). Customer relationship management is one of the most significant practices in supply chain (Noble, 1997; Tan et al., 1998). The mass customization and personalized service are enhancing due to customer relationship, and that's why customer relationship is becoming a very crucial for the financial status of an organization (Wines, 1996). Tan et al. (1999) focused on the upstream and downstream of SCM practices in which the key dimensions of the supply chain practice involve the suppliers are in upstream and customer integration are in downstream. Customer relationship management work as an internal component of a marketing strategy to increase sales and profit of an organization (Mandal, 2014; Bommer et al., 2001). The main goal of customer relationship is to understand the customer needs and requirements (Aeron et al., 2012). Customer relationship management allows an organization to distinguish its products from competitors and radically spread the value it provides to its customers (Aeron et al., 2010; Magretta, 1998a) and sustain customer reliability. Customer relation practices are responsible for managing the whole supply chain and internal performance of the organization (Mandal and Bhattacharya, 2013b; Deshpande et al., 1993). The product and services, customization are performed within the distribution channel to enhance the customer satisfaction (Aeron et al., 2008; Lee and Billington, 1995).

b) Information Sharing

In the landscape of the 21st century global marketplace, the organizations are connected through electronically and dynamic and try to enhance their overall competitiveness in the terms of flexibility, responsiveness, operating strategy, methods and technologies that comprise the supply chain implementation paradigm and information technology (Zwass, 1996), in order to compete in the world wide (Gunasekaran et al., 2004). To enhance the overall efficiency and competitiveness, SCM is an increasingly applied operations paradigm (Gunasekaran et al., 2004). Merely, a question arises within the SCM window frame, whether it is possible to achieve the SCM effective and efficient, without information technology? The answer is that information technology is a nervous system to achieve the SCM effective and efficient, within the time window frame, and literature also supported that IT will be very useful to find out the critical success factors of IT for an integrated supply chain. However, there is a need for attention to the design and implementation of IT system for business to business (B2B), e-commerce (EC) and SCM (Gunasekaran et al., 2004).

Information sharing refers to the degree to which the information is communicated to the supply chain partner is very critical and exclusive (Monczka et al., 1998). It has been observed that many researchers have suggested that a smooth supply chain is making available accurate and up-to-date marketing data at each and every cluster within the supply chain (Towill, 1997; Turner, 1993; Balsmeier and Voisin, 1996). Many researchers and academicians have focused the importance of information sharing within supply chain management. The information sharing is one of the five building blocks that distinguish concrete supply chain relationship (Lalonde, 1998). The organizations who have shared their information on a regular basis within the supply chain are able to work as a single entity (Stein and Sweat, 1998). The negative impact of bullwhip effect within the supply chain can be eliminated or reduced by accurate information sharing with trading partners (Yu et al., 2001). The competitive and distinguish factored for 20th century is the accurate and timely use of information sharing within the supply chain to fulfil the goals of the organization (Tompkins and Ang, 1999). The benefits of information sharing are faster cycle times, reduced in inventory and increase forecasts. Meanwhile, the customer gets a high quality products at low price (Stein and Sweat, 1998). Information sharing gives a competitive advantage over competitors, and organizations resist sharing with their partners (Vokurka & Lummus, 2000). The sensitive information sharing regarding inventory levels and production schedules with other network members and

the potential of losing customers to other competitors (Lancioni and Smith, 2000; Ballou et al., 2000; Croom et al., 2000).

Information sharing is one of the most important concepts to enhance the manufacturing competitiveness in India. Most of the researchers and practitioners have focused on the effective and efficient communication based on information sharing on real time frame with respect to hardware and software domain to enhance and synchronization of the supply chain (Nishat et al., 2007; Humphreys et al., 2004; Carr and Kaynak, 2008). Information system plays an important role to integrate and flow the information among supplier, manufacturer, customer, distribution, and retailer, within the supply chain (Chopra and Meindl, 2007). The companies like Dell, Hewlett Packard, Mumbai Dabbawala, Indian Posts, etc. are the best examples of information sharing, within a supply chain window (Zhou and Benton, 2007).

c) Information Quality

Information quality is one of the most important system in SCM practices, which includes accuracy, timeliness, adequacy, and credibility, etc. of information exchanged (Monczka et al., 1998). Information system depends upon what type of information is to be shared, when and how it is shared, and with whom it is shared, and what is the quality of information to be shared, information sharing seems to have different functions in the supply chain (Chizzo, 1998; Holmberg, 2000). The accurate information sharing within the entire supply chain can create the flexibility, but this needs timely, accurate information works on actual customer demand and short-term forecast (Jarrel, 1998). Information has not given the effective and efficient performance due to delay and distortion within the supply chain (McAdam and McCormack, 2001; Metters, 1997; Lee et al., 1997; Mason-Jones and Towill, 1997). Hence, to achieve the best supply chain management solution, information shared has to be a very accurate and appropriate as possible (Alvarez, 1994). Therefore, organizations must consider their information as a strategic assists and also put attention in information sharing with a minimum delay and without interruption.

d) Supply Chain Integration

Supply chain integration is defined as the degree to which all activity suppliers, customers, and other supply chain members, are integrated together within an organization (Stock et al, 1998; Narasimhan and Jayaram, 1998; Wood, 1997). The two types of interconnected forms of integration of supply chain. First, the involvement is coordination and integration towards the physical flow of deliveries between suppliers, manufacturers, and

customers, etc. Second, involvement in the backward coordination of information flows among suppliers, manufacturers, and customers (Frohlich and Westbrook, 2001). From, the earlier studies, it has found that supply chain integration have been classified into three categories: functional integration, internal integration, and external integration. First, is functional integration and its generates close relationships between functions such as purchasing, raw material management, shipping and inventory (Turner, 1993; Stevens, 1990; Morash and Clinton, 1997). This stage is very important for the internal flow of the goods rather than customer satisfaction, and cost reduction rather than performance improvement (Narasimhan and Kim, 2001). Second, is internal integration and its generating the integration of all internal functions of raw material management through production, shipping, and sales (Narasimhan and Jayaram, 1998). This stage focuses on the flow of the goods into the organization till customers' satisfaction. This stage is transparent characterized for the clear visibility of purchasing and distributing the raw material, and proper coordination and integration, to achieve customer satisfaction (Stevens, 1990). The third, has involved the outside integration with grip suppliers and customers (Narasimhan and Jayaram, 1998). In the supply chain, the relationship between the suppliers and customers are mutual and cooperation support (Vokurka and Lummus, 2000). The highest level of supply chain integration will permit to meet customers' requirements faster and more efficiently than non-integrated organizations (Magretta, 1998a). Organizations are not only collaborating internally across business functions, but also they must establish external strategic linkages with other organizations.

2.5.3 Eco-Innovation

In the last decades, an ever enhance growing attention has turned towards the eco-innovation. Eco-innovation can be defined as "an innovation that consists of new or modified processes, practices, systems and products which benefit the environment and contribute to environmental sustainability" (Rennings, 2000). "Eco-innovation is defined as innovation, which benefits the environment and contributes to environmental sustainability" (Rennings, 2000). It has been argued in the literature that the terminology eco-innovation is referred to as an ecological, environmental, green and sustainable innovation (Angelo et al., 2012; Schiederig et al., 2012) and the terms have similarity in the objective to reduce the environmental impacts (Schiederig et al., 2012). The drivers of eco-innovation have to achieve the sustainability (Angelo et al., 2012; Carrillo and Pujari, 2010) especially in manufacturing industries (Sezen and Çankaya, 2013). Meanwhile, many of the academicians and practitioners are keen to learn,

how companies performing environmental innovation into the manufacturing process and developing eco-product. (Carrillo and Pujari, 2010; Dangelico & Pujari, 2010; Hellström, 2007; Schiederig et al., 2012). Literature shows that the various theories that are vital to derive eco-innovation efforts, i.e., stakeholder theory, resource base theory and institutional theory. Butler (2004) focused on the two theories which are famous for eco-innovation effort at firm level, i.e., resource based theory and stakeholder theory. These two theories emphasized on the firm level and which, depending upon either the stakeholder demands (consist of its management, government regulations, consumers and environmental activist) or based on the firm's internal resources and capabilities.

Meanwhile, Institutional theory relies on the commitment of the companies, which is towards environmental solutions, resulted from tight regulation by government, professional associations, public opinion, or the media policy and compliances (Colwell and Joshi, 2013). Further, these theories are applied to support the sustainable development in the global forum. Hence, theory testing is important to gain more knowledge about which factors are crucial for organizations to commit eco -innovation efforts on.

Innovation has played an important role in enhancing the manufacturing competitiveness in India. Due to the excessive pressure in global markets and regional players, application of technology becomes more competitive (Soley and Pandya, 2003). It has been observed that without the major efforts for innovation (Rai et al., 2011a), R&D, marketing and financial approaches, the manufacturing sector loses its competence and its competitiveness in the global market (Raymond et al., 2014; Lau et al., 2013, Czurchy et al., 2009). Literature shows that some researchers and academicians have focused on the innovation, open innovation and eco-innovation (Savitskaya and Torkkeli, 2011; Subramanian et al., 2010). The capabilities of technology and innovation play a crucial role in determining the performances of firms (Nandialath et al., 2014). Innovation plays a mediating role in the relationship between strategy orientation and performance (Augusto et al., 2014). Innovation acts as a major driver of any organizational growth in a free market economy. Author focused on "the assessment of the internal culture of a large commercial engineering company seeking to enhance its ability to build, promote and sustain competitive advantage within its market" (Burdon et al., 2013).

Since, the economic growth of the manufacturing sector in India, technological changes and innovation is a spirit of a long foot race. Innovation is very essential for the manufacturing competitiveness and sustainable growth in the micro-economic level and macroeconomic level (Şener and Sarıdoğan, 2011). "The innovative behavior of firms varies in terms of product

differentiation, pricing, financing, marketing, management and organization" (Şener and Sarıdoğan, 2011). The earlier studied shows that a conceptual model that describes the critical factors for eco-innovation or green practices among the manufacturing industry as a postulate by scholars. Literature shows that there are various types of empirical studies has been done on drivers of eco-innovation, and internal and external factors are included in the firm level (Horbach, 2008; Rennings, 2000; Rennings and Zwick, 2002). This well-known model has been proposed by Rennings (2000) in his article named "Redefining innovation-eco-innovative research and the contribution from ecological economics' which describes the determinants of eco-innovation, which rely on three main factors, namely regulatory push, technology push and market pull" and the framework of eco-innovation determinants (Rashid et al., 2014). Literature shows that there are few literature reviews are directly associated with the field of eco-innovation with respect to manufacturing sector (Horbach, 2014; Berkhout, 2011; Kemp, 2010; Kemp and Oltra, 2011; Klewitz and Hansen, 2014).

2.5.4 Supply Chain Management Performance

The design and analysis of the supply chain is the establishment of appropriate performance measures. A performance measure, or a set of performance measures, is used to determine the efficiency and/or effectiveness of an existing system, or to compare competing alternative systems (Beamon, 1998). It has been observed from literature, most prominent way to measure the supply chain performance is an economic performance with respect to customer satisfaction (Harland, 1996). Garwood (1999) focused on the SCM performance index, the old performance index to measure the SCM performance on the basis of old metric like purchase price variance, direct labour efficiency, equipment utilization, development and production budget, etc., are no longer adequate, but there is need of attention to measure the SCM performance with new dimensions/metric in the present scenario. Meanwhile, literature reveals that the new way of supply chain performance measurement is very crucial for success. The major changes of acceptance and implementation of the supply chain are very difficult due to the lack of performance measurement (Bhattacharya et al., 2014; Owens and Richmond, 1995; Alvarez, 1994). It has been observed that organizations frequently, lack of vision to measure SCM performance very effectively and efficiently within the new metrics Gunasekam et al., 2001).

According, to Lee and Billington (1992), many organizations have no solid performance dimensions for SCM. Those who have no such proper dimension for the

measurement of SCM performance, do not have monitor regularly, and they have not satisfied their customers with different aspects. Holmberg (2000) summarizes the SCM measurement performance in three different ways: First, strategy and measurement are not interconnected because due to the missing links of SCM, they focus on internal functions instead of overall performance and customer requirement; Second, they have only concentrated on financial metrics. Of course financial performance, unfortunately, showing the better result of yesterdays 'actions than indicating tomorrow's performance; and Third, there are too many remote and mismatched measures of SCM performance. There are various academicians and practitioners focused on the organizations, who have used a number and variety of metrics for measurement of SCM performance to enhance their business process and supply chain performance. Holmberg (2000) focused that the measurement of SCM performance is the span of the entire supply chain. Van Hoek (1998) focused on the new measurement of supply chain, it must be designed for all the sub-systems and organizations, and to support market share, value, and profit.

Kiefer and Novack (1999) presented on customer focus that when developing performance measures, considered customer as a paramount. In addition, the number of characteristics of effective SCM performance measurement includes: inclusiveness (measurement of all pertinent aspects), universality (allow for comparison under various conditions), measurability (data required are measurable), and consistency (measures consistent with organizational goals) (Beamon, 1999). On the basis of the above guidelines, he suggested that SCM performance measurement has been categories into three parts: resource measures (general efficiency), output measures (general customer satisfaction), and flexibility (how well the system reacts to uncertainty). Each type of SCM performance measurement is dynamic to the overall performance of the supply chain.

In the present scenario, the various authors and practitioners have been suggested that there is a need of attention to enhance the SCM performance measurement with new dimensions; like, service level, throughput, efficiency, inventory level, supplier performance, and cost (Stevens,1990), customer responsiveness and manufacturing performance (Narasimhan and Jayaram, 1998), cost reduction, and customer satisfaction (Spekman et al., 1998), information, material flow integration, flexibility, risk management, and supplier performance (Chakraborty et al., 2011b; Beamon, 1998), inventory, suppliers, delivery performance, customer service, and logistics costs (Gunasekaran et al., 2001), etc. Based on an extensive literature survey, the new dimension emphasis is on SCM performance measures.

From, the above research findings, we are summarizing, two major dimensions of SCM performance are proposed which cover the performance measurement proposed by Beamon (1999), supply chain integration (resource measure), and customer responsiveness (output measure). The list of two sub-construct of SCM performance along with their definitions and supporting literature are shown in Table 2.12.

Table 2.12 List of Sub-constructs for SCM Performance

S. No.	Construct	Definitions	Literature
a)	Customer Responsiveness	The customer responsive implies the responses of the customers' requests.	Stevens, (1990); Lee and Billington, (1992); Narasimham & Jayaram, 1998); Beamon, (1998); Spekman et al. (1998); Kiefer and Novack, (1999); Gunasekran et al. (2001)
b)	Supply Chain Efficiency	The extent to which the supply chain optimizes cost, inventory and delivery performance	Cohen and Lee,(1988); Fisher, (1997); Beamon, (1999); Shah and Ward, (2003); Zhang et al. (2006); Modi and Mabert, (2010)

The sub-constructs of SCM performance has been described below:

a) Customer Responsiveness

It's defined as the speed of an organization's response to the customer requests (Narasimham & Jayaram, 1998; Beamon, 1998). The SCM performance measurement is measured by its responsiveness to customers (Lee and Billington, 1992). The SCM strategy process varies from organization to organization, and some of the organizations have focused on customer requirement and some organizations are focused on the other things like delivery of products etc. (Owens and Richmond, 1995). The main focus of many organizations is in customer responsiveness to enhance the SCM performance (Stevens, 1990; Spekman et al., 1998; Kiefer and Novack, 1999). The best examples of SCM performance like General Motors, Philips, Caterpiller, IPL, and Rank Xerox have focused on fast delivery, and customer responsiveness, etc. to accomplish supply chain integration (Dey, 2002; Narasimhan and Jayaram, 1998). The organizations are focused to achieve SCM performance measurement, so the supply chain metrics must be interlinked to customer responsiveness, especially, design for customer specification. The whole workout of applying the supply chain strategy could be costly and wasted without customer satisfaction (Gunasekran et al., 2001).

b) Supply Chain Efficiency

In the management studies, efficiency and effectiveness are the two commonly discussed performance metrics. The efficiencies refer to " do things right". On the general terms, efficiency focuses on driving outputs by using minimal inputs. It has been observed, most of the academician and researchers have discussed extensively regarding efficiency and the supply chains efficient design. There is a clear distinction between efficient supply chains and responsive supply chains (Fisher, 1997). Fisher (1997), the focus of efficient supply chains is to minimize cost and inventory build-up all along the supply chain. The literature shows that lean also focused on supply chain efficiency. The philosophy of lean is based on the principle of minimizing waste. The lean literature addresses the multiple issues like, raw materials, time, labor, and cost reduction by targeting the various sources of waste (Shah and Ward, 2003). The cost based efficiency directly associated with the supply chain performance measurement system (Beamon, 1999; Cohen and Lee, 1988; Cohen and Lee, 1989; Cohen and Moon 1990; Lee and Feitzinger, 1995; Pyke and Cohen, 1993; Pyke and Cohen, 1994; Tzafestas and Kapsiotis, 1994). The lean supply chain associated with minimization of inventories throughout the supply chain. To overcome this problem supply chain try to excess inventory, but the excessive inventory has not fully solution of this problem. The use of Just in Time (JIT) principles and JIT supply is one way to minimize inventory levels. The supply chain efficiency optimizes the inventory levels at echelons of the supply chain. Modi and Mabert (2010), focused on inventory based measures and provide a good indication of supply chain efficiency. The prompt delivery of goods and services are the different aspects of supply chain efficiency. The delivery reliability and lead time reduction are the two important determinants of supply chain efficiency (Yeung et al., 2008). The supply chain efficiency refers to the extent to which the supply chain optimizes cost, inventory and delivery performance.

2.5.5 Supplier Selection

In the global market, the role of supplier selection is very crucial in supply chain management (Lee et al., 2001). In the 1960s, many academicians and purchasing practitioners have focused on the selection and measuring the performance of suppliers in supply chain management. Purchasing activities are most important research topic in supply chain management. In the present scenario, purchasing is directly associated with strategy formulation (Moses, 2011) and better linkage of effective management in the supply chain

partners (Collins et al., 2010). Elkington (1998a), focused on the triple bottom line, i.e., simultaneous balance between economic, environmental and social issues. "Nowadays, many of the company's efforts to implement the environmental and social aspect into their supply chain for future generation to meet their desired needs" (Bowen et al., 2001). Most of the literature and practitioners suggest that they are concentrating more on the social aspects, and many of the organizations are implementing the supplier assessment tool, codes of conduct and better collaboration with Suppliers (Keating et al., 2008; Andersen and Skjoett-Larsen, 2009)

The main goal of the supplier selection process is to structure a good relationship between buyers and suppliers, minimizing purchasing risk, and to maximize the overall efficiency of a purchasing system, which is very valuable for the achievement of Just in Time (JIT) production system (Li and Fun, 1997). Apart from use of Just in Time (JIT) and Total Quality Management (TQM) concepts by the different manufacturing company, the supplier selection process is very essential (Petroni and Braglia, 2000). Evaluation and selection of suppliers are a very crucial topic in the manufacturing sector (Motwani and Youssef, 1999; Tahriri et al., 2008). Aissaoui et al. (2007) presented two stages of the supplier selection process: the first step is formulation of problems with respect to decision criteria, and second steps is choosing the appropriate supplier for the organization on the basis of different criteria and qualification. Chou and Chang (2008) focused on the selection of the supplier on the basis of four distinct phases- define the appropriate problem, formulate different criteria, qualification and select the supplier for the manufacturing industries. During, the last three decades, there are drastic changes in the supplier selection process. In the present global scenario, it is not possible to produce low cost, high quality products without supplier support. Therefore, supplier selection decisions are a very crucial component of production and logistics management for an organization. It has been observed that most of the researcher, incorporated different criteria, in supplier selection. The most important three criteria of supplier selection are innovation, after sales services and pricing (Dewanagan et al., 2015b). These three criteria are most relevant and significant to evaluate and select the most appropriate supplier in the supply chain to enhance the competitive advantage (Dewanagan et al., 2015b).

Supplier selection is an important part of the supply chain activities for a variety of reasons. Various practitioners have highlighted different criteria for supplier evaluation. The combination of the multiple phases of suppliers, sorting based model, unconventional criteria for supplier development (Xiang-Yang (2007; Schurr, 2007). The environmental issues are also an important issue for supplier evaluation (Cormican and Cunningham (2007). It has been

observed that raw material cost and component cost themselves carry around 70 percent of the total cost of the product (Punniyamoorty et al., 2012; Weber et al., 2006). Supplier selection is an important requirement in the flow of supply chain (Punniyamoorty et al., 2012). The supplier selection process can be categorized into pre-selection and post-selection procedures (Davidrajuh, 2003). The MCDM problem containing both quantitative and qualitative criteria for supplier selection, are in conflict (Kannan, D et al., 2013). For the last few decades, many researchers have worked on different decision making methods for supplier selection effectively (Zeydan et al., 2011; Ho et al., 2010).

Literature shows that supplier selection is a multiple criteria problem that includes both qualitative and quantitative factors (Amid et al., 2011). Zeydan et al. (2011) focused on new approaches, considers both qualitative and quantitative variables in evaluating performance for selection of suppliers based on efficiency and effectiveness in one of the biggest car manufacturing factories in Turkey. Supplier selection in multi-service outsourcing is a very important decision problem, research concerning this issue is still relatively scarce (Feng et al., 2011) and Zouggari and Benyoucef (2012).

Dickson (1966), presented 23 different supplier evaluation criteria measuring cost, quality and delivery times, on the basis of three perceptions namely, conceptual, empirical and mathematical. Weber et al. (1991), focused about a very important factor in the selection of supplier, i.e., price rank which is a leading factor as compared to lead time and quality conformance. Ellram (1995), presented financial issues, enterprise issues, strategy issues and technological issues in the process of supplier selection. She discussed about the benefits and limitations of the normative and descriptive model to solve the various issues during the selection of suppliers. Patton (1996), presented 1500 samples of suppliers to analyze the effects of human judgment models in the selection of suppliers. He analyzed the relationship between attributes and variables in the selection of suppliers. This shows that mostly conventional criteria such as cost, quality, and lead time remained at the core of supplier selection. Others have suggested use of different approaches for supplier selection. These approaches include qualitative evaluation of neural network models, multi criteria decision models, data envelopment analysis (DEA), analytical hierarchy process (AHP) and principal component analysis (PCA), etc. Timmerman, E. (1986) focused on the suppliers rated on the basis of cost ratio and ownership of cost criteria and he categorized different rating into a single score through the analytical hierarchical process, but the model was not perfectly calibrated with suppliers' problems due to limitations of qualitative evaluation criteria.

Nowadays organization wants to switch over the heightened level of competition in the global market. Organizations are not performing well in the competitive market due to the lack of concise product life cycles, innovation, etc. The existing product in the market is helpless in changing the requirement of customers in the supply chain.

2.5.6 Manufacturing Competitiveness

Over the past three decades, manufacturing sectors relied merely on the competitiveness based on the traditional dimensions such as cost, quality, services, flexibility, etc. (Singh et al., 2008; Carpinetti et al., 2000; Dacko, 2000). Most of the literature shows that these traditional dimensions are not much sufficient to obtain the competitive performance in today's environment (Liu, 2013). A variety of integrated systems have been proposed to overcome the limitations of the traditional competitiveness dimensions, but these traditional competitiveness dimensions have not fulfilled the requirements for present scenario of manufacturing competitive environment in the global market (Liu, 2013). Relatively, manufacturing companies focused on monitoring and controlling to optimize the overall competitiveness and simultaneously addressing the dynamic change of the competitive environment (Liu, 2013). As a result, many of the researchers and practitioners are suggesting new manufacturing competitive performance dimensions. In the arena of business surveys, the competitiveness of manufacturing sector is one of the most significant topics.

The research on manufacturing competitiveness started debatably with the determining work on the competitiveness of nations by Porter (1996), "who defined national competitiveness as an outcome of a nation's ability to innovatively achieve, or maintain, an advantageous position over other nations in key industrial sectors". Competitiveness also provides the relationship between the productions of goods as well as better quality and services, so that the product and services of the companies is standing in the global market.

Tefertiller and Ward (1995) presented the relationship between the competitiveness, productivity growth, quality differences, prices, cost of production and distributions, market's ability, etc. Boltho (1996), focused on differentiated between the short-run and long- run competitiveness of nations. He presented the short-run international competitiveness as the milestone of the genuine replacement tempo of internal and external balance with suitable policies of domestic, whereas the longer-run international competitiveness is the production of highest possible growth of well matched with exterior balance. Manufacturing competitiveness is totally depends upon the different industries, levels in the country competing both in

domestic and international markets, industry level competitiveness generally consigns to the capability of enlarging in size of the industries, and spread out its globally as well as profit share of the global market (Sharma et al., 2006; Clark and Hebb, 2005). In addition, there are so many authors has focused on determining the national manufacturing competitiveness and other factors of competitiveness that can be affected to manufacturing industries to stabilize in the global market. The list of four sub-construct of manufacturing competitiveness along with their definitions and supporting literature are shown in Table 2.13.

Table 2.13 List of Sub-constructs for Manufacturing Competitiveness

S. No.	Construct	Definitions	Literature
a)	Price/Cost	The price implies to competing against major competitors based on low price.	Wood et al., (1990); Miller et al. (1992); Hall et al. (1993); Koufteros, (1995); Easton and Moodie, (1999); Rondeau et al. (2000)
b)	Continuous Improvement	The extent to which an organization is capable to enhance the manufacturing competitiveness.	Terziovski et al. (2000); Bhuiyan et al. (2005); Jaca et al. (2014)
c)	New Product Development	The extent to which the organization has introduced the new product to satisfy the customer expectations.	Cooper, (1990); Gruenwald, G (1992); Griffin, (1997); Bruch and Bellgran, (2014); Schrettle et al. (2014)
d)	Manufacturing Flexibility	The extent to which manufacturing flexibility implies to machines and labor flexibility, who can execute multiple operations in the manufacturing firms	Camis´on and L´opez, (2010); Patel, (2011); Goyal et al. (2012); Oke, (2013); Kim, M. et al. (2013); Mishra et al. (2014)

The sub-constructs of Manufacturing Competitiveness has been described below:

a) Price/Cost

The price of the products is directly associated with the capability, to make better products as compared to competitors with low price (Koufteros, 1995; Wood et al., 1990; Miller et al., 1992, Hall et al., 1993; Rondeau et al., 2000). Generally, pricing policy is estimated of all direct cost and desirable profit margin on the specific project (Easton and Moodie, 1999). Price of products like semi-finished or finished products is dynamic in nature and it will change with change in profit margin, lead time and actual time. Pricing policy is responsible for the demand pattern as well as applied to control demand of the finished

products. Suppose, the price of the finished products is so high, then the demand of the finished products is less and vice versa (Kimes, 2000). Profit is directly proportional to the price of the products.

b) Continuous Improvement

Continuous Improvement (CI) plays an important role to enhance the competitiveness of manufacturing industries through the supply chain in India. Deming described the philosophy of (CI) i.e., "Improvement initiatives that increase successes and reduce failures" (Juergensen, 2000; Terziovski et al., 2000). The basic concept of CI is the improvement of quality or process, or both, in order to minimize the waste, shorten the production line and improve quality (Bhuiyan and Baghel, 2005). The continuous improvement depends on how the iron and steel industries continuously improve its innovativeness and product development capabilities for Long term competitiveness. The worldwide companies like Tata Motors, Toyota, etc., have implemented the (CI) to sustain in the global marketplace.

c) New Product Development (NPD)

In today's rapidly technological environment and increasing global competition, New Product Development (NPD) has gained major emphasis in the manufacturing industry (Cooper, 1990; Gruenwald, 1992; Griffin, 1997). New Product Development (NPD) is a dynamic process and practitioners have a broad understanding of what it means to design a product, although the methods and approaches are yet debated. (NPD) is also one of the most important issues in today's business environment, especially to enhance the competitiveness of iron and steel industries in India. The worldwide companies like Apple, Honda, etc. have already adopted the NPD for achieving the fast project times as well as enhancing the competitive advantage globally. An NPD process defines that the normal means by which an organization can frequently convert developing ideas and make an innovative product into the market place. The new product development process involves in developing innovative products at the right time, which meet the customer requirement. The basic goals of NPD process is to make high quality products, reduced time to market, low cost and high productivity (Gruenwald, 1992; Griffin, 1997). All these factors have contributed towards higher levels of customer satisfaction, early capturing of the global market, enhance market share and increase in profits (Bruch and Bellgran, 2014; Schrettle et al., 2014).

d) Manufacturing Flexibility

In the global scenario, the increase in the customer expectation in the variety of the products, customized and innovative products in the current competitive environment, assessment of manufacturing flexibility is important to determine the manufacturing competitiveness of a firm. The manufacturing flexibility assessment is a very important task for an operations manager, as employment of manufacturing flexibility requires significant capital investment and manufacturing flexibility to affect performance (Gerwin, 1987). Due to the multidimensional nature of flexibility the assessment of manufacturing flexibility is a very difficult task for operation managers (Mishra et al., 2014). The literature shows, the need of attention for manufacturing flexibility from both academia and industry experts. In the literature, many reviews are available for addressing the issues surrounding the definition, classification, nature and need of various manufacturing flexibility dimensions (Beach, 2000a, 2000b; Vokurka and O'Leary-Kelly, 2000; Kara and Kayis, 2004; Oke, 2005; Saleh et al., 2009). Manufacturing strategy is highly associated with the business strategy (Sharma et al., 2005). The research established the framework that business strategy is directly associated with manufacturing strategy which influences to increase the firm performance (Williams et al., 1995).

2.6 Gaps Identified from Literature

Based on the outcome of this review, avenues for future research could be categorized on the basis of the following guidelines.

There is a need for attention for the assessment of manufacturing competitiveness through supply chains and cross study in various types of industries setup. It is very necessary to analyze whether the manufacturing competitiveness is beneficial for the firm performance, which gives the value added to the end customer, as is the ultimate goal of manufacturing sectors. In this study, several issues and application area was discussed in the present chapter, but still there are some gaps have been identified in the literature. In this study, methodology/approaches, major findings and gap identification have been obtained from the literature as shown in the (Table 2.14).

Table 2.14 Summary of selected literature survey, major findings and gaps identified.

S. No	Title of the Study	Researcher/ Proponent	Journal/ Year	Objectives	Methodology/Approach	Major Findings	Gaps Identified/ Comments
1.	Manufacturing and supply alignment: Are different manufacturing strategies linked to different purchasing practices	Claudia Rebolledon, Marie-HélèneJobin	International Journal of Production Economics. 146 (2013) 219–226. (Elsevier Science Ltd.)	The objectives of this paper is to investigate different manufacturing strategies into different supply management practices.	This paper developed a numerical taxonomy of manufacturing strategies based on ten competitive priorities using survey data from manufacturing plants in developed countries. Cluster analysis is identifies three manufacturing strategy types: Quality customizers, Caretakers and Timekeepers..	The major findings of this paper are to links between manufacturing strategic priorities and practices in supply management. Cluster analysis reveals three manufacturing strategy types: Quality customizers, Caretakers and Timekeepers. Quality customizers combined the emphasis on quality of Millerand Roth's	To further understand the manufacturing-purchasing connection, it could be interesting to compare purchasing practices of firms using innovative manufacturing systems such as lean production and agile manufacturing.
2.	Sustainable manufacturing tactics and cross-functional factory modelling	Mélanie Despeisse, Michael R. Oates, Peter D. Ball	Journal of Cleaner Production 42 (2013) 31- 41, (Elsevier Science Ltd.)	This paper presents a tactics library to provide a connection between those generic sustainability concepts and more specific examples of operational practices for resource efficiency in factories.	The factory modeling approach is introduced to support the use of tactics by combining the analysis of building energy and manufacturing process resource flows. Finally a step-by-step guide in the form of a workflow for factory modeling and resource flow analysis is presented and tested via a prototype tool	The major findings are that to provide guidelines for manufacturers to undertake the sustainability journey by guiding them through the steps of factory modeling, resource flow analysis and improvement opportunities identification.	Future work includes reposition the research activity as a result of the tool development for integrated modeling of resource flows to identify sustainable manufacturing improvement opportunities through combined analysis of manufacturing operations, supporting facility systems and production buildings, and integration of best

							practices available from manufacturers.
3.	A Review of Engineering Research in Sustainable Manufacturing	Karl R. Haapala, Fu Zhao, Jaime Camelio, John W. Sutherland, Steven J. Skerlos, David A. Dornfeld, I. S. Jawahir, Andres F. Clarens, Jeremy L. Rickli	Journal of Manufacturing Science and Engineering (2013), Vol. 135 / 041013-1 Copyright VC 2013 by ASME.	The main objective of this paper is to addressed issues related to planning, development, analysis, and improvement of processes.	Analysis have been done on the basis of qualitative research.	This study suggests that a engineering research has addressed challenges relating to facility operation, production planning and scheduling, and supply chain design	There is a need for research on (1) manufacturing processes and equipment, (2) manufacturing systems, (3) changes in Life cycle paradigms, and (4) education.
4.	Efficiency measurement of Indian steel industry using data envelopment analysis	Amit Kumar Dwivedi, Priyanko Ghosh, G.S. Dangayach Department	International Journal of Operational Research, Vol. 18, No. 4, (2013) (Inderscience Enterprises Ltd)	The main objective of this paper is that to measure the technical and scale efficiency of the public and private steel firms of the Indian steel industry.	Data envelopment analysis (DEA) has been used to calculate the technical efficiency (TE) and allocative efficiency (AE). measures of the public and private steel firms of the Indian steel industry (2006 to 2010). A representative sample of 17 public and private firms which account for major portion of the total market share is studied	After empirical analysis using the panel data of five years (2006–2010) from 17 Indian steel firms demonstrates that Indian firms have achieved, on an average TE, about 86% to 90%. From the analysis the input and output efficiency is same for constant returns to scale (CRS) while variable returns to scale (VRS) is different.	There is a need for research on (1) Steel industries with different dimensions with the competitive environment. (2) The approach will use for other industries like sugar and banking industries. .
5.	Manufacturing strategy–technology relationship among auto suppliers	Ce´ sar H. Ortega Jimenez, Pedro Garrido-Vega , Jose´ Luis Pe´ rez Dıez delosRıos, Santiago Garcıa Gonzalez.	International Journal of Production Economics. 133 (2011) 508–517. (Elsevier Science Ltd.)	The objectives of this paper is to tests the link between two of the most important manufacturing practices areas, manufacturing strategy (MS) and technology, without addressing causality or their combined effect on performance. This is done by selection fit, i.e., congruency adjustment.	A survey of ninety auto supplier plants with at least 100 employees in ten countries across Asia, Europe and North America was used to test the propositions in this paper. A two- step procedure was used when performing the data analysis. First, canonical correlation analysis was performed to test the multivariate relationship across	The major findings are that regression results from a wide-ranging survey of auto supplier plants show that, in general, MS seems to have some kind of impact on technology, and that technology has some kind of influence on MS. In addition, a strong congruency between both practices areas is observed when using correlation.	There is a need for research on relationships between the two areas of practices (Manufacturing Strategy and technology).

					the variables representing Technology and Manufacturing Strategy practices (H1). The significance of this test provided the basis for two series of individual and mutually exclusive multivariate multiple regression analyses one for each of the next two hypotheses (H2andH3)		
6.	Resilience and competitiveness of small and medium size enterprises: an empirical research	Angappa Gunasekaran, Bharatendra K. Rai & Michael Griffin	International Journal of Production Research (2011), (Taylor & Francis)	The objectives of this paper is to analysis the resilience and competitiveness of SMEs through appropriate theory and empirical analysis.	A survey involves a sample of 40 SMEs in the South coast of Massachusetts and provides further insight into the key characteristics associated with resilience and competitiveness of SMEs that are influenced by advances in operations strategies, technology and globalisation.	The major findings of this paper are to determine the resilience and competitiveness of the SMEs. The findings of this paper also support external support to be resilient and competitive in the changing global scenario.	There is need of research on technological advance, IT and systems such as the EDI, Internet, e-commerce, WWW, ERP and RFID etc.
7.	The role of networking in the competitiveness of firm	Isabel Álvarez, Raquel Marin, Antonio Fonfría.	Technological Forecasting & Social Change 76 (2009) (Elsevier Science Ltd.).	The main objective of this paper is to explore the new key aspects i.e., technology and innovation in the competitiveness of manufacturing firms	A survey involves four Spanish manufacturing industries: food, chemicals, electronics and vehicles and data collected since 1998 to 2003. the Polytomous Logistic Universal Model (PLUM), is used for empirical analysis.	From the analysis through Polytomous Logistic Universal Model (PLUM) the major findings are that, there is a positive relation between technology and company performance in the competitive environment.	There is need of research on innovation and technology development in the competitive environment.
8.	Development and innovation in the IT industries of India and China	Shiu-Wan Hung	Technology in Society 31 (2009) 29–41(Elsevier Science Ltd.)	The main objective of this paper is to analyzing innovations in the IT industries of India and China	Analytic framework for analyzing innovations in the IT industries of India and China.	This study describing the role and performance of particular institutions, this framework also explores interactions among these institutions to illustrate the dynamics and efficiency of innovation systems. The framework reveals that the IT industries in	There is a need for research on i) High demand for infrastructure improvements. ii) R&D investment.

						both India and China have unique character- istics, but they also share numerous complementary features.	
9.	Validity and reliability of applying manufacturing excellence frameworks to Indian industries	M Sharma and R Kodali	J. Engineering Manufacture (2008) (sage)	This paper explores the validity and reliability of existing manufacturing excellence/world-class manufacturing frameworks when applied to Indian companies by means of a survey conducted across a wide range of man-ufacturing companies based in India.	The exploratory analysis and questionnaire-based survey methodology is used for the study.	This study describes the level of manufacturing excellence in an organization.	Indian frame- works, considers important elements such as green manufacturing, knowledge management, process flexibility, world-class maintenance, etc. Hence, none of the existing frameworks can be used in their present form and therefore, a new manufacturing excellence framework is required to address all these gaps.
10.	Manufacturing strategy, competitive strategy and firm performance: An empirical study in a developing economy environment	Kwasi Amoako-Gyampah, Moses Acquaah	International Journal of Production Economics 111 (2008) 575–592. (Elsevier Science Ltd.)	This paper examines the relationship between manufacturing strategy and competitive strategy and their influence on firm performance. This paper focused on how competitive strategy influences manufacturing strategy and competitive strategy on firm performance among Ghanaian manufacturing firms.	The path analytic approach and regression analysis was applied to examine 250 manufacturing and service organizations in Ghana.	The major findings of this paper is that there is significant and positive relationships between competitive strategy and the manufacturing strategies of cost, delivery, flexibility, and quality etc.	It is needed to examine the functional strategies such as marketing and human resources and assess the joint contributions of these strategies to competitive strategy and firm performance.

11.	Technology, competitiveness and specialisation in OECD manufacturing Dirk	Dirk Frantzen	Journal of Economic Studies Vol. 35 No. 1, (2008) (Emerald)	To analyse the relation between technology, competitiveness and specialisation in (Organisation for Economic Co-operation and Development.)OECD manufacturing	A regression analysis has been performed in series of OECD countries by their relative unit labour costs (ULC) and R&D investment.	The major findings of this paper are that there is always negative impact of the ULC-based variables on industries but technology factors are especially important in the research-intensive industries with respect to wages.	There is a need for research in the innovation process and technology with respect to skilled labour because the production workers able to operate with the new more sophisticated technologies and who can, through their learning-by-doing experience, actually actively contribute to the innovation process itself.
12.	Manufacturing strategies and financial performance—The effect of advanced information technology: CAD/CAM systems	Petros Theodoroua, Giannoula Floroub	Omega 36 (2008) 107–121(Elsevier Science Ltd.)	To analyse the impact of IT on financial performance of Manufacturing organisations.	The cluster analysis and VACOR algorithm were used, to distinguish clusters of firms and estimate the effect of IT on financial performance.	The major findings of this paper is that there is the effect of IT on financial performance with respect to higher level of flexibility strategy and the middle level of cost strategy.	There is a need for research on alignment between IT with respect to business structure, uncertainty of the environment and contingencies like: age and size of the firms.

13.	Manufacturing flexibility and business strategy: an empirical study of small and medium sized firms.	Shih-Chia Chang, Chen-Lung Yang, Hsin-Chia Cheng, Chwen Sheu.	International Journal of Production Economics. 146 (2003) 219–226. (Elsevier Science Ltd.)	This study investigates the practice of manufacturing flexibility in small and medium sized firms.	The Cluster analysis has been done on 87 firms from machinery and machine tool industries in Taiwan. This paper analyzed and prescribed the alignment of various manufacturing flexibility dimensions with business strategies.	The paper investigated the effect of manufacturing flexibility on business performance under three different business strategies: i) Manufacturing flexibility and Preemptive/First Mover strategy ii) Manufacturing flexibility and Differentiation/Follower strategy iii) Manufacturing flexibility and Cost/Follower strategy	There is a need for Research on investigating the applicability of these findings with other industries and areas such as Manufacturing Strategy etc..
14.	Manufacturing networks and supply chains: an operations Strategy perspective	Martin Rudberg, Jan Olhager.	The International Journal of Management Science. Omega 31 (2003) 29 – 39. (Elsevier Science Ltd.)	The objective of this paper is to analyze manufacturing networks and supply chains from an operations strategy perspective. These two areas have traditionally been treated as separate research tracks, but with the ongoing globalization of markets and operations there is a need to integrate these complementary disciplines to study networks of facilities.	In this paper author focused on two research areas based on two structural decision categories in an operations strategy, viz. facilities and vertical integration. The analysis of network systems is used to for analysis.	The major findings of this paper are to analysis of differences and similarities between manufacturing network and supply chain theory. The paper focused on the operations strategy perspective, focusing on two structural decision categories; facilities and vertical integration.	There is a need for research to analyze the issues of configuration and coordination of networks, to analyze network hierarchies (networks, organization, sites, plants, production processes), and to develop inter-/firm network strategies.

15.	Manufacturing flexibility: defining and analyzing relationships among competence, capability, and customer satisfaction	Qingyu Zhanga, Mark A. Vonderembseb, Jeen-Su Limc	Journal of Operations Management 21 (2003) 173–191 Manufacturing (Elsevier Science Ltd.)	To explore the relationships among flexible competence, flexible capability and customer satisfaction etc.	The factor analysis and structural equation modeling to a large-scale sample (n = 273) has been done.	The results indicate strong, positive, and direct relationships between i) Flexible manufacturing competence and volume flexibility ii)Flexible manufacturing competence and mix flexibility iii) Volume flexibility and mix flexibility have strong, positive, and direct relationships with customer satisfaction	There is a need for research on Manufacturing flexibility and value chain flexibility (product development, logistics etc.).
16.	The alignment between manufacturing and business strategies: its influence on business performance	Hongyi Sun, Cui Hong (2002)	Technovation 22 (2002) 699–705. (Elsevier Science Ltd.)	This paper examines alignment between manufacturing strategy and business strategy on business performance and the contribution of manufacturing performance to business performance.	The research is based on the empirical data from the International Manufacturing Strategy Survey (IMSS) conducted in more than 20 countries. In this paper, the analyses of variance (ANOVA) were used to analyse the hypothesis. The performance parameters include: profitability, market share, on-time delivery, inventory turnover, manufacturing on-time delivery, quality improvement, cost reduction.	This research found that there is a significant positive relation between manufacturing business alignment and the improvement of business performances.	There is a need for research on many other factors like (R&D , Innovativeness and human resources) that may contribute to the improvement of firm performance.
17.	A Resource-Based View of Manufacturing Strategy and the Relationship to Manufacturing Performance.	Roger G. Schroeder, Kimberly A. Bates and Mikko A. Unttila	Strategic Management Journal 23: 105–117 (2002). (John Wiley & Sons, Ltd.)	This study places research on manufacturing strategy in the context of the resource-based view (RBV) of the firm by studying how manufacturing plants	The research is based on the empirical data from 164 manufacturing plants in Germany, Italy, Japan, the United Kingdom, and the United States et. In this paper, the CFA and SEM are	The major findings of this paper are that three distinct manufacturing resources and capabilities that have the potential for creating a performance advantage	There is a need for research to incorporate ideas from the Resource-Based View. At the same time, the Resource-Based

				develop capabilities and resources in pursuit of better performance and competitive advantage.	used to analyse the data.		View literature needs to measure constructs like (Product Capability, Product Design, Manufacturing infrastructure etc.) at the plant level where capability and resources are actually built.

2.7 Research Problem

Over the past decades, India's economy had recorded impressive growth rates because of the service sector, but the overall performance is still being dragged down by an underperforming manufacturing sector, resulting in their current growth rate being reduced from 8.5 percent to the 6.5 percent. However, it is still a remarkable performance as compared to other countries, but it could have been so much better.

India's manufacturing sector has always suffered from an overburdened infrastructure, R&D, innovative products, and supply chain, etc. According, to Government of India National Manufacturing Competitiveness Council, report (2011) the major cause of manufacturing's failure was due to speedily rising population that results in unemployment levels that have increased in the past few years in spite of their rapid economic growth. Additionally, the majority of their goods was imported from abroad, due to the weak manufacturing sector, resulting in a sharply broadening trade shortage. The literature raises, there is a need for attention on the manufacturing competitiveness in the Indian manufacturing sector. The main goal of this study is to assess the manufacturing competitiveness through supply chains in the Indian manufacturing sector.

2.8 Research Model (Detailed)

On the basis of various studies and the gaps identified from the literature, a research model has been proposed as shown in Figure 2.9. In this proposed model, 06 factors are presented for measuring the manufacturing competitiveness. The Figure 2.9 presents a research model of the interrelationships among constructs, including environmental uncertainty, supply chain management practice, eco-innovation, supply chain management performance, supplier selection, manufacturing competitiveness, etc., are discussed in the following text.

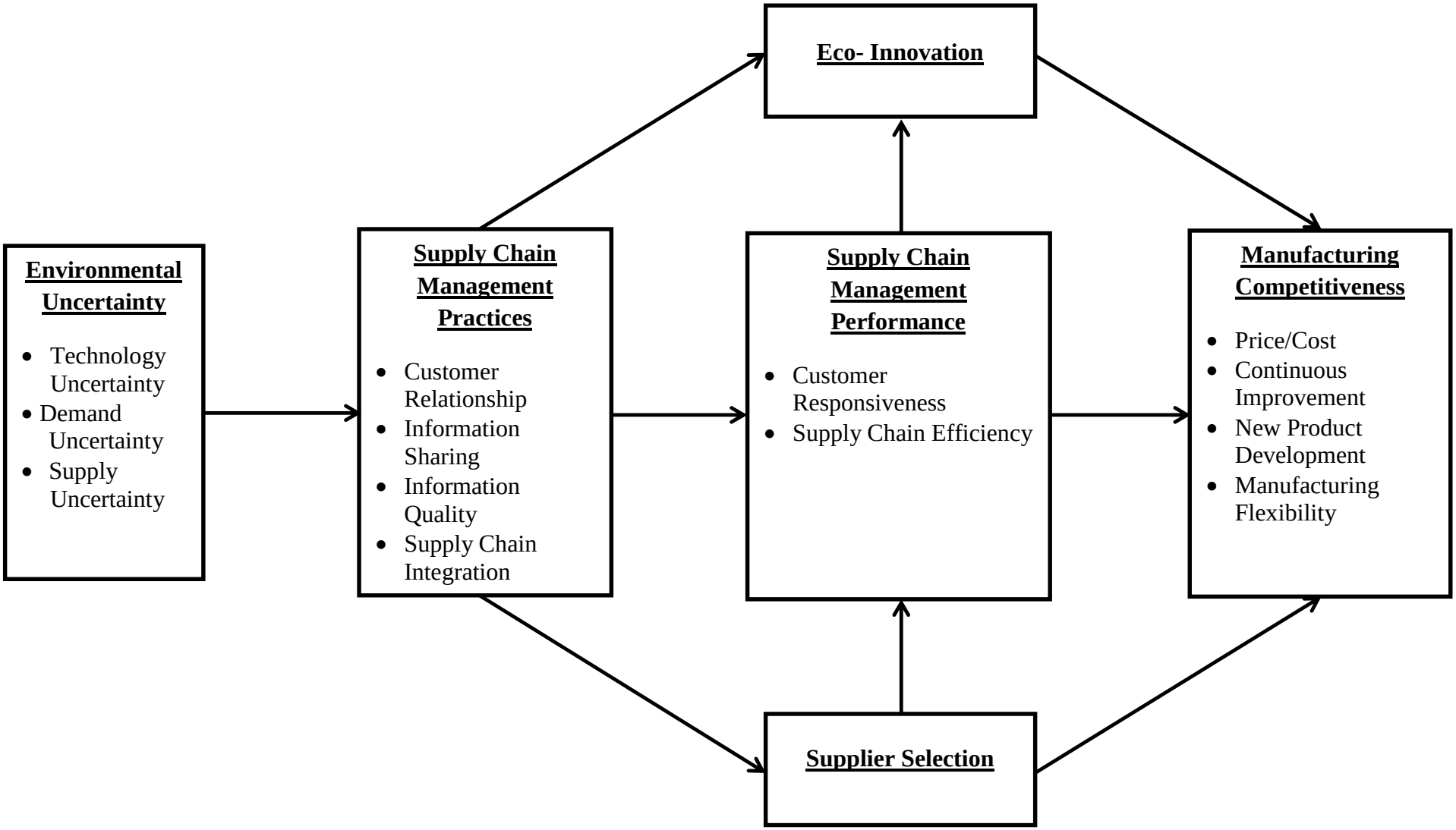


Figure 2.9 A Proposed Model of Supply Chain Management and Manufacturing Competitiveness

2.9 Conclusion

This chapter presented, the theoretical backgrounds of SCM, Eco-Innovation, Supplier selection, manufacturing competitiveness and various constructs which are related to SCM and manufacturing competitiveness. In this study, the initial section provides a concise introduction of the Indian manufacturing sector and the evolution of supply chain management. The literature review presented different definitions of supply chain management and manufacturing competitiveness. The literature has been categorized into five important categories: period of publication of journals, country wise distribution, journal wise distribution, dimension wise distribution and methodology adopted for analysis. From the literature review, a conceptual model has been developed and presented in Figure 2.9. This chapter shows, the different literature gaps, which resulted in the objectives of this study. For the achievement of the objectives, this present chapter provides a strong foundation for the use of new methodology has been applied. In the next chapter, overall framework will present that describes the causal relationships among these constructs and the development of research hypotheses.

CHAPTER – 3

THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

Preview

This chapter presents the combination of comprehensive supply chain management (SCM) and manufacturing competitiveness models, designed for enabling better and more well-organized supply chain management (SCM) and manufacturing competitiveness. Researchers have emphasized that effective supply chain management practices enhance the efficiency of organizations (Hayes and Wheelwright, 1984). To understand the phenomenon of supply chain management (SCM), it will be helpful to have a framework to work within and draw testable hypotheses from. A theoretical framework helps to predict the outcomes of the SCM and manufacturing competitiveness initiatives. It also helps to observe the behaviour of business organizations and provides a better description of the motivations behind the implementation of SCM and manufacturing competitiveness as well as its significance. The model presented in this chapter is expected to be the most significant model to enhance the manufacturing competitiveness of an organization, among the ones available so far.

3 Theoretical Framework

To understand the background to, and significance of, supply chain management (SCM), the chapter formulates a framework giving the details of the causal relationships among the facilitating factors of Environment Uncertainty, SCM Practices, Eco-Innovation, Supplier Selection, SCM Performance, and Manufacturing Competitiveness, as shown in Figure 3.1.

The basic assumptions of this research framework are straightforward. First, the implementation of the SCM practices should be driven and facilitated by environmental uncertainty. Second, a higher level of SCM practices will lead to a higher level of eco-innovation, SCM performance and supplier selection, and a higher level of SCM performance, in turn, will lead to an enhanced manufacturing competitiveness.

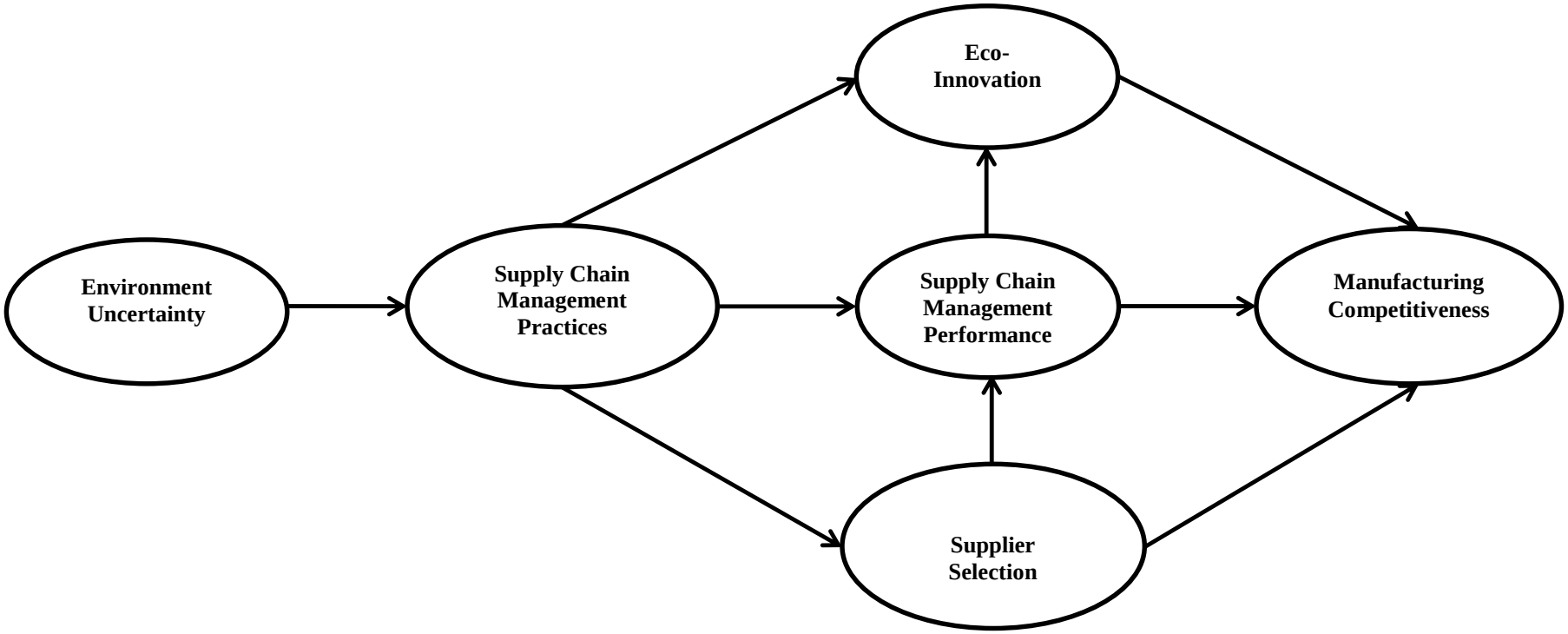


Figure 3.1 A Proposed Research Framework of Supply Chain Management and Manufacturing Competitiveness

In the available literature, most of the studies are empirical, but they directly link only a few aspects of the SCM practices to organizational performance. They do not consider any intermediate performance measures, such as the SCM performance and competitive advantage (CA) (Stuart, 1997; Shin et al., 2000; Frohlich and Westbrook, 2001). As per the literature, the SCM practices indirectly impact on the organizational performance through the SCM performance, and lead to competitive advantage. But few academicians or industry experts have discussed how the SCM performance impacts on the manufacturing competitiveness, directly or indirectly.

In this study, all the factors and sub-factors missing in the previous researches have been considered step by step. By considering the missing factors and sub-factors of the SCM performance and the manufacturing competitiveness of each facilitating factor, as well as including the sub-dimensions of each construct, the framework in Figure 3.1 can be expanded to the one shown in Figure 3.2, depicting the proposed relationship among the six constructs discussed in Chapter 2. In the next part, all the six constructs have been represented by an arrow and each construct corresponds to one of the nine hypotheses to be developed in this chapter.

As shown in Figure 3.2, the environmental uncertainty directly impacts on the SCM practices; the SCM practices directly impact on eco-innovation; the SCM performance and supplier selection, as well as the SCM performance, directly impact on the manufacturing competitiveness. Therefore, it is hypothesized that:

- the SCM practices are directly impacted on by environmental uncertainty;
- eco-innovation, SCM performance and supplier selection are directly impacted on by SCM practices;
- the SCM performance is directly impacted on by supplier selection;
- eco-innovation is directly impacted on by the SCM performance; and
- Manufacturing competitiveness is impacted on by eco-innovation, SCM performance, and supplier selection.

  The model also reveals a direct, positive relationship between the SCM performance and manufacturing competitiveness. The following section provides the theoretical support to each hypothesis.

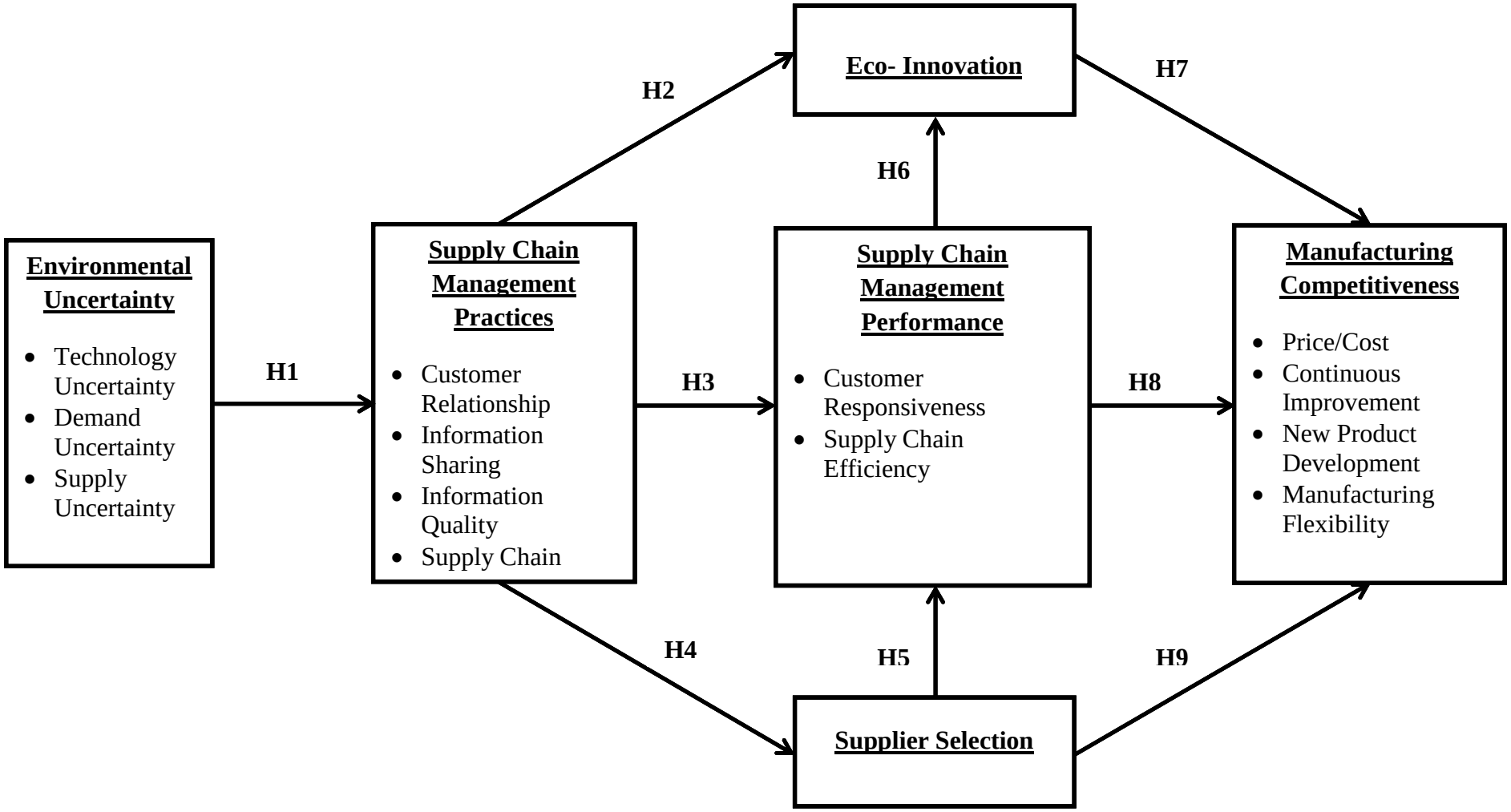


Figure 3.2 A Proposed Model and Hypothesis of Supply Chain Management and Manufacturing Competitiveness

3.1 Research Hypothesis l (Environmental Uncertainty and SCM Practices)

In much of the existing literature, environmental uncertainty has been considered an important driver for the implementation of the SCM practices (Lawrence, 1997; Collins and Bechler, 1999; Claycomb et al., 1999; Franks, 2000; Chandra and Kumar, 2000). In today's global economy, markets are very uncertain and, therefore, the unstable organizations are adopting various SCM practices, such as supplier performance, supply chain integration and postponement, to increase the flexibility of the organization, enhance its manufacturing efficiency, and also reduce the risks associated with the uncertain environment of the global markets. Environmental uncertainty is an essential factor with respect to information sharing and coordination within the supply chain partners (Ellram, 1990; Grover, 1993). It is directly associated with fast changing customer demand as well as mass customization and flexibility of the products (Tan et al., 1998), often easily leading to the adoption of the postponement strategy (Waller et al., 2000). This argument leads to:

Hypothesis l: ***Environmental uncertainty positively affects the supply chain management practices.***

3.2 Research Hypothesis 2 (SCM Practices and Eco-Innovation)

In the last few decades, India has seen an unprecedented economic growth. However, this has also led to environmental degradation and resource depletion. It is the pollution caused by the manufacturing sector which is mainly responsible for this negative byproduct of India's economic miracle. It has been reported that nearly 80% of the environmental contamination comes from the production processes and other operations of the firms. Due to this immense risk inherent in the economic growth and industrial up-gradation, it is essential for the Indian companies to actively collaborate to measure the environmental as well as economic performances in order to balance them and achieve sustainable development. "One possible solution is eco-innovation, that is, the creation or application of novel products, processes, services, organizational structures, institutional arrangement, as well as social structure, with lower environmental impacts." Hence, eco-innovation has received considerable academic attention and, among its various aspects, motivation research is the most flourishing one. There are plenty of empirical studies on issues

ranging from environmental regulations (e.g., tax, emission charge and standard, emission trade permit) and market and technology push (e.g., retail or requirement, customer satisfaction, export orientation, and external competitive pressure) (Cleff and Rennings, 1999; Popp, 2001; Rehfeld, et al., 2007; Frondel, et al., 2008) to integrated cooperative practices to manage raw materials, components, product designs as well as logistics. Information sharing, information quality, and knowledge and technology sharing are very important to enhance eco-innovation and improve the supply chain collaboration (Ding, 2014). Several empirical studies have affirmed that supply chain collaboration positively affects eco-innovation, for example, the study of Geffen and Rothenberg (2000) that focused on collaboration between eco-innovation and the suppliers for the adoption of advanced environmental technologies. This assertion leads to:

Hypothesis 2: ***The SCM practices positively affect eco-innovation.***

3.3 Research Hypothesis 3 (SCM Practices and SCM Performance)

It has been observed that effective SCM practices lead to an improved SCM performance (Narasimhan and Jayaram, 1998). Most researchers and practitioners suggest that the "SCM practices are directly connected to the organizational performance without explicitly considering any intermediate measures, such as the SCM performance and competitive advantage, but a direct link from the SCM practices to the SCM performance is plausible". Research shows that a sound implementation of SCM practices provides a high level of supply chain flexibility and integration (Jarrell, 1998). A sound implementation of SCM practices is also responsible for customer satisfaction, market changes, and best designs for manufacturing processes (Doyle, 1998). Research also shows that information sharing and information quality greatly contribute to a positive effect on customer satisfaction (Rai and Pedersen, 2010; Spekman et al., 1998) and partnership quality (Walton, 1996; Lee and Kim, 1999), and dramatically improve performance (Towill, 1997). The literature bears out that the implementation of the postponement strategy enhances the flexibility of the supply chain, and balances global efficiency and customer responsiveness (Van Hoek et al., 1999). This argument leads to:

Hypothesis 3: ***Supply chain management practices positively affect the supply chain management performance.***

3.4 Research Hypotheses 4 and 5 (SCM Practices, Supplier Selection and SCM Performance)

SCM practices have been defined as a set of activities undertaken in an organization to promote the effective management of its supply chain. Donlon (1996) focuses on the latest trends in the evolution of SCM practices, which include supplier partnership, outsourcing, cycle time compression, continuous process flow, and information technology (IT) sharing. On the other hand, Chen and Paulraj (2004) discuss supplier base reduction, long-term relationship, communication, cross-functional teams and involvement of the supplier to measure the relationship between the buyer and the supplier. Min and Mentzer (2004) further elaborate the concept of SCM as including agreed vision and goals, information sharing, risk and award sharing, cooperation, process integration, long-term relationships and agreed supply chain leadership. Thus, the literature throws light on the SCM practices from a variety of perspectives, with the common goal of improving organizational performance (Li, S. et al., 2006).

Supplier selection is an important part of the supply chain for a variety of reasons. Various practitioners have highlighted different criteria for supplier evaluation, in order to enhance the SCM performance. Xu and Xiang-yang (2007) focus on a multiple phase supplier sorting model based on supplier development orientation, using multiphase selection methods and a combination of unconventional criteria. Schurr and Ozanne (2007) have studied the important interactions that fundamentally strengthen, or fatally weaken, the development of relationships. On the other hand, Cormican and Cunningham (2007) discuss the environmental issues in supplier evaluation. The literature shows that the cost of raw materials and component parts, in itself, is responsible for around 70 percent of the total cost of the product (Punniyamoorty *et al*., 2012). Thus, supplier selection is an important requirement in the flow of supply chain practices and performance (Punniyamoorty *et al*., 2012).

The supplier selection process can be categorized into pre-selection, selection and post-selection procedures (Davidrajuh, 2003). "Supplier selection is MCDM problem containing both quantitative and qualitative criteria which, together, are in conflict" (Kannan *et al*., 2013). "Over the last few years, many researchers have worked on the supplier selection problem to develop suitable decision making methods which can deal with the problem effectively"

(Zeydan et al., 2011; Ho et al., 2010). Thus, the literature is very clear about the influence of the SCM practices on supplier selection, and the influence of supplier selection on the SCM performance. It affirms that managing the supplier involvement well can lead to better supplier performance, improved manufacturing, and product and process advancements, which, in turn, enhance customer satisfaction and the firm's performance (Epatko, 1994; Schilling and Hill, 1998; Vonderembse and Tracey, 1999). This leads to the following two hypotheses:

Hypothesis 4: ***Supply chain management practices positively affect supplier selection.***

Hypothesis 5: ***Supplier selection positively affects the supply chain management performance.***

3.5 Research Hypothesis 6 (SCM Performance and Eco-Innovation)

The literature shows that there is a strong correlation between eco-innovation and the supply chain. The collaboration of the two is a positive process that generates synergies and competitiveness through strategic alliances and collaboration among organizations and their external environment, including the suppliers, customers, training bodies and government agencies (Liao and Kuo, 2014). In recent years, the significance of eco-innovation has been recognized and many organizations have engaged in supply chain collaboration for eco-innovation. For example, to comply with the environmental regulations of the WEFE and ROHS of the European Union, Shanghai General Motors has implemented the "Green Future" strategy; Skyworth has signed the "Green Supply Chain Agreement" with 500 suppliers; Sony, IBM, Dell and HP require their suppliers to refrain from supplying the regulated materials and have launched the programme of "Supply Chain Collaboration Innovation" (De-hai, 2009). Eco-innovation represents a peculiar category of innovation, not only due to its "double externality problem" (Rennings, 2000) which implies market failure and the necessity of government regulation but also due to its dependence on cooperative effort defined as "systemic environmental innovation" (Foxon and Andersen, 2009).

Eco-innovation is characterized by integrated enhancement, ranging from the raw materials and components to the design, logistics and recycling. The eco-friendly attributes of eco-innovation are not sufficient in the current market, and hence the need to span the demand of the supplier, manufacturer and vendor-manufacturer collaboration (Geffen and Rothenberg, 2000). The collaboration is also at the level of the "life cycle perspective" to the recyclability of the

manufacturer's product (De Marchi, 2012). Eco-innovation is essential to meet the current market requirements for better customer responsiveness, and is integrated with the supply chain. In other words, eco-innovation is led by the supply chain performance to meet the demands of the customers (Ding, 2014). This leads to:

Hypothesis 6: ***The SCM performance positively affects eco-innovation.***

3.6 Research Hypothesis 7 (Eco-Innovation and Manufacturing Competitiveness)

In the last few decades, there has been an ever increasing interest in eco-innovation. "Eco-innovation can be defined as an innovation that consists of new or modified processes, practices, systems and products which benefit the environment and contribute to environmental sustainability" (Rennings, 2000). The needs of the hour are innovation (Raymond et al., 2014; Lau et al., 2013; Yam et al., 2011), effective technologies (Liu, 2013), manufacturing flexibility (Hung et al., 2014, Vokurka et al., 2000), and reconfiguration of capabilities in the manufacturing sector (Chengen, 2000). In order to sustain the competitiveness in the global market, the manufacturing companies need to engage in a continuous process of improvement in technologies as well as innovation (Johnson et al., 2004) as innovation plays a vital role in today's rapidly-changing business environment (Von, 2007). Most of the literature supports the view that innovation means "rewiring organizations for creativity and growth" (Balsano et al., 2008; McGregor, 2006). Eco-innovation is also referred to as ecological, environmental, green or sustainable innovation (Angelo et al., 2012; Schiederig et al., 2012), with all these terms pointing to the same objective of reducing the environmental impact (Schiederig et al., 2012). The drivers of eco-innovation have to achieve sustainability (Angelo et al., 2012; Carrillo et al., 2010) especially in the manufacturing industries (Sezen and Çankaya, 2013). Meanwhile, many academicians and managers are keen on learning "how companies are performing environmental innovation in the manufacturing process and in developing eco-products" (Carrillo et al., 2010).

Innovation has played an important role in enhancing the manufacturing competitiveness in India (Dewangan et al., 2015a). Due to the excessive pressure of the global markets, and of regional players, the application of technology has become more competitive. It has been observed that without major efforts in innovation, R&D, marketing and financial approaches, the

manufacturing sector loses its competence and competitiveness in the global market (Raymond et al., 2014; Lau et al., 2013). This is why many researchers and academicians have focused on innovation, open innovation and eco-innovation (Savitskaya and Torkkeli, 2011). This leads to:

Hypothesis 7: ***Eco-Innovation positively affects the manufacturing competitiveness.***

3.7 Research Hypothesis 8 (SCM Performance and Manufacturing Competitiveness)

The literature makes it clear that the traditional dimensions of manufacturing competitiveness are not enough to sustain the competitive perform
ance in today's business environment (Liu, 2013). So, the researchers have proposed a number of integrated systems to overcome the limitations of the traditional competitiveness dimensions (Liu, 2013). Hence, most of the researchers and practitioners have focused on new manufacturing competitive performance dimensions. Many researchers (Stevens, 1990; Chandra and Kumar, 2000; Tan, 2001) affirm that a good SCM performance can provide an organization with competitive advantage. A good supply chain management similarly provides flexibility in the system and supports the introduction of new products and features in the global market. A supply chain distinguished by quick customer response and supplier performance will be competitive in terms of time and quality. The best integration of both the suppliers and the customers has the strongest association with improvement in performance, including cost, time, speed of product development, delivery dependability, etc. (Frohlich and Westbrook, 2001). There is a direct relationship between supply chain performance and manufacturing competitiveness in terms of price/cost, continuous improvement, research and development, new product development and lead time, etc. These are "improvement initiatives that increase successes and reduce failures" (Terziovski and Samson, 2000).

The basic concept of CI is improvement in the quality or process, or both, in order to minimize the waste, shorten the production line, and improve the quality (Bhuiyan, and Baghel, 2005).). It has been argued that the integration of manufacturing and R&D is challenging for the manufacturing companies (Bruch et al., 2014). Yet, over the last decades, R&D (Bruch and Bellgran, 2014; Lööf et al., 2014) has played an important role in enhancing the competitiveness of the manufacturing industries. The above argument leads to:

Hypothesis 8: ***Supply chain management performance positively affects the manufacturing competitiveness.***

3.8 Research Hypothesis 9 (Supplier Selection and Manufacturing Competitiveness)

In the global market, supplier selection plays a crucial role in supply chain management (Lee, et al., 2001). In the 1960s, many academicians and purchase practitioners focused on the selection and measurement of the performance of suppliers in the supply chain, in order to enhance the competitiveness of the manufacturing companies. One of the major objectives of supplier selection is to enhance manufacturing competitiveness. Purchasing is one of the most important activities, and an important research topic, in supply chain management. In the present scenario, purchasing is closely linked to strategy formulation by the senior management (Moses, 2011), and effective management of the supply chain partners positively affects the firm performance (Collins et al., 2010). It is usually operationalized through the triple bottom line, a concept developed by Elkington (1998b), which simultaneously considers and balances the economic, environmental and social issues from a micro-economic point of view. "Nowadays, many of the companies are making efforts to implement the environmental and social aspects in their supply chain for the future generations to meet their desired needs" (Bowen et al., 2001). Most of the academic and industry experts suggest that they are concentrating more on the social aspects, and many organizations are implementing the supplier assessment tools, codes of conduct, and better collaboration with the suppliers (Keating et al., 2008; Andersen and Skjoett-Larsen, 2009).

The main goal of the supplier selection process is to structure a good relationship between the buyers and the suppliers minimizing the purchasing risks, enhancing the manufacturing competitiveness, and maximizing the overall efficiency of the purchasing system which is very valuable for the achievement of Just in Time (JIT) production system (Li et al., 1997). Moreover, in the use of the concepts of Just in Time (JIT) and Total Quality Management (TQM) by different manufacturing companies, the supplier selection process is very important (Petroni and Braglia, 2000). Evaluation and selection of suppliers is a very crucial factor in enhancing the competitiveness of the manufacturing sector (Motwani et al., 1999). Chou and Chang (2008) focus on supplier selection on the basis of four distinct phases – defining the appropriate problem,

formulating different criteria and qualifications, and selecting the supplier for the manufacturing industry. During the last three decades, the supplier selection process has witnessed drastic changes. In the present global scenario, it is not possible to produce low cost, high quality products without supplier support. Therefore, supplier selection decisions form a very crucial component of production and logistics management for an organization. Researchers have incorporated different criteria in the process of supplier selection. It has been argued that the purpose of identification of the supplier evaluation and selection criteria in the general contexts is to enhance the competitive advantage of the manufacturing industries in India. This gives rise to:

Hypothesis 9: ***Supplier selection positively affects the manufacturing competitiveness.***

3.9 Conclusion

Combining Hypothesis 1, 3 and 8, a causal path can be drawn from the environmental uncertainty and SCM practices, through the SCM performance, to the manufacturing competitiveness, which specifies the direct or indirect impact of the SCM performance on manufacturing competitiveness. Therefore, it can be concluded that supply chain management is very significant to enhance manufacturing competitiveness.

In sum, this chapter delivers a theoretical framework for understanding the background to, and significance of, SCM and develops nine hypotheses based on the literature review. The next chapter will discuss the research methodology for generating items for the measurement instruments.

CHAPTER – 4

INSTRUMENT DEVELOPMENT PHASE I - ITEM GENERATION AND PILOT TEST

Preview

The objective of this chapter is to develop the scale for manufacturing competitiveness, particularly in the context of Indian manufacturing companies. This chapter also provides the outlines of quantitative research conducted for the same. A scale development process has been done for previously discussed research model (Chapter 3). Validation and assessment of variables are also discussed. In addition, this chapter provides details of the research methodology, and research design.

4 Introduction

The first stage for conducting any empirical study is setting out the theoretical base. It may be either theory development (exploratory) or theory verification (confirmatory) or may be the combination of both (Flynn and Pearcy, 1990). Based on the review of literature presented in Chapter 2 and Chapter 3, a conceptual framework has been presented as shown in Figure 3.1. In this study, supply chain management and manufacturing competitiveness are the two major constructs of interests (Heaton et al., 2004).

This chapter deals with the instruments for this research work, which includes developing questionnaires and testing of questionnaires for reliability and validity. Literature shows that various researchers have focused on scale development processes. Likert and Bowers (1969), defined the three general steps in scale development, including initial survey design, questionnaire development, and data analysis. Later, Spector (1992), has sub-divided Likert's three stages into five steps: (i) define the construct, (ii) design the scale, (iii) pilot test the scale, (iv) administers the scale and perform item analysis to determine whether the items form scales, and (v) validate and norm the measures. Schwab (1980), identified three stages: item generation, scale development, and scale evaluation.

Since few of the constructs have already been tested in previous studies and were found to be valid and reliable. But, they were again tested in the pilot study, re-validated in the large-scale analysis in Indian context. The instruments to measure environment uncertainty, SCM Practices, eco-innovation, SCM performance, supplier selection, and manufacturing competitiveness were developed and pilot tested in this chapter. The instrument development process can be divided into three stages: first, item generation; second, structured interview and pre-test; and third, a pilot study (Churchill, 1979; Segars and Grover, 1993). The Initial pool of items was pre-tested with twenty practitioners and seven academicians. After pre-tested by the experts, interactions with the respondent was doing and asked to provide the feedback regarding the clarity of questions, instructions, as well as the length of the questionnaires. So, based on the feedback, items were modified or discarded to strengthen the constructs and content validity. In the second stage, scale development and testing was done through a pilot study. The instruments were further redefined based on the pilot study outcomes. The third stage is described later, including all the validity and reliability tests using the data from a large-scale sample. Research hypotheses were then tested based on the large-scale data analysis. To test the hypothesized relationships among the constructs as shown in Figure 3.2., a reliability and validity measure for each and every construct must first be developed. The instruments to measure (1) Environmental Uncertainty (EU), (2) SCM Practices (SCMPR), (3) Eco-Innovation (ECO), (4) SCM Performance (SCMP), (5) Supplier Selection (SS), and (6) Manufacturing Competitiveness (MC), were adopted from previous studies with minor modifications (Nahm, 2000; Krause et al., 1998; Tan, 2001; Monczka et al., 1998; Augusto et al., 2014; Lau et al., 2013; Sezen & Çankaya, 2013; Schiederig et al., 2012; Berkhout, 2011; Kemp, 2010; Holmberg, 2000; Gunasekam et al., 2001; Zeydan et al., 2011; Punniyamoorty, M et al., 2012; Zouggari and Benyoucef, 2012; Kannan, D. et al., 2013; Zouggari and Benyoucef, 2012; Kannan, D et al., 2013; Singh et al., 2008; Liu, 2013). The scale development process is discussed in the next section.

4.1 Scale Development Process

Churchil (1979), proposed a well-defined scale development process. Further, this process was refined by various researchers (Peter, 1981; Bentler and Bonnet, 1980; Bagozzi, 1980; Nunnally and Bernstein, 1994). This process consists of two phases (Figure 4.1). These phases are described in detail below:

4.1.1 Item Generation and Selection Phase

From the literature review and expert opinions, new items and constructs were extracted. The development stages to develop items are as followed:

- Content analysis and categorization
- Generation of initial pool of items
- Assessment of content and face validity through experts' judgments

4.1.2 Scale Refinement Phase

The scale refinement phase has been categorized into two sub phases, i.e., pilot-testing stage and purification stage. The steps in these stages are as follows:

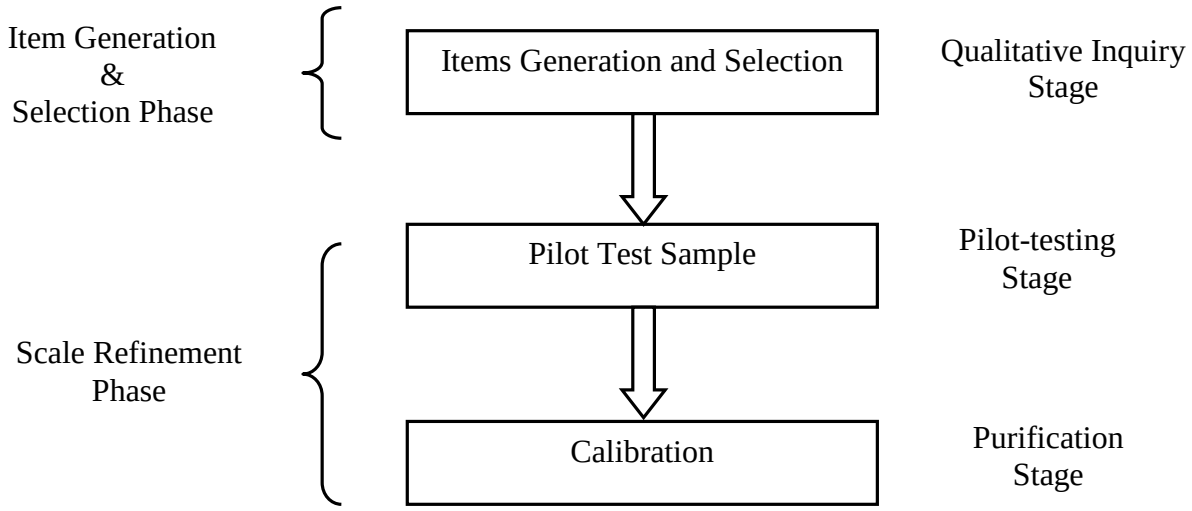


Figure 4.1 Scale Development Procedure

"The very basic requirement for a good measure is to have content validity, which means the measurement items contained in an instrument should cover the major content of a construct" (Churchill, 1979; Hinkin, 1995). Content validity can be achieved through a comprehensive literature review and interviews with practitioners and academic research experts (Fink, 1998; Hinkin, 1995). Therefore, the content validity was achieved through a rigorous literature review as well as interviews with practitioners and academicians. Literature shows that there is a clear linkage between theoretical literature and description of the process for items generation. Spector (1992) focused on the inductive approach which is consistent with defining the construct which is

based on the theory and developing items and if the construct is complex then it is advisable to sub-divided the construct into sub-construct which is relevant to the research work. The method of content validity assessment may be done successfully by the experience person or researcher who is being researched in the specific area (Schriesheim and Hinkin, 1990). The initial items for each construct have been generated on the basis of rigorous literature review of relevant literature. The list of initial items for each construct was created based on a comprehensive review of relevant literature. Then, items are systematized into groups to measure a particular dimension of a construct domain. The literature based for items in each construct are described below:

To achieve the content validity for environment uncertainty (EU), previous literature on institutional theory is reviewed. Burgess, (1998), Tan et al. (1998), Thomas and Griffin (1996), Krause et al. (1998), Oswald et al. (1997), Miller and Droge (1986), Nahm (2000) are some of the important contributions in the area of environment uncertainty. The environment uncertainty includes three domains: (1) Technology Uncertainty (Evan et al., 1993; Tan et al., 1998; Tattum, 1999; van Hoek et al., 1999), (2) Demand Uncertainty (Boyaci and Gallego, 2002; Alonso-Ayuso et al., 2005; Zuckerman, 2005; Xiao, T. et al., 2008; Kunnumkal and Topaloglu, 2008) and (3) Supply uncertainty (Lau, G. et al., 1999; Chandrasekar, S. et al., 2002; Pyke, et al., 2003; Tan, 2004). On the basis of the definition presented in Table 2.10, initial pools of items are generated to measure the three dimensions of environment uncertainty. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

The contribution from Donlon (1996), Tan et al. (1998), Alvarado and Kotzad (2001), Tan (2001), Monczka et al. (1998) are used to generate items from SCM practices (SCMPR). The SCM Practices includes four domains: (1) Customer Relationship (Tan et al., 1998; Claycomb et al., 1999; Aggarwal, 1997; Bommer et al., 2001; Magretta, 1998a; 1998b; Noble, 1997; Wines, 1996), (2) Information Sharing (Humphreys et al., 2004; Carr and Kaynak, 2008; Chopra and Meindl, 2007; Zhou et al., 2007; Ballou et al., 2000; Mentzer, 2000), (3) Information Quality (Monczka et al., 1998; Holmberg, 2000; Me Adam and McCormack, 2001), and (4) Supply Chain Integration (Stock et al., 1998; Narasimhan and Jayaram, 1998; Magretta, 1998a; Stevens,1990; Wood, 1997; Frohlich & Westbrook, 2001) as shown in Table 2.11. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

Previous work of Rennings (2000), Angelo et al. (2012), Schiederig et al. (2012), Carrill et al. (2010), Sezen and Çankaya (2013) was referred to get items for eco-innovation (ECO) as shown in Table 2.9. The items which are related to eco-innovation are shown in Appendix 5. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

The authors like Beamon (1999), Kiefer and Novack (1999), Garwood (1999), Holmberg (2000), Gunasekam et al. (2001) are contributed in developing items for SCM performance (SCMP). The SCM Performance includes two domains: (1) Customer responsiveness (CRs) (Narasimham & Jayaram, 1998; Beamon, 1998; Spekman et al., 1998a; Stevens, 1990; Lee and Billington, 1992; Kiefer and Novack, 1999; Gunasekran et al., 2001), (2) Supply chain efficiency (SCE) (Cohen and Lee,1988; Beamon, 1999; Schroeder and Flynn, 2001; Shah and Ward, 2003; Vonderembse et al., 2006; Modi and Mabert, 2010) as shown in Table 2.12. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

The items for Supplier selection (SS) are shown in Table 2.9. These items are selected from the work of Dickson (1966), Timmerman (1986), Aissaoui et al. (2007), Tahriri et al. (2008), Andersen and Skjoett-Larsen (2009), Ho et al. (2010), Amid et al. (2011), Punniyamoorty et al. (2012), Kannan et al. (2013). The items which are related to eco-innovation are shown in **Appendix 5**. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

The authors like Tefertiller and Ward (1995), Porter (1996), Boltho (1996), Singh et al. (2008), Carpinetti et al. (2000), Clark et al. (2005), Dacko (2000), Liu (2013) are contributed in developing items for Manufacturing Competitiveness (MC). The Manufacturing Competitiveness includes five domains: (1) Price/Cost (P/C) (Koufteros, 1995; Wood et al., 1990; Miller et al., 1992, Hall et al., 1993; Rondeau et al., 2000), (2) Continuous Improvement (CI) (Jaca et al., 2014; McLean et al., 2014; Bhuiyan et al., 2005; Terziovski et al., 2000; Juergensen, 2000), (3) New Product Development (NPD) (Bruch et al.,2014; Schrettle et al., 2001), and (4) Manufacturing Flexibility (MF) (Swamidass and Newell, 1987; Sethi and Sethi, 1990; Skipper and Hanna, 2009; Camis´on and L´opez, 2010; Patel, 2011; Goyal et al., 2012; Oke, 2013; Mishra et al., 2014) as shown in Table 2.13. A five-point Likert scale is used to measure the importance of these constructs (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = not applicable).

4.2 Structured Interview and Pre-test

Once the item pools for the various construct were developed, then construct were reviewed by the seven academicians, doctoral students in the fields of operation management/SCM and re-evaluated through structured interviews with ten industry experts. The objective was to check the significance of every construct's definition and clarity of the wordings of sample questionnaire items. The redundant and ambiguous items are either modified or eliminated after the feedback from academicians and practitioners. New items were added wherever required. Then, the practitioners act as judges and sort the items into separate sub-constructs. Items are subject to two sorting rounds by two independent judges per round. Each item is printed on a 3 × 2.6-inch index card. By random order the cards are shuffled for presentation to the judges. Then judges categorized the card on the basis of their judgement and put each and every card into specific categories. A "not available (NA)" category is included to ensure that the judges do not force any item into a particular category. "Before sorting the cards, the judges are briefed with a standard set of instructions that were previously tested with a separate judge to ensure comprehensiveness of the instructions. Judges are allowed to ask any questions related to model, definition, and procedures to ensure that they understand the procedures correctly". After the sorting items by judges the overall, 150 questionnaire items are ready to be sent out for the pilot study. The Q-sort results are not incorporated in this dissertation, because a more comprehensive pilot study was conducted. The methodology, procedures, and results of the pilot study are reported in the next section.

The total number of pools and items outcomes after the feedback from academicians and practitioners are as described below: The total numbers of pools 15 and 80 items are as shown in Table 4.1. The survey questionnaire items are provided in Appendix 5.

Table 4.1 List of Pools and Items with Code

S. No.	Code	Number of pools	Number of items
	(EU)	**Environmental Uncertainty**	
1.	**(TU)**	Technology Uncertainty	**05**
2.	**(DU)**	Demand Uncertainty	**05**
3.	**(SU)**	Supply Uncertainty	**05**
	(SCMPR)	**SCM Practices**	
4.	**(CR)**	Customer Relationship	**10**
5.	**(IS)**	Information Sharing	**07**
6.	**(IQ)**	Information Quality	**04**
7.	**(SCI)**	Supply Chain Integration	**04**
8.	(**ECO**)	**Eco-Innovation**	**05**
	(SCMP)	**SCM Performance**	
9.	**(CRs)**	Customer Responsiveness	**05**
10.	**(SCE)**	Supply Chain Efficiency	**04**
11.	**(SS)**	**Supplier Selection**	**05**
	(MC)	**Manufacturing Competitiveness**	
12.	**(P/C)**	Price/Cost	**05**
13.	**(CI)**	Continuous Improvement	**06**
14.	**(NPD)**	New Product Development	**06**
15.	**(MC)**	Manufacturing Flexibility	**04**
Total		**15 Pools**	**80 items**

4.3 Pilot Study Methodology

A Pilot study was conducted with a small number of respondents (preferably, the sample size of 40 or more) before the large-scale survey administration provides valuable preliminary information about the reliability and validity of the measurement scales. It offers a last opportunity to further purify the scales. The manufacturing companies and its supply chain are the research unit for this study. To obtain a representative sample, we used the CMIE (Centre for Monitoring Indian Economy Pvt. Ltd.) and Prowess database of Indian directory as our sampling pool. We selected randomly manufacturer and identified a key informant, who typically had a title such as Operation managers, supply chain managers, CEO/president, vice president or director, and was knowledgeable about the company's internal and external processes. Further, we contacted the key informants by telephone, in order to obtain their preliminary agreement to participate.

The questionnaire has been mailed to concerning companies, along with a cover letter highlighting the study's objectives and potential contributions. After that follow-up procedure was

done through telephone calls and mailings were used to improve the response rate and addressed potential missing data issues (Frohlich and Westbrook, 2002). There are approximately 4200 manufacturing companies in India, which relates to our study (CMIE, 2014). Hence, the sample size taken is, for more than 10% of the population, i.e., 420 manufacturing companies (Malhotra, 2008). Out of 4200 manufacturing companies contacted, a total of 420 questionnaires was distributed, and around 50 questionnaires had missing data and some 20 questionnaires had multiple responses, so those data were not considered. Hence, 350 usable responses were found.

4.3.1 Pilot-testing Stage

In the pilot-testing stage, the items selected in the earlier stage were tested on a pilot sample. The following steps were taken at this stage are as follows:

- Item analysis
- Exploratory factor analysis
- Consistency and reliability assessment

After getting the responses from various companies, the pilot analysis was done with the following objectives in mind: purification, uni-dimensionality, and reliability.

The purification of data needs to be done before conducting factor analysis. Churchill (1979), suggested the need for the purification of the item. He argues that "when factor analysis is done before purification, there seems to be a tendency for factor analysis to produce many more dimensions than can be conceptually identified, confounding the interpretation of the factor analysis" (Koufteros et al., 1998). For the item purification, the Corrected Item Total Correlation (CITC) is calculated for each item (Kerlinger, 1978). The items are eliminated whose value of CITC is less than or equal to 0.4 (Hair et al., 2013). Those items are accepted whose values are lower CITC, if that item is considered to be important to the construct.

Second, after purifying the items, an exploratory factor analysis (EFA) (i.e., dimension level factor analysis) of the remaining items for each construct is conducted to assess the uni-dimensionality of each sub-construct and to eliminate the cross-loading items. "Dimension level factor analysis can also provide useful directions for possible merge or split of existing constructs dimensions. If a construct-level factor analysis is not possible because of small sample size, correlation coefficients are checked to ensure discriminant validity of measurement scales. Items with loadings on more than one factor of 0.40 or higher are considered to be eliminated

(Hair et al., 2013). If a certain sub-dimension has two factors or more, the items for this sub-dimension are closely examined".

Third, after uni-dimensionality is obtained, then check internal consistency or reliability for remaining items using Cronbach's alpha (Cronbach, 1951). According to Nunnally (1978) items are considered and the acceptable whose value of Alpha is greater than 0.7. In the next section, the results of the pilot test for each construct are present, which is used in the model.

4.3.2 Refinement and Validation Stage

The items obtained from section 4.3.1 were polled for consistency and reliability. They were further purified on a representative sample as follows:

- Confirmatory factor analysis
- Unidimensionality and reliability assessment
- Convergent and discriminant validity assessment

The above stages are used for the scale development. The scale development process is explained in detail in chapter 5.

4.4 Research Methodology

The main objective of the research methodology is to guide the researcher at each and every step of his study, and to achieve the objective of the study. The research methodology is like strong foundation platform which gives the answer to the research questions. According to, Malhotra and Dash (2010), the basic steps of the research methodology includes the research design, sample design, data collection and analysis process. These are shown in Figure 4.2.

4.5 Research Design

According to Yin (1994 "*A research design is the logical sequence that connects the empirical data to the study's initial research questions and ultimately its conclusions*". According to Malhotra and Dash (2010) research design can be classified into three categories, i.e., exploratory, descriptive and causal (Amartunga et al., 2001). The listed questionnaires in the (**Appendix 5**) are required to examine through exploratory, descriptive and causal research design. First, the objective of exploratory research is a thorough study of the literature on supply chain management and manufacturing competitiveness, and interview was conducted by various experts

of industry and academic. It is very essential to list out all the factors of supply chain management and manufacturing competitiveness. Apart from that, the exploratory research design has been used to achieve the objective of the study (Objective 1 and 2) as shown in Chapter 1.

Second, in the present study, the research design has adopted was cross sectional descriptive and multiple cross sectional. It has been observed that the data collection by multiple cross sectional method is too much costly, so, the data collection has been done from different sample elements only once. For the collection of data, a personal telephone and a mail survey were conducted for the various managerial level employees of the manufacturing companies in India as discussed in (Section 5.1).

Third, the causal research design has been used to understand the relationship between dependent and independent variables. In this study, supply chain management is independent variable and manufacturing competitiveness is acting as a dependent variable. Thus, to identify the causal relationship between these two variables, a causal research design was developed.

In brief, a combination of all three research design exploratory, descriptive and causal has been adopted in the present study. In the present study, the application of both qualitative and quantitative methodologies have been used to identify the nature of problems, different variables and the relationship between these variables. The mixed research design has been used for holistic and structured preview of the research problems. The three designs (exploratory, descriptive and causal) complement each other and supported each other in attaining the present research objective. The overview of research methodology followed in the present research as shown in Figure 4.2. The details of the research methodology have been described in the next chapter.

4.6 Conclusion

In the beginning of this chapter, initially, scale development process, i.e., (item generation and selection phase, structured interview and pre-test, pilot study methodology, pilot-testing stage, refinement and validation stage) has been done, to measure the manufacturing competitiveness. Further, a details step of research methodology has been discussed.

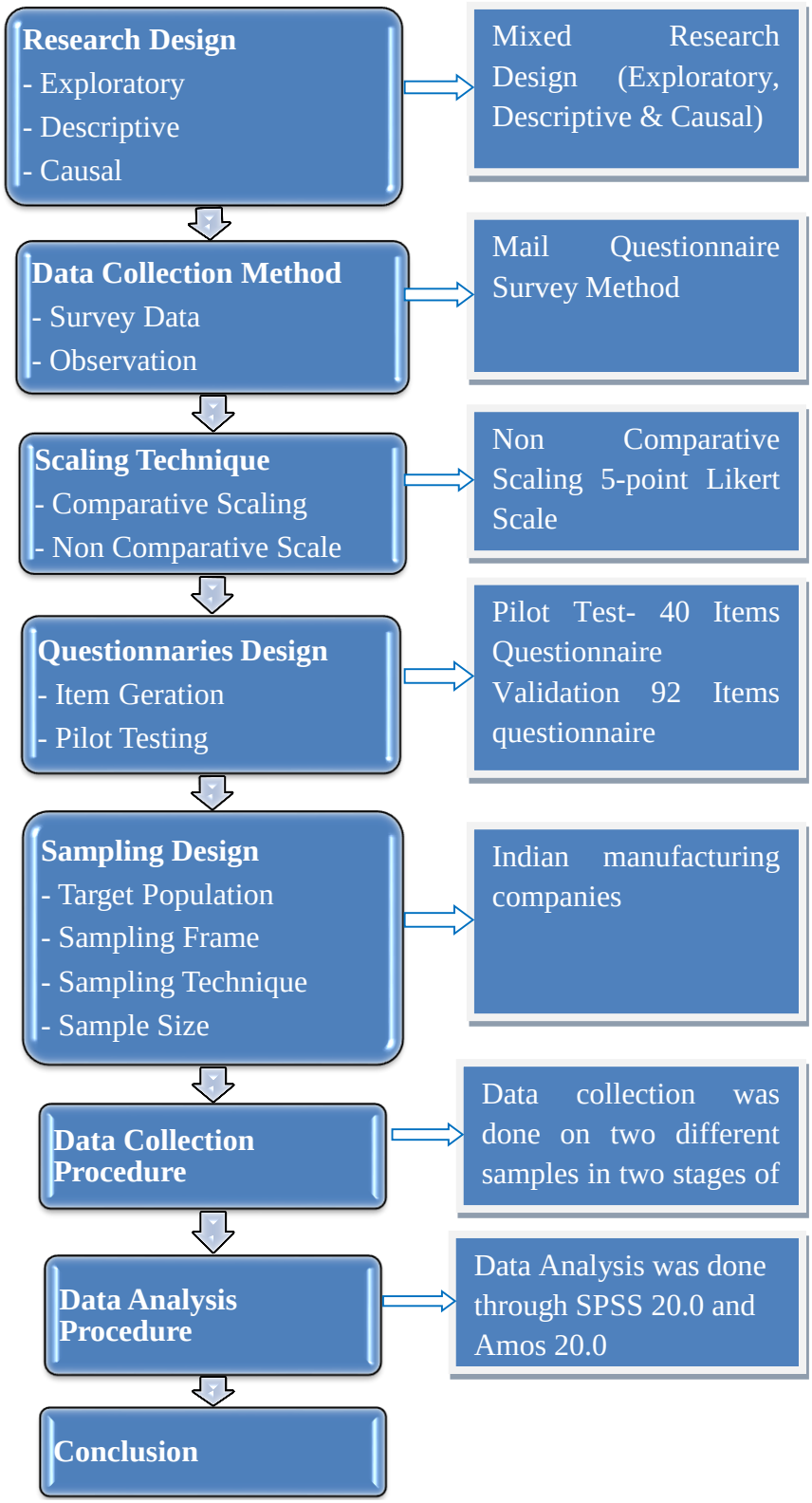


Figure 4.2 Overview of Research Methodology Followed in Present Research

CHAPTER – 5
INSTRUMENT DEVELOPMENT PHASE II – LARGE SCALE ADMINISTRATION AND INSTRUMENT VALIDATION

Preview

This chapter deals with data collection of large-scale survey after item generation and structured interview. The main objective of large-scale survey is to collect the data for validation of the instrument developed and to test the hypothesized relationships among variables in the research model. This chapter presents the research methodology used in the large-scale survey (section 5.1) and the steps of research methodology includes the research design, data collection methods, questionnaire design, sampling design, data analysis procedure and demographic profile of the respondents and companies. For the analysis of the data, the different steps, and tests were performed, to check for the discriminant validity, convergent validity, test of reliability, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of all reflective scales in the model (which include the independent scales of Environmental Uncertainty, SCM practices, Eco-Innovation, SCM performance, Supplier Selection, and Manufacturing Competitiveness). For each construct and sub-construct, the data has been collected through the survey method by a Likert scale (5 point). This chapter describes the procedures used in testing the structural model. Anderson and Gerbing (1988) recommended a two-step approach to test hypotheses. In the first step, the confirmatory factor analysis (CFA) measurement models were tested to establish the validity and reliability of the scales as described in Chapter 4.

5. Large-scale Data Collection: Methods

The literature shows that there are different methods of data collections. These are discussed earlier. It has been observed that there are various earlier studies has adopted a questionnaire method for data collection in this field of study (Benito and Benito, 2005; Herremans et al., 1993; Russo & Fouts, 1997). The main advantage of questionnaire method is low cost, accurate, covers a wide range, and quick in data collection (Zikmund, 2000; Cresswell, 2003). Apart from that, an online survey method is also a better option for data collection for internal consistency and predictive validity (Sethuraman et al., 2005; Schillewaert and Meulemeester, 2005).

The respondent is one of the most important resources for data collection. The quality of the respondents is one of the most important factors in an empirical study. In this study, the respondents are expected to have the best knowledge about the operation and management of the supply chain in his/her organization. On the basis of literature review and recommendations from industry experts, it was decided to choose Chief Executive Officer (CEO)/President, Vice President or Director, Operation Managers, Supply Chain Managers, and Purchasing Managers, etc., as the respondents for the current study. The survey approach was used for data collection in the current study. The survey method is an attractive method of data collection, because of its potential to afford the researcher a large amount of information that can be analyzed to test relationships between two or more variables. The survey method is also an attractive method to generate a great deal of information from a large sample of the subjects under study (Kerlinger, 1986). This survey method presents the opportunity to validate a researcher's psychometric measurement scale. In this study, our target respondents are all upper-level managers or C-level executives who are well off. All survey respondents are on a voluntary basis. In this study, each potential respondent was contacted via telephone and asked about their willingness to participate in the survey to prequalify them. It has been observed that personalized emails can increase the response rate (Erdos, 1970; Dillman et al., 2009). The individual mail to the respondent is more effective rather than bulk, messages. Literature shows that to test the effectiveness of email invitation personalization (Heerwegh, 2005) and the personalized invitations resulted in nearly an 8-percentage point increase in response rates over the un-personalized invitations (Heerwegh, 2005).

5.1 Large-scale Data Collection: Procedures

The large-scale data collection procedure is very important for the data collection from the organization. In this study, data were collected through a structured questionnaire because of even nature of the results, the analysis and interpretation is comparative ease. The large-scale data have been obtained from CMIE and Prowess database and personal contact via e-mails and telephone to renowned organization of manufacturing companies. The details of the company name and their manufacturing area and other details are obtained from the CMIE and Prowess database. From, the CMIE and Prowess database, 4200 manufacturing companies were randomly selected. Initially, the turnover of selected companies is more than 100 crore (INR) and the list was limited to companies with more than 1000 employees for companies with less than 1000 employees are unlikely to engage in this study. The respondent of this study are

purchasing/manufacturing/materials executives and included CEOs, presidents, vice presidents, managers, and directors.

A structured questionnaires were sent to the respondents through e-mail with cover letter and reference letter from the thesis supervisor. To collect the data from respondents the following steps were followed:

- The questionnaires were sent through e-mail along with cover letter. The cover letter contains the brief introduction of researcher, purpose of the research, and their significance. To verify the authenticity of the researcher, a formal letter from the supervisor were sent to each of the respondents (Appendix 1).
- The cover letter was addressed to the name and designation of the particular of the responsible employee who is involved in operations or supply chain management (Appendix 2).
- After sending the questionnaires with cover letter, after three weeks again reminder e-mail cover letter (Appendix 3) were sent to the employee who had not given the reply.
- The reminder e-mail has been working, so, the same process has been adopted to enhance the response rate of the respondent (Appendix 4).
- The response rate is less via reminder e-mail, finally, the researcher contacted respondents through telephonic appointment followed by personal meetings at different places for data collection across the country.

5.2 Scaling Techniques

According to Malhotra and Dash (2010), Scaling involves creating a continuum upon which measured objects are located". Literature shows that scaling techniques are categories into two ways: comparative scales and non-comparative scales (Malhotra and Dash, 2009). For the achievement of the objective of this present study, the data has been collected through a structured questionnaire for three levels of scale development. With the help of structured questionnaire the data were collected in two stages, i.e., scale refinement and scale validation stage of the scale development process. Initially, 80 item questionnaire (Appendix 5) was applied to pilot test. Out of the 80 items, 49 items were usable (Appendix 6) for first order confirmation analysis. A 5-point Likert scale was used for items scored because it is best suited for the present study. The various reasons behind the adoption of 5 point Likert scale. The main reason is the scale construction and administration is very easy. This scale is very suitable for personal, mail and telephonic interview (Malhotra and Dash, 2009). Literature shows that the

adoption of Likert scale is that highest number of studies have adopted the 5-point Likert scale for collecting of data on SCM performance and manufacturing competitiveness (Rettab et. al., 2009; Benito and Benito, 2005).

5.3 Questionnaire Design

The questionnaire design was started with the total number of pools and items outcomes from experts. The unwanted items were deleted through an initial screening process, details of the screening process and the pilot study have been explained in (section 4.3). Hence, a total number of pools are 15 and 49 were developed which was tested again by the pilot survey as shown in Table 5.1. The detail of these activities is given in the next chapter.

Table 5.1 List of Pools and Items

S. No.	Code	Number of pools	Number of items
	(EU)	**Environmental Uncertainty**	
1.	**(TU)**	Technology Uncertainty	**05**
2.	**(DU)**	Demand Uncertainty	**04**
3.	**(SU)**	Supply Uncertainty	**02**
	(SCMPR)	**SCM Practices**	
4.	**(CR)**	Customer Relationship	**05**
5.	**(IS)**	Information Sharing	**02**
6.	**(IQ)**	Information Quality	**01**
7.	**(SCI)**	Supply Chain Integration	**03**
8.	(**ECO**)	Eco-Innovation	**05**
	(SCMP)	**SCM Performance**	
9.	**(CR)**	Customer Responsiveness	**02**
10.	**(SCE)**	Supply Chain Efficiency	**04**
11.	**(SS)**	Supplier Selection	**05**
	(MC)	**Manufacturing Competitiveness**	
12.	**(P/C)**	Price/Cost	**05**
13.	**(CI)**	Continuous Improvement	**02**
14.	**(NPD)**	New Product Development	**02**
15.	**(MC)**	Manufacturing Flexibility	**02**
Total		**15 pools**	**49 items**

5.4 Sampling Design

After the questionnaire design, the next step is sampling design, to achieve the objective of this study, choose the suitable sample data. Literature shows that there are numbers of techniques to decide the sample size with different criteria. In sampling techniques, there are two types, sampling design, i.e., probability sampling and non-probability sampling. Malhotra and Dash (2009), suggested five steps in the sample design process, they defined as the target population, determination of sampling frames, selection of sampling technique suitable for the particular study, an estimation of the sample size and last but not least the execution of sample process. The most important issues in this stage are that the issues that comes into the picture or whether this research should be specific industry oriented or not. Second, the success of this research totally depends on the right selection of the respondent. In this study, respondents were managers of various functional area and top level managers of the companies. Both the upper and high levels of managers are taking part and members from functional teams and top management were incorporated to understand the managerial perception of supply chain management and manufacturing competitiveness. Hence, the survey questionnaires were designed to get more and specific information about supply chain management and manufacturing competitiveness. At least 5 times of the items, observations are to be analyzed, it is more appropriate if the observation is more than 10 times of the items (Hair et al., 2013). With respect to this theory, the sample size is in between 200 to 400. In this study, the same size has taken is 350.

5.4.1 Target Population

Target population refers to the entire group of individuals or objects to which researchers are interested in generalizing the conclusions. The target population usually has varying characteristics and it is also known as the theoretical population. Malhotra and Dash (2010) focused on the target population, and it is defined in terms of elements, sampling units, extent and time. In the present study, the target population has classified in two ways: Elements- Managers, Sampling units.

5.4.1.1 Elements- Managers

The elements of the present study are managers of Indian manufacturing companies. The targeted elements/respondent are Chief Executive Officer (CEO)/President, Vice President or Director, Operation Managers, Supply Chain Managers, and Purchasing Managers, etc. The main reason for the selection of managers was that they provide the appropriate information

about their company. The frequency of managers and executives are shown in Table 5.2. The frequency of Chief Executive Officer (CEO)/President is 52, Vice President or Director is 103, Operation Managers is 53, Supply Chain Managers is 77, and Purchasing Managers is 65, etc., are managers (respondents), who provides the appropriate information regarding this research work as shown in Table 5.2., etc.

Table 5.2 List of Managers/Respondent, Frequency and Their Percentage

Job Title	Frequency
CEO/President	52
Vice President or Director	103
Operation Managers	53
Supply Chain Managers	77
Purchasing Managers	65
Total	**350**

5.4.1.2 Sampling Units- Why Manufacturing Companies?

In this study, for the sampling unit, manufacturing industries was selected for a variety of reasons. These are stated as follows: It has been observed that a number of studies have been available to the manufacturing industry across the globe for supply chain and manufacturing competitiveness using different techniques. These kind of studies with new dimensions of SCM and manufacturing competitiveness are still not common in the Indian manufacturing sector. So, due to this reason, the present study was conducted in the Indian manufacturing sector.

5.4.2 Sampling Frame

The sampling frame denotes the elements of the target population. "It comprises of the list of guidelines to mark the target population" (Malhotra and Dash, 2009). The manufacturing companies are the targeted sector in this study. The list of companies were selected from the directory of Indian manufacturing companies published by CMIE and Prowess database. The two criteria have been adopted for the company selection. First, the company has more than 5 years of manufacturing operations and Second, the net profit is more than 50 million in year 2013-2014. In the CMIE and Prowess database, there are approximately 4200 manufacturing companies in India were found. According to the survey of Government of India National Manufacturing Competitiveness Council, report (2011), the manufacturing sector contributes 15.24% of the country's Gross Domestic Product (GDP) and the major sector manufacturing includes. The seven sectors are Automobiles & Auto Ancillaries Industry, Cement Industry,

Food and Beverages Industry, Metal and Non Metals Industry, Pharmaceuticals Industry, Power & Energy Industry, and Textiles Industry, etc.

5.4.3 Sampling Method

The sampling method is different for different stages. The convenience sampling method is the best method of pilot survey. There are different types of respondents from different sectors as earlier mentioned in (table 5.2) and respondent were contacted through telephone and e-mail mentioned in (section 5). These respondents are working at the top management position in the different types of companies. In this study, the data were collected in between January to June, 2015. In this study, the target population (N) consists of the ten sectors. The variable used for the stratification was 'type of industry'. The list of the companies has been identified from CMIE (CMIE, 2015) and Prowess data base, (2015). The seven sectors are Automobiles & Auto Ancillaries Industry (65), Cement Industry (150), Food and Beverages Industry (30), Metal and Non Metals Industry (50), Pharmaceuticals Industry (75), Power & Energy Industry (60), and Textiles Industry (70), etc., and their percentage is shown in Table 5.3., and the percentage wise industries are shown in Figure 5.1.

Table 5.3 List of Industries, Frequency and their Percentage

Name of Industries	Frequency	Percentage
Automobiles & Auto Ancillaries Industry	65	13.0
Cement Industry	150	30.0
Food and Beverages Industry	30	6.0
Metal and Non Metals Industry	50	10.0
Pharmaceuticals Industry	75	15.0
Power & Energy Industry	60	12.0
Textiles Industry	70	14.0
Total	**500**	**100**

5.4.4 Sample Size

5.4.4.1 For Pilot Testing Stage

The pilot testing stage provides the basic idea of conducting the exploratory factor analysis with Principal Component Analysis along with the an assessment of the consistency and reliability of the items. The pilot study was conducted in a very few number of

respondents, This stage has been considered for the preliminary development of the scale. The refinement and the validation stage was discussed in next section.

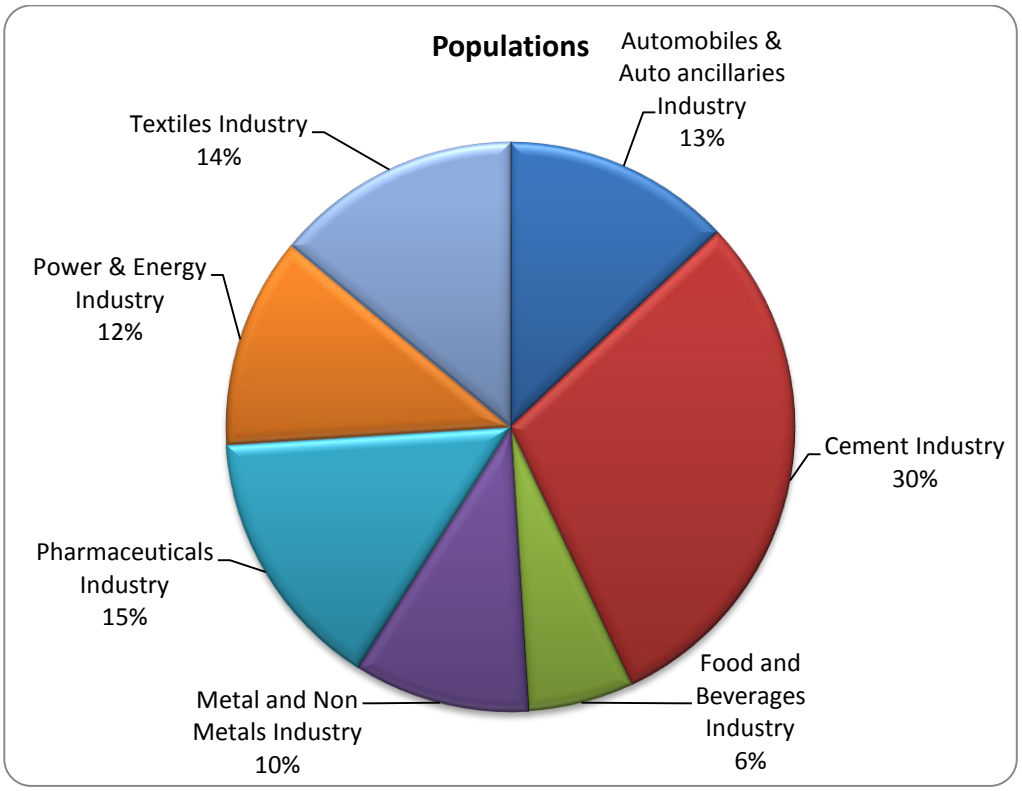


Figure 5.1 Description of Population

5.4.4.2 For Refinement and Validation Stage

The author Green (1991) focused on a desirable sample size (n) should be:

$$n > 50 + 8V$$

Where 'V' is the number of independent variables for testing the multiple regression and the 'n' is number of respondent. For, the sample size of the respondent, the different authors may suggest differently, but the desirable ration should in the range of 15 to 20 for each independent variable. According to Hair et al. (1998), a lower ratio like 5:1 could be also be considered. The minimum sample size should be 300 for the exploratory factor analysis (Tabachnick and Fidell, 2001). The sample size of the population is 1:10 to ensure the factor reliability (Nunnally, 1978). The minimum sample size of the respondent for the SEM should be 150 (Hair *et al.*, 2006).

5.5 Final Data Collection Procedure

This final data procedure is conducted through primary source. The data were collected in two stages, First, The pilot study was conducted, for the standard validity and reliability of

data. Second, the stage was purification and validation phase. The Pilot survey was conducted on the top level respondent in the different manufacturing companies in India. The pilot survey has conducted in the month of January to June, 2015. The questionnaires were sent by e-mail and follow the steps in section 5.1. With the questionnaires a cover letter (Appendix 1 & 2) has been explained with the research objective and questionnaires (Appendix 5). A reminder letter (See Appendix 3 and 4) has been sent along with the instrument to the respondent after three weeks. To improve the response rate of the survey, other methods like telephone, personal contact, and personal visit after telephonic appointments were also used to improve the response rate. A total 380 instrument was returned, resulting in 20% rate of response and the literature shows that this rate of response is well accepted (Fraj-Andre´s et al., 2009; Rettab et al., 2009). The response rate, in the first round 2.1%, in second round 2.4%, and third round 3.3%, were received. After the third round, it has been observed that there is an immense rate of responses were received by 3.7%, 4.9%, and 5.5%, respectively, as shown in (Table 5.4, Figure 5.5). In this study, to enhance the response rate, a continuing follow up action like telephone, and personal visits have been conducted. Hence, the overall response rate has considerably increased up to 20% as shown in (Table 5.4). Once the response rate was received, the number has been assigned to each and all questionnaires in the sequence of receipt, and to maintain the uniformity, the unusable questionnaires were deleted from the system. Finally, after the deletion of unusable questionnaires, the total number of complete and usable responses are 350 were found, representing a response rate of 20% as shown in (Table 5.5 and Figure 5.2).

5.6 Data Analysis Procedure

In this study, the data analysis has been conducted by using Structural Equation Modeling (SEM). The SEM is a statistical tool, designed to test a conceptual or theoretical model. The SEM is a combination of exploratory confirmatory factor analysis, path analysis, and latent growth modeling, etc. The basic fundamental of SEM is to analyze the data and to set the hypothesized relationship among the variables. The SEM is appropriate techniques because the purpose of this study is to examine a series of interrelationships between simultaneous endogenous and exogenous variables in defining multifaceted constructs and studying path dependent variances (Hair et al., 1998). For testing the hypothesized relationships among the variables a two-step approach of SEM has been defined by the Anderson, (Anderson and Gerbing's, 1988). First, the measurement model is tested to establish validity and reliability of the scales used in the analysis; and Second, the structural relationships are tested.

Table 5.4 Manufacturing Industry Category-wise Break-up of Responses Received

Industry Category/ Responses		Automobiles & Auto Ancillaries Industry	Cement Industry	Food and Beverages Industry	Metal and Non Metals Industry	Pharmaceuticals Industry	Power & Energy Industry	Textiles Industry	Total	Percentage
First Wave		**400**	**550**	**150**	**140**	**200**	**250**	**210**	**1900**	
	Received	8	15	3	5	4	2	3	40	**2.1**
Second Wave	Delivered	**392**	**535**	**147**	**135**	**196**	**248**	**207**	**1860**	
	Received	9	17	4	5	4	3	3	45	**2.4**
Third Wave	Delivered	**383**	**518**	**143**	**130**	**192**	**245**	**204**	**1815**	
	Received	10	19	8	7	6	5	5	60	**3.3**
Final (Telephonic Follow up)	Delivered	**373**	**499**	**135**	**123**	**186**	**240**	**199**	**1755**	
	Received	11	22	8	8	6	5	5	65	**3.7**
Final (Personal Contacts)	Delivered	**362**	**477**	**127**	**115**	**180**	**235**	**194**	**1690**	
	Received	9	25	10	10	11	8	9	82	**4.9**
Final (Personal Visit)	Delivered	**353**	**452**	**117**	**105**	**169**	**227**	**185**	**1608**	
	Received	10	27	11	10	12	9	9	88	**5.5**
Total	Delivered	**400**	**550**	**150**	**140**	**200**	**250**	**210**	**1900**	
	Received	57	125	44	45	43	32	34	**380**	**20.0**

In this study, the total number of constructs is six and 49 items are related to these constructs. Therefore, the SEM is a useful technique for the present study.

In the present study, useful data were found from 350 manufacturing companies, the final population, frequency and percentage of the manufacturing industries as shown in the (Table 5.5 and Figure 5.2). The collected data are huge than the required sample size. After finalizing the sample size, for the validation of the data, various reliability and validity tests were conducted to analyze and validate both measurement and structural model.

Table 5.5 Final Population, Frequency and their Percentage

Name of Industries	**Frequency**	**Percentage**
Automobiles & Auto Ancillaries Industry	30	8.6
Cement Industry	113	32.3
Food and Beverages Industry	20	5.7
Metal and Non Metals Industry	25	7.1
Pharmaceuticals Industry	45	12.9
Power & Energy Industry	53	15.1
Textiles Industry	64	18.3
Total	**350**	**100.0**

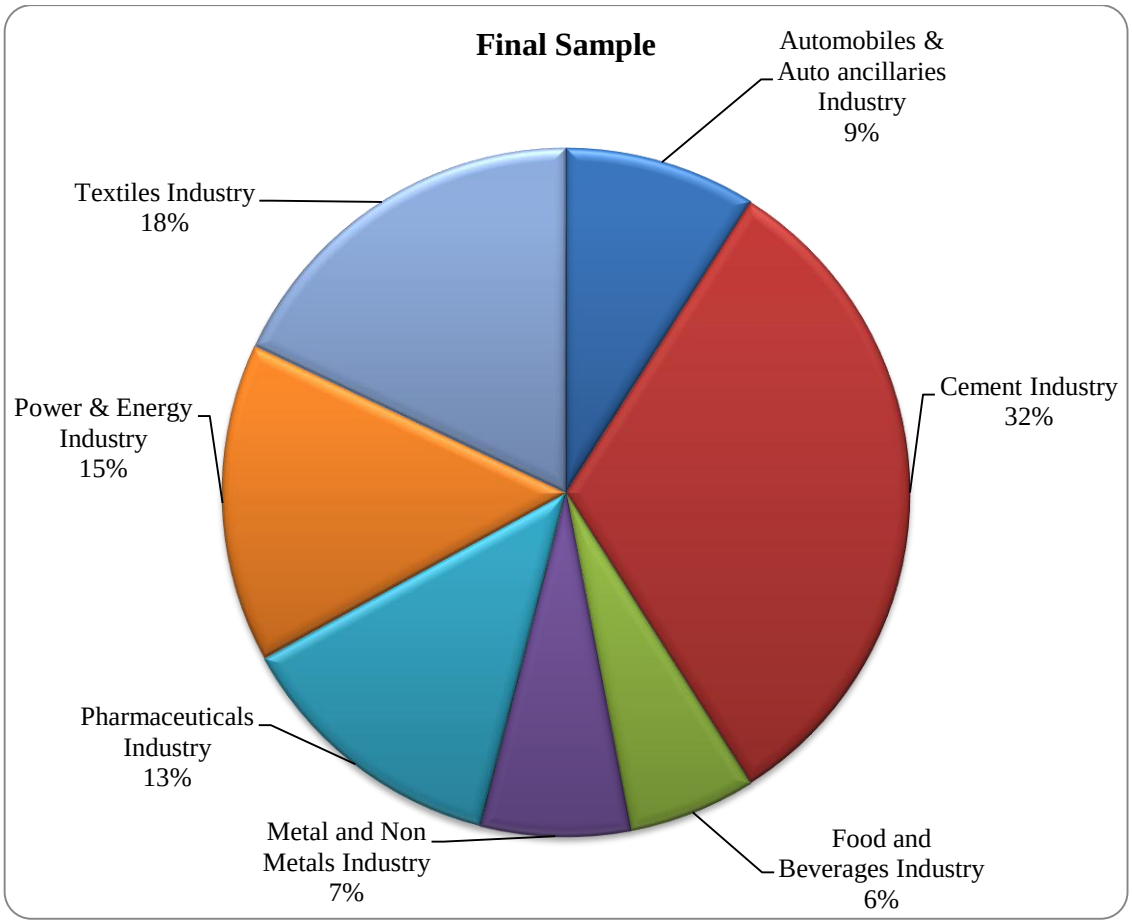


Figure 5.2 Description of Final Sample

5.7 Demographic Profile of the Respondents and Companies

The demographic data provide the relevant information regarding the characteristics of the respondents and satisfactory information to make a clear picture of the respondents. This information is very necessary to make the generalization of the respondent. In the first section, the data related to the demographic have been collected, which includes few questions which is related to various characteristics of the respondent and companies.

5.7.1 Individual Job Function

This study has been performed on the basis of managerial perceptions of the supply chain management and manufacturing competitiveness. It has been assumed that the top level and middle level managers possess the relevant information related to this study. The survey has been made on the behalf of 350 manufacturing companies, and the top managers and middle managers are

categories into CEO/President (15%), Vice President or Director (29%), Operation Managers (15%), Supply Chain Managers (22%), and Purchasing Manager (19%), respectively, as shown in Figure 5.3. This predicts that the responses of the respondent are relevant and significant up to some context.

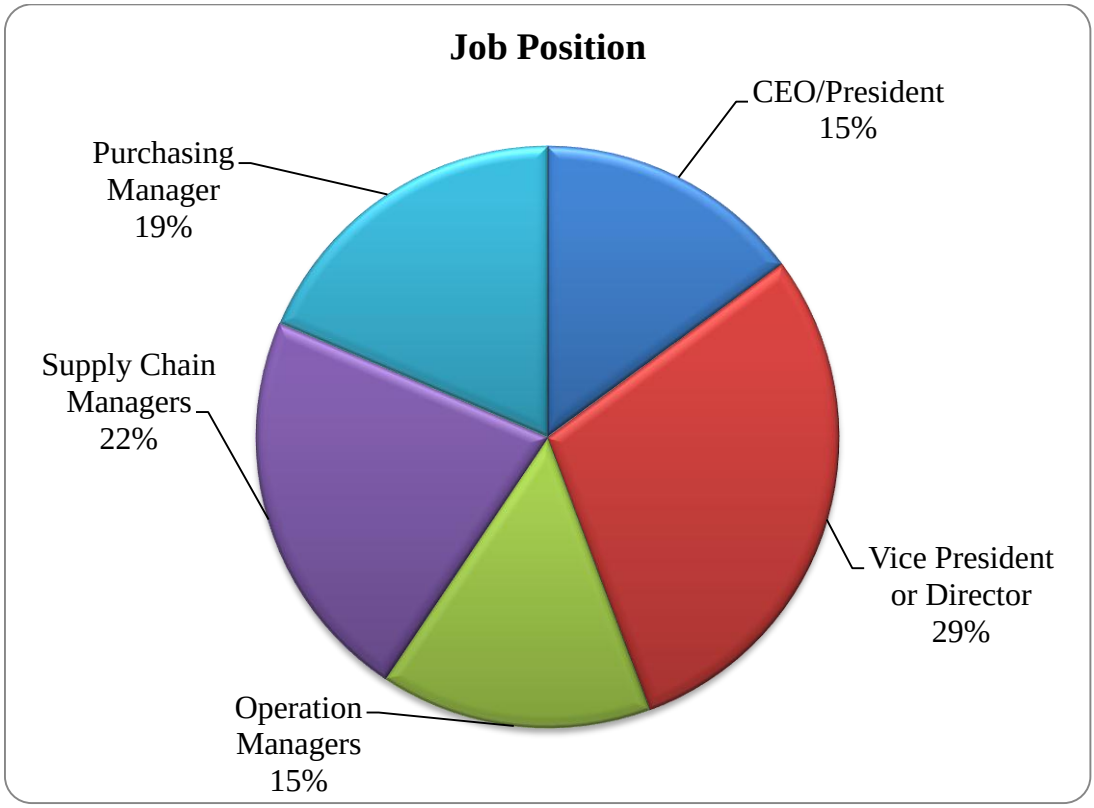


Figure 5.3 Description of Job Position of Respondent

5.7.2 Job Experience of Respondents

This demographic survey reveals the characteristic of manufacturing organizations, having low or high turnover rate. In this study, the job experience of the respondent is 37% were found to have an experience of 1to 4 years, 32% were found to have an experience of 5to10 years, and 31% were found to have more than 10 years of experience (Figure 5.4)

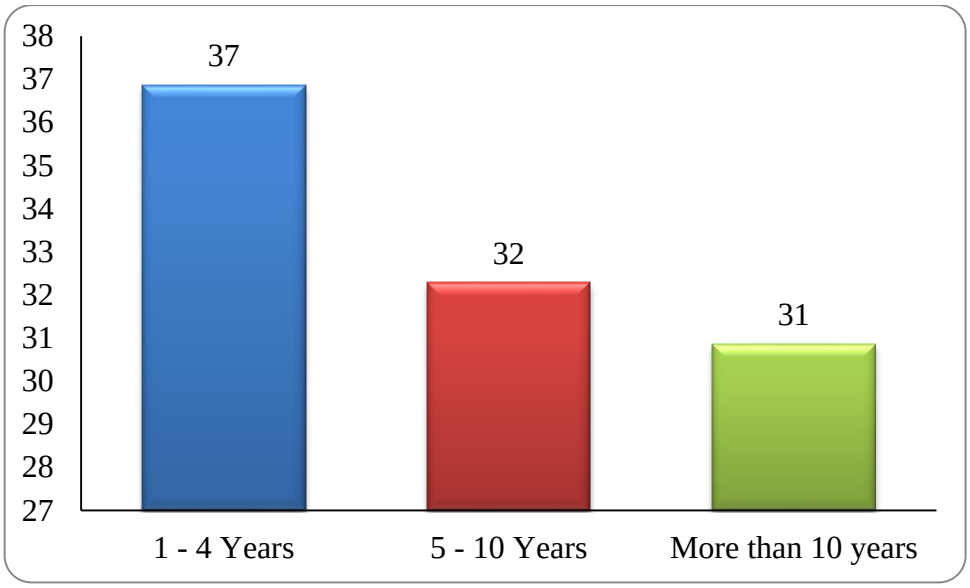


Figure 5.4 Job Experience in Years

5.7.3 Gender Bias

In this study, the respondents are both male and female. This study found that, there are 304 male respondents (87%) and 46 female respondents (13%), have participated in the survey as shown in Figure 5.5. The study shows that an Indian manufacturing companies favour male candidates in their recruitment practices at various levels as compared to female candidates. The study reveals that the ratio of the male respondent is much higher as compared than female respondents. Stephens and Greer (1995) also supported this bias-ness in the recruitment.

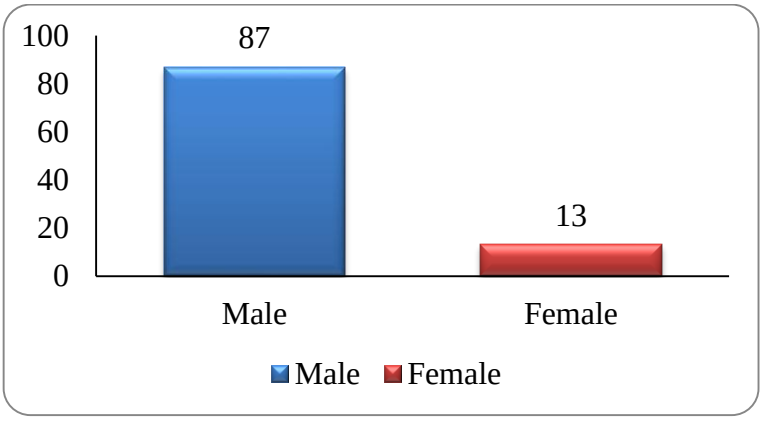


Figure 5.5 Gender Bias

5.7.4 Company Ownership

The study shows that out of the 350 companies, 35 were public companies (10%) and 315 were private companies (90%) as shown in Figure 5.6. Further, most of the public companies were cement companies and metal and non-metal companies which were governed by both state and central government. The figure 5.6., shows that ownership of the companies in terms of percentage.

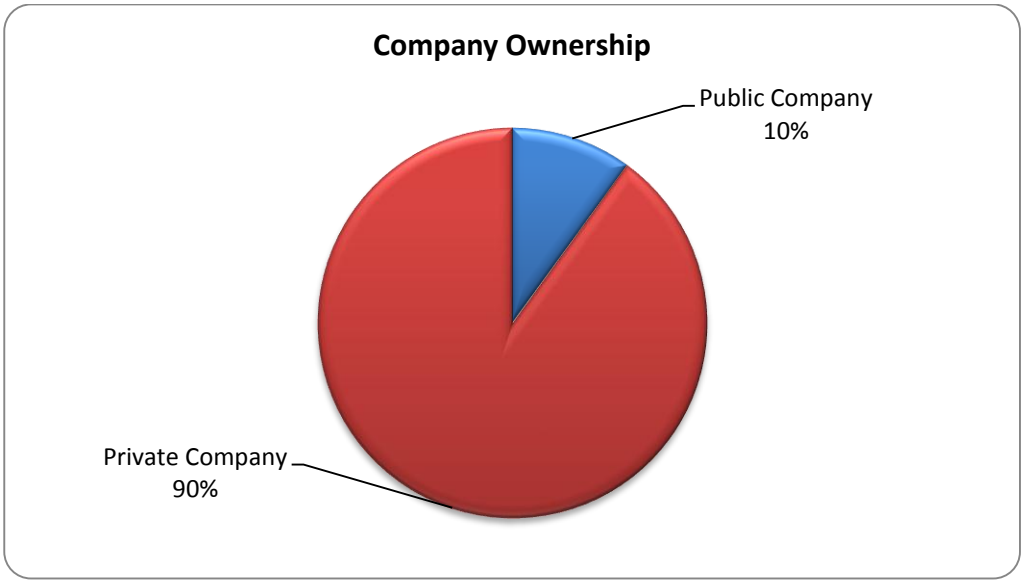


Figure 5.6 Company Ownership

5.7.5 Number of Employees

In any manufacturing companies, the number of employees has significant values. With respect to the information collected the number of employees categorized into five categories. The result shows that the manufacturing companies which have less than 499 employees are only 17%, in between 500 to 999 employees are 16%, 1000 to 1999 employees are only 5%, 2000 to 4999 employees are 45%, and more than 5000 employees are 16% respectively as shown in Figure 5.7.

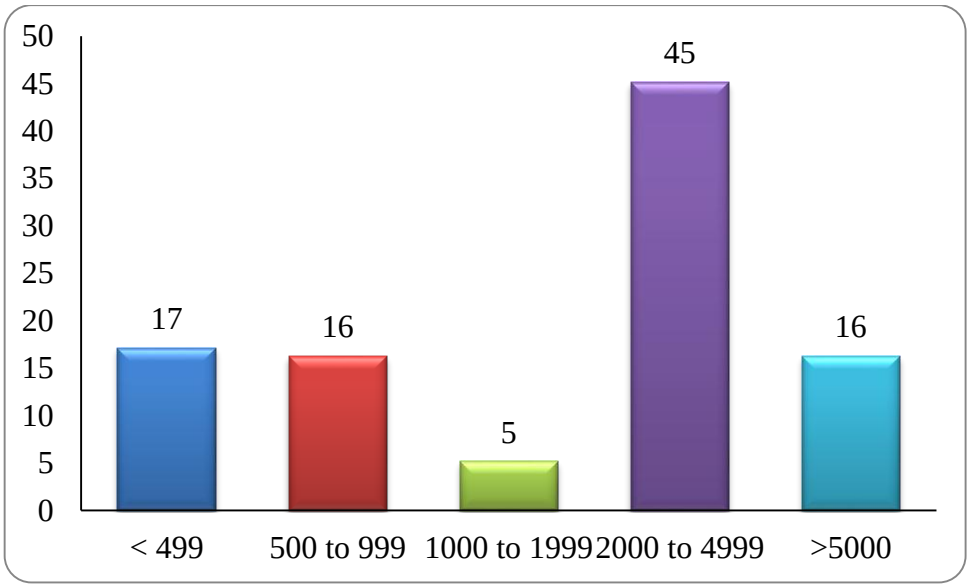


Figure 5.7 Number of Employees

5.8 Non Response Bias Test

For the assessment of non-response bias in the data collection through mail survey, statistical difference tests between earliest and latest responses is applied (Kureshi et al., 2010; Krause and Scannel, 2002; Armstrong and Overton, 1977). The information collected from the respondent through the survey methodology might cause a non-response bias. The non-respondents change the sample frame and can be lead to a sample that does not represent the population (Forza, 2002). Hence, the non-respondents can limit the generalizability of results. The non-response bias testing is an important step before the sample is generalized to the population (Armstrong and Overton, 1977). In this study, it is not possible to investigate non response bias directly, because it had a limited access to any information regarding the organizational details except name, phone, and individual details. The late return of the survey, represents the opinion of non-respondent (Armstrong and Overton, 1977; Lambert and Harrington 1990). In a study the following assumption has been considered, and compared between those respondents who reply early and those whose reply late (e.g., those who responded after the initial emails) with those who responded late (e.g., those who responded to the follow-up emails). Literature shows that, similar methodology has been used in previous studies of operations management and supply chain management (Handfield and Bechtel, 2002; Narasimhan and Kim, 2001).

The detailed procedure of the data collection was discussed in section 5.5 and the details of responses as shown in the Table 5.4. Commonly, there are two types of methods in operations

management research are discussed in the previous literature. First, independent t tests (Armstrong and Overton, 1977; Modi and Mabert, 2007) and, Second, the chi-square test (Meyer and Collier, 2001). To examine the mean differences between items of early and late respondents, the independent t tests were conducted. After dividing 380 respondents into two groups (145 early responses and 235 late responses) as shown in (Table 5.4), 350 variables were selected as shown in (Table 5.5), and t tests were performed between the two groups. The result showed that there are no statistically significant differences among those variables. Using X^2 test statistics and P <0.05, it has been observed that there were no significant differences between the two groups in terms of firm size (i.e., number of employees), and annual revenue (Table 5.6). This analysis represents, the received respondent are unbiased sample are shown in Table 5.6.

The calculation formula: $\chi^2 = \sum_{i=1}^{k} \frac{(f_i - e_i)_2}{e_i}$, where, *fi* = observed frequency for category *i*, *ei* = expected frequency for category *i*, *k* = number of categories, and degrees of freedom = *k-1*.

Table 5.6 Comparison of Sample and Respondents: Non-Response Bias Test

Variables	**Early Respondents (Initial E-mails)**	**Late Respondents (Follow-up E-mails)**		**Chi-square Test**
	Frequency (%)	Expected Frequency (%)	Observed Frequency (%)	
Firm size (n=350)				
< 499	60 (46)	88 (40)	83 (38)	$\chi^2 = 3.38$ d.f. = 4 p>0.01
500-999	30 (23)	50 (23)	52 (24)	
1000-1999	20 (15)	40 (18)	42 (19)	
2000-4999	15 (12)	25 (11)	26 (12)	
Over 5000	5 (4)	17 (8)	18 (8)	
Annual revenue (Rs in Crores) (n=350)				
<50	31 (24)	44 (20)	25 (11)	$\chi^2 = 9.08$ d.f. = 4 p>0.01
51-100	45 (35)	72 (33)	95 (43)	
101-200	19 (15)	39 (18)	53 (24)	
201-299	21 (16)	35 (16)	28 (13)	
Over 300	14 (11)	30 (14)	20 (9)	

5.9 Test of Common Method Bias (CMB)

In the present study, the nature of research questions require to collect data on multiple construct from a single respondent at the same time, so, one of the most important issues, with using self-reported data are common methods or single source bias (Spector, 1987). The common method bias (CMB) is also known as common method variance (CMV); therefore, these two terms are interchangeably used. The common method variance CMV occurs because all data are self-reported and collected through the same questionnaire during the same period of time with the cross-sectional research design. CMB is concern of organizational researcher (Heaton and Harung, 1999), and has to come out with the mixed results concerning the seriousness of the problem. When considering the self-reporting methodologies, the researchers of management address two types of problems (Podsakoff et al., 2003). First, how much relevant is self-report for the measurement of particular constructs in the context of study. Literature shows that secondary index is unavailable in case of emerging economies like India (Mishra and Suar, 2010). Hence, the managers who are working in the manufacturing company, only provides the information related to the company's data towards the supply chain and manufacturing competitiveness. Meanwhile, this study is based on the perception of managers on the supply chain performance. Hence, the methodology of self-reported was an appropriate way to assess all constructs in the model.

Second, problem deals with the practical and ethical concern of the data collected from the respondents. In this study, anonymity and confidentiality of the data were assured to the respondents and this motivated respondents for the honest and open answer regarding their perception on the construct of interest. These are one way methods, in which common method bias (CMB) will be tested. Other methods have been described in the literature which are as follows:

It has been observed from the literature that there are two methods used to test the (CMB). First, post hoc statistical tests are used. In this method, all the variables are entered into an exploratory factor analysis (EFA), using un-rotated principal components factor analysis, principal component analysis with varimax rotation, and principal axis analysis with varimax rotation to determine the number of factors that are necessary to account for the variance in the variables. If a significant amount of common method variance (CMV) is present, either (i) a single factor will emerge from the factor analysis, or (ii) one general factor will account for most of the covariance among the variables (Andersson and Bateman, 1997; Podsakoff et al., 2003).

Second, the Harman's single factor test is using confirmatory Factor Analysis (CFA) is conducted to test the hypothesis that a single factor accounts for all the variance in the data (Podsakoff et al., 2003). If CMV is fully responsible, among the variables, the single-factor CFA model should fit the data well (Posdakoff et al., 2003). Although the results of these analyses do not preclude the possibility of CMB, they do suggest that CMV is not of great concern and thus is likely to confound the interpretations of results. Hence, it has been assumed that this study doesn't suffer from the overestimation of the responses.

5.10 Large-scale Instrument Validation Methodology

In the large scale instrument validation, the survey instrument was subjected to rigorous reliability and validity assessment using the 350 survey responses. This section describes the procedures used during the instrument validation process and the consequent statistical results.

5.10.1 Measurement Model, Validity, and Reliability

The main objective of the survey instruments is validity and reliability. The validity measures the extent to which the item or scale truly measure what is exactly to measure (Flynn et al., 1990). The reliability represents the extent to which researchers all measure the same thing (Flynn et al., 1990; Hair et al., 2006). The instruments which are reliable, produce the same measurable results, and it is capable to replicate the whole study over time and populations (Flynn et al., 1990). It has been observed that a construct cannot be valid if it is failing to be reliable, although that same construct can be reliable in the absence of validity (Gordis, 2009). Thus, confirmatory factor analysis (CFA) incorporating IBM Statistical Package for the Social Sciences (SPSS) Statistics 20 and Analysis of Moment Structures (AMOS 20), was used to evaluate the properties of the measures addressing the latent first-order constructs in this study. The content validity assesses the representativeness of each measurement item in relation to its theoretical posited construct. When the measurement items are a sample of a universe in which the researchers are interested than content analysis is established (Cronbach and Meehli, 1955) and when the items of the construct sufficiently cover the domain of that construct (Churchill, 1979). The content validity has been examined by literature review comprehensively (Nunnally, 1978) and having expert judges like academicians and practitioners, evaluate the measurement items with the structured interviewed (Moore and Banbasat, 1991). This study used these procedures to ensure the

content validity of the constructs. In the assessment of convergent validity, the measurement items in one construct come together to form a single common dimension and thus is assessed by checking the value of the loading for an item (Bagozzi and Yi, 1998).

To assess the validity of the first-order measurement models, the CFA method has been used. It has been observed that the multiple fit of the indices can be used to assess the model fit (Shah and Goldstein, 2006). The literature shows that there are two types of model fit indices are reported. First, Absolute fit indices imply to ($\chi 2$, goodness-of-fit index [GFI], root mean square error of approximation [RMSEA], and standardized root mean square residual [SRMR]) measure how well the hypothesized model fits the sample data. Second, Incremental fit indices, implies to (normal fit index [NFI], comparative fit index [CFI], and incremental fit index [IFI]) compares the hypothesized model to two alternative baseline models: a null model, which assumes there are no correlated constructs, and an ideal model, which perfectly matches the hypothesized model (Talwar 2011a, 2011b; Shah and Goldstein, 2006).

The literature shows appropriate and acceptable cutoff values for model fit indices (Hu and Bentler, 1998; Modi and Mabert, 2006). Generally, "values of GFI >0.80 are considered acceptable for model fit, and scores of 0.90 or higher are evidence of good fit (Hair et al., 1998; Papke-Shields et al., 2002). SRMR is an error fit indicator and thus lower values represent adequacy in the model. SRMR values <0.05 indicate good fit, whereas values <0.08 represent reasonably acceptable errors of approximation (Browne and Cudeck, 1993). RMSEA values <0.05 indicate good fit, and values up to 0.09 indicate acceptable errors of approximation. This study also uses NFI, CFI, and IFI as widely accepted incremental model fit indices, and values of 0.90 or higher are associated with good model fit" (Hair et al., 2006). In the confirmatory factor analysis (CFA), the average variance extracted (AVE) among a set of construct items may also be used as an indicator of convergence and thus AVE is provided for each first-order measurement model (Hair et al., 2006). The literature suggested that values of 0.5 or higher are an adequate measure of convergence and will represent the target threshold for convergent validity. "Discriminant validity examines the extent to which the measurement items from a unique dimension of a construct that is independent of all other dimensions" (Bagozzi and Phillips, 1982). If the value of AVE of each construct is greater than the square of the correlations, so it means that the evidence of discriminant validity exist (Braunscheidel and Suresh, 2009). Reliability can be measured, if the construct can produce the same results in repeated attempts. The values of reliability >0.7 are preferable, values >0.60 are

acceptable for newly developed scales (Cronbach, 1951; Nunnally, 1978). Cronbach's α and composite reliability (Fornell and Larcker, 1981) are used to examine the reliability values. The targeted CFA statistical cut-off values used in this study are summarized as shown in Table 5.7

Table 5.7 Fit statistics for Validating the Measurement

Fit statistic	**Recommended cut-off values**
Root Mean Square Error of Approximation **(RMSEA)**	< 0.09
Goodness-of-Fit Index **(GFI)**	> 0.85
Comparative Fit Index **(CFI)**	> 0.90
Normal Fit Index **(NFI)**	> 0.90
Incremental Fit Index **(IFI)**	> 0.90
Standardized Root Mean Square Residual **(SRMR)**	> 0.08
Average Variance Extracted **(AVE)**	> 0.50
Cronbach's Alpha **(Reliability)**	> 0.7 are preferable, > 0.60 are acceptable for newly developed scales

5.10.2 Large-scale Measurement Results

In this section, the large-scale instrument results have been presented on each of the six constructs: Eco-Innovation (ECO), Environment Uncertainty (EU), Manufacturing Competitiveness (MC), SCM Performance (SCMP), SCM Practices (SCMPR), Supplier Selection (SS), and, etc. For each construct, the methodology for instrument assessment was applied.

In the next section, the analysis of the construct and there items has been discussed. After, the first order confirmation analysis, there are 21 items found to be usable for further analysis as shown in the Table 5.8, and questionnaires are shown in (Appendix 7). The analysis has been started with purification using Corrected Item-Total Correlation (CITC) analysis. The initial CITC, final CITC and Cronbach's alpha (reliability) α, for each item and its corresponding code name are shown in Table 5.8. The analysis began with purification using CITC analysis and the value of CITC for ECO1, ECO2, ECO4, and ECO5 are more than 0.50 and significant, except the item ECO3 indicating sufficient evidence of acceptable reliability 0.493, but it's very important items so, it was not eliminated (Hair et al., 2013). Hence, the items having more than 0.50 CITC value and important for this study have been taken for further analysis.

Table 5.8 Item Purification Results (CITC/Alpha)

Dimensions	Items Code	Item Descriptions	Mean	Std. Deviation	Initial Corrected Item-Total Correlation (CITC)	Final CITC	Cronbach's Alpha (α)
Eco-Innovation (ECO)	**ECO1**	Our company made eco-innovation products	2.794	1.293	0.519	0.990	0.892
	ECO2	Environmental patent applications position among peers	2.780	1.278	0.520	0.912	
	ECO3	After-tax returns among peers	2.789	1.290	0.493	0.888	
	ECO4	Reductions of energy compared to peer companies	2.777	1.270	0.513	0.912	
	ECO5	Waste reduction ratio compares with peer companies	2.774	1.299	0.514	0.989	
Environmental Uncertainty (EU)	**EU1**	Our company is characterized by rapidly shifting technology.	2.966	1.130	0.648	0.860	
	EU2	Our company frequently changes our process and production technology. So the rate of process obsolescence is high in our company	2.889	1.202	0.606	0.836	
	EU3	Our master production schedule has a high percentage of variation in demand	2.940	1.128	0.617	0.823	
	EU4	Our demands are fluctuating radically from week to week	2.869	1.190	0.602	0.837	
	EU5	We maintain our inventory of critical material to fulfil the changing demand	3.000	1.289	0.661	0.766	
	EU6	Stability of quality of critical material	2.971	1.260	0.654	0.732	
Manufacturing Competitiveness (MC)	**MC1**	Our company offers, product at competitive price/cost, lower than our competitors	2.934	1.215	0.402	0.483	
	MC2	We try to reduce the R&D and production price/cost of the product	2.743	1.236	0.417	0.349	
	MC4	Our company uses empowers employees for continuous improvement	2.989	1.271	0.507	0.488	

SCM Performance (SCMP)	**SCMP3**	Our company supply chain is successful in minimizing inventory levels and overall cost	3.066	1.304	0.149	0.155	
	SCMP5	Our company supply chain is successful in meeting quality specifications	3.103	1.292	0.272	0.228	
SCM Practice (SCMPR)	**SCMPR1**	We regularly assess the formal and informal complaints of our customers	2.834	1.183	0.416	0.475	
	SCMPR2	We often interact with clients to determine reliability, responsiveness other standards for us	2.803	1.160	0.501	0.487	
	SCMPR4	Our trading partners share proprietary information with us	2.826	1.168	0.572	0.524	
Supplier Selection (SS)	**SS1**	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers	2.860	1.199	0.485	0.557	
	SS4	Our suppliers provide high quality, responsive service to us.	2.860	1.178	0.512	0.584	

Environmental Uncertainty (EU) construct was initially represented by initial (six items), and their corresponding code names are shown in Table 5.8. The scores of initial CITC for all the items in EUs are well near above 0.60., indicating sufficient evidence of acceptable reliability as shown in Table 5.8., these items have been taken for further analysis. Hence, those items having more than 0.50 CITC value have been taken for further analysis.

The Manufacturing Competitiveness (MC) construct was initially represented by three items. The three items and their corresponding code names are shown in Table 5.8. Initially, the analysis has been started with purification using Corrected Item-Total Correlation (CITC) analysis. The initial score of CITC for item MC4 is well near above 0.50, whereas the value of initial CITC for MC1 and MC2 is less than 0.50, except the item MC1and MC2 is 0.402 and 0.417 respectively, indicating insufficient evidence of acceptable reliability, but it's very important items so, it was not eliminated. Hence, the items having more than 0.50 CITC value and it is important for this study has been taken for further analysis (Hair et al., 2013).

The Supply Chain Management Performance (SCMP) construct was initially represented by two items. The initial value of CITC for items SCMP3 and SCMP5 is 0.149 and 0.2725 which less is than 0.50, but these items are very important for this analysis, so the data are not eliminated as shown in Table 5.8. The Cronbach's alpha (reliability) α for these items are satisfactory. Hence, these items are important for the analysis so it has been taken to the next level.

The Supply Chain Management Practice (SCMPR) construct was initially represented by three items. The initial three items and their corresponding code names are shown in Table 5.8. The initial value of CITC for SCMPR1 is less than 0.50, but this item is very important for this analysis, so the item is not eliminated. The value of CITC for SCMPR2, and SCMPR4 is more than 0.50 and significant as shown in Table 5.8. The Cronbach's alpha (reliability) α for these items are satisfactory. Hence, these items have been taken to the next level.

The supplier selection construct was dimension less and initially represented by two items. The initial two items and their corresponding code names are shown in Table 5.8. The initial value of CITC for SS4 is greater than 0.50, and significant, whereas the value for SS1 is less than 0.5, but this item is important for this study. The Cronbach's alpha (reliability) α for these items are satisfactory as shown in Table 5.8. Hence, the expectable value of CITC and reliability is more than standard value, so, it is acceptable for further analysis.

The Cronbach's alpha (reliability) α for these twenty one items are 0.892, which is more than satisfactory and considered reliable also, considering that the scale is relatively exploratory, having been adapted to a new context for the purposes of this research as shown in Table 5.8. The mean and standard deviation of each item are satisfactory. Hence, all scales used in this study are considered reliable based on their alpha coefficients.

After the analysis of reliability, an exploratory factor analysis was done using principal components as a means of extraction and varimax as a method of rotation. The evaluation of the correlation matrix through the KMO and Bartlett’s test resulted in high KMO statistics (ranging from 0.79 to 0.92) and a significant probability level (p, 0.001) for the Bartlett’s test of all constructs. The result of the analysis of KMO and Bartlett’s test is 0.800 and 0.0000 respectively, shows in Table 5.9. This analysis indicates that sufficient correlations were found within the correlation matrix for factor analysis to proceed.

Table 5.9 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.800
Approx. Chi-Square	6681.151
Bartlett's Test of Sphericity df	210
Sig.	0.000

The factor analysis shows the cumulative % of variance explained by the six constructs (EU, ECO, SCMPR, MC, SS, and SCMP) are 75.703%. In this study, loading factor for each item is more than 0.4 (Hair et al., 2013). All the factors and there were no items with cross loadings greater than 0.40 as shown in Table 5.10. Further, the test of uni-dimensionality for each construct (EU, ECO, SCMPR, MC, SS, and SCMP) was tested using AMOS 20.0. According to Sethi and King (1994), "iterative modifications were made for each of the sub-constructs by observing modification indices and coefficients to improve key model fit statistics". Further, Joreskog and Sorbom (1989), has as recommended, only one item was altered at a time to avoid over-modification of the model. This iterative process continued until all model parameters and key fit indices met recommended criteria. It has been observed that if the constructs have less than 4 items, the statistics of the model fit could not be obtained. To overcome this problem the two-factor model was tested by adding the items of another construct.

Table 5.10 Factor Analysis (within each variable) for Retained Items

Items	Factors Loadings Environmental Uncertainty (EU)	Factors Loadings Eco-Innovation (ECO)	Factors Loadings SCM Practices (SMPPR)	Factors Loadings Manufacturing Competitiveness (MC)	Factors Loadings Supplier Selection (SS)	Factors Loadings SCM Performance (SCMP)
EU4	0.887					
EU1	0.874					
EU2	0.868					
EU3	0.848					
EU5	0.749					
EU6	0.718					
ECO1		0.926				
ECO5		0.923				
ECO3		0.897				
ECO4		0.792				
ECO2		0.785				
SCMPR1			0.840			
SCMPR2			0.772			
SCMPR4			0.701			
MC1				0.837		
MC4				0.768		
MC2				0.745		
SS1					0.825	
SS4					0.789	
SCMP3						0.825
SCMP5						0.747
Eigen value	4.589	3.971	2.173	2.052	1.729	1.383
% of Variance	21.854	18.912	10.347	9.774	8.231	6.586
Cumulative % of Variance	21.854	40.765	51.112	60.886	69.117	75.703

5.11 Summary of Large-scale Analysis Results

The summary of large-scale analysis shows the details summary of the analysis. In this section, the details of each construct and the number of final constructs measurement items, mean, standard deviation, initial CITC, final CITC, Cronbach's alpha (reliability) α, and their factor loadings are displayed as shown in Table 5.11. It has been observed from the table that the mean, standard deviation, initial CITC, final CITC, final score of the Cronbach's alpha (reliability) α, and loading factors are for all the constructs are acceptable value. The overall final measurement instrument for all six constructs in this study were found to be valid and reliable and thus can be used in future research. In the next section, construct-level correlation analysis has been discussed.

Table 5.11 Summary of Analysis

Dimensions	Items Code	Item Descriptions	Mean	Std. Deviation	Initial Corrected Item-Total Correlation (CITC)	Final CITC	Cronbach's Alpha (α)	Factor Loadings
Eco-Innovation (ECO)	**ECO1**	Our company made eco-innovation products	2.794	1.293	0.519	0.990	0.892	0.926
	ECO2	Environmental patent application's position among peers	2.780	1.278	0.520	0.912		0.785
	ECO3	After-tax returns among peers	2.789	1.290	0.493	0.888		0.897
	ECO4	Reductions of energy compared to peer companies	2.777	1.270	0.513	0.912		0.792
	ECO5	Waste reduction ratio compares with peer companies	2.774	1.299	0.514	0.989		0.923
Environmental Uncertainty (EU)	**EU1**	Our company is characterized by rapidly shifting technology.	2.966	1.130	0.648	0.860		0.874
	EU2	Our company frequently changes our process and production technology. So the rate of process obsolescence is high in our company	2.889	1.202	0.606	0.836		0.868

	EU3	Our master production schedule has a high percentage of variation in demand	2.940	1.128	0.617	0.823		0.848
	EU4	Our demands are fluctuating radically from week to week	2.869	1.190	0.602	0.837		0.887
	EU5	We maintain our inventory of critical material to fulfil the changing demand	3.000	1.289	0.661	0.766		0.749
	EU6	Stability of quality of critical material	2.971	1.260	0.654	0.732		0.718
Manufacturing Competitiveness (MC)	**MC1**	Our company offers, product at competitive price/cost, lower than our competitors	2.934	1.215	0.402	0.483		0.837
	MC2	We try to reduce the R&D and production price/cost of the product	2.743	1.236	0.417	0.349		0.745
	MC4	Our company uses empowers employees for continuous improvement	2.989	1.271	0.507	0.488		0.768
SCM Performance (SCMP)	**SCMP3**	Our company supply chain is successful in minimizing inventory levels and overall cost	3.066	1.304	0.149	0.155		0.825
	SCMP5	Our company supply chain is successful in meeting quality specifications	3.103	1.292	0.272	0.228		0.747
SCM Practice (SCMPR)	**SCMPR1**	We regularly assess the formal and informal complaints of our customers	2.834	1.183	0.416	0.475		0.840
	SCMPR2	We often interact with clients to determine reliability, responsiveness other standards for us	2.803	1.160	0.501	0.487		0.772
	SCMPR4	Our trading partners share proprietary information with us	2.826	1.168	0.572	0.524		0.701

Supplier Selection (SS)	**SS1**	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers	2.860	1.199	0.485	0.557		0.825
	SS4	Our suppliers provide high quality, responsive service to us.	2.860	1.178	0.512	0.584		0.789

5.12 Construct-Level Correlation Analysis

The Pearson correlation (i.e., no causal relationships are specified) was used to check for the preliminary statistical validity of the 9 hypotheses presented in Chapter 3. Thus, each construct was represented by a composite score, computed by taking the mean scores of all items in a specific construct and the result shown in Table 5.12. The results show that all the correlations are statistically significant at the 0.01 level except the correlation 0.023 (Supply Chain Management Performance and Eco-Innovation) (H6) which is less significant as compared to others.

Table 5.12 Construct – Level Correlation Analysis Results

Hypothesis	**Independent Variables**	**Dependent Variables**	**Pearson Correlation**
H1	Environmental Uncertainty	Supply Chain Management Practice	0.478**
H2	Supply Chain Management Practice	Eco-Innovation	0.229**
H3	Supply Chain Management Practice	Supply Chain Management Performance	0.193**
H4	Supply Chain Management Practice	Supplier Selection	0.443**
H5	Supplier Selection	Supply Chain Management Performance	0.151**
H6	Supply Chain Management Performance	Eco-Innovation	**0.023**
H7	Eco-Innovation	Manufacturing Competitiveness	0.379**
H8	Supply Chain Management Performance	Manufacturing Competitiveness	0.182**
H9	Supplier Selection	Manufacturing Competitiveness	0.298**
**. Correlation is significant at the 0.01 level (2-tailed)			

The correlation coefficients in descending order are: 0.478 (Environmental Uncertainty to Supply Chain Management Practice), 0.443 (Supply Chain Management Practice to Supplier Selection), 0.379 (Eco-Innovation to Manufacturing Competitiveness), 0.298 (Supplier Selection to Manufacturing Competitiveness), 0.229 (Supply Chain Management Practice to Eco-Innovation), 0.193 (Supply Chain Management Practice to Supply Chain Management Performance), 0.182 (Supply Chain Management Performance to Manufacturing Competitiveness), 0.151 (Supplier Selection to Supply Chain Management Performance), 0.023 (Supply Chain Management Performance to Eco-Innovation) as shown in Table 5.13. It has been observed from the Table 5.13 that there are high correlations between the constructs for most hypothesized relationships; the test for causal relationships between the constructs using structural equation modeling will be discussed in the next chapter.

Table 5.13 Construct-Level Correlation Analysis as per Pearson Correlation

Hypothesis	**Independent Variables**	**Dependent Variables**	**Pearson Correlation**
H1	Environmental Uncertainty	Supply Chain Management Practice	0.478**
H4	Supply Chain Management Practice	Supplier Selection	0.443**
H7	Eco-Innovation	Manufacturing Competitiveness	0.379**
H9	Supplier Selection	Manufacturing Competitiveness	0.298**
H2	Supply Chain Management Practice	Eco-Innovation	0.229**
H3	Supply Chain Management Practice	Supply Chain Management Performance	0.193**
H8	Supply Chain Management Performance	Manufacturing Competitiveness	0.182**
H5	Supplier Selection	Supply Chain Management Performance	0.151**
H6	Supply Chain Management Performance	Eco-Innovation	**0.023**
**. Correlation is significant at the 0.01 level (2-tailed)			

5.13 Conclusion

At the beginning of this chapter, initially, data collection via a large-scale survey after item generation, and structured interview were conducted. This chapter deals with the validation of the instrument development, and also discussed the research methodology, including research design, data collection methods, questionnaire design, sampling design, data analysis procedure and demographic profile of the respondents and companies. A chapter provides a brief detail of the large-scale instrument validation methodology. The analysis has been done to test the convergent, discriminant validity, test of reliability, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of all reflective scales in the model. Further, the hypothetical relationships were tested among the construct by Pearson Correlation, which is the focus of this chapter. From, the analysis the correlations are statistically significant among the construct, except (H6) hypothesis. A detailed description of the data analysis process is given in the subsequent chapter of the present thesis.

CHAPTER – 6
STRUCTURAL EQUATION MODELING AND DISCUSSION

Preview

This chapter deals with a brief background of causal model and hypothesis testing. From the analysis, it has been observed that the bivariate correlations (Pearson correlation) are statistically significant for most pairs of the constructs considered for the hypotheses (8 out of 9) (Chapter-5). Now, there is a need for attention, to explore the significance of these hypothesized relationships, when all the relationships are put together in a multivariate complex model due to the interactions among variables. A structural equation modeling (SEM) has been used for testing the hypotheses (Joreskog and Sorbom, 1989).

The standard Structural Equation Modeling (SEM) is categories into two parts. First, the measurement model (a sub-model in SEM that specifies the indicators of each construct and assesses the reliability of each construct for later use in estimating the causal relationships). Second, the structural model (the set of dependent relationships linking the model constructs). Meanwhile, the analysis of the measurement properties of each construct have already been evaluated through rigorous validity and reliability analysis. To test the proposed hypotheses, the Structural Equation Modeling (SEM) has been used, and, more specifically, AMOS package version 20. Software. A proposed structural model was tested and the overall goodness-of-fit of the entire structural equation model is assessed as well.

6. The Proposed Researched Model

The proposed research model and their hypothesis are shown in Figure 6.1. In this study, six latent constructs are taken in the model. The variables in the model are: environmental uncertainty (EU), SCM Practices (SCMPR), eco-innovation (ECO), SCM performance (SCMP), supplier selection (SS), and manufacturing competitiveness (MC). The environmental uncertainty (EU) is regarded as independent (exogenous) variables, and all others like (SCMPR, ECO, SCMP, SS, MC) are dependent (endogenous) variables. The 9 hypotheses proposed in the Chapter 3 (Figure 3.1) are represented by 9 causal relationships in the model. The Hypothesis H1 is the relationship of Environmental Uncertainty (EU) and SCM Practices (SCMPR), hypothesis H2 is the relationship of SCM Practices (SCMPR) and Eco-Innovation (ECO), hypothesis H3 is the relationship of SCM Practices (SCMPR), and SCM

Performance (SCMP), hypothesis H4 is the relationship of SCM Practices (SCMPR) and Supplier Selection (SS), hypothesis H5 is the relationship of Supplier Selection (SS) and SCM Performance (SCMP), hypothesis H6 is the relationship of SCM Performance (SCMP) and Eco-Innovation (ECO), hypothesis H7 is the relationship of Eco-Innovation (ECO) and Manufacturing Competitiveness (MC), hypothesis H8 is the relationship of SCM Performance (SCMP) and Manufacturing Competitiveness (MC), hypothesis H9 is the relationship of Supplier Selection (SS) and Manufacturing Competitiveness (MC), etc., as shown in Figure 6.1.

The various indices can be used, to assess the fit of the hypothesized model to the data. The various indices are Chi-square, GFI, AGFI, CFI, NFI, and RMSEA. These indices are already described in the Chapter 5, the first four indices (GFI, AGFI, CFI, and NFI) in the range of 0.80-0.89 represents a reasonable fit; scores of 0.90 or higher are considered as evidence of good fit. The RMSEA values range from 0 to 1, with smaller values indicating a better model; values below 0.05 signify good fit (Hair et al., 2013) as shown in Table 5.7.

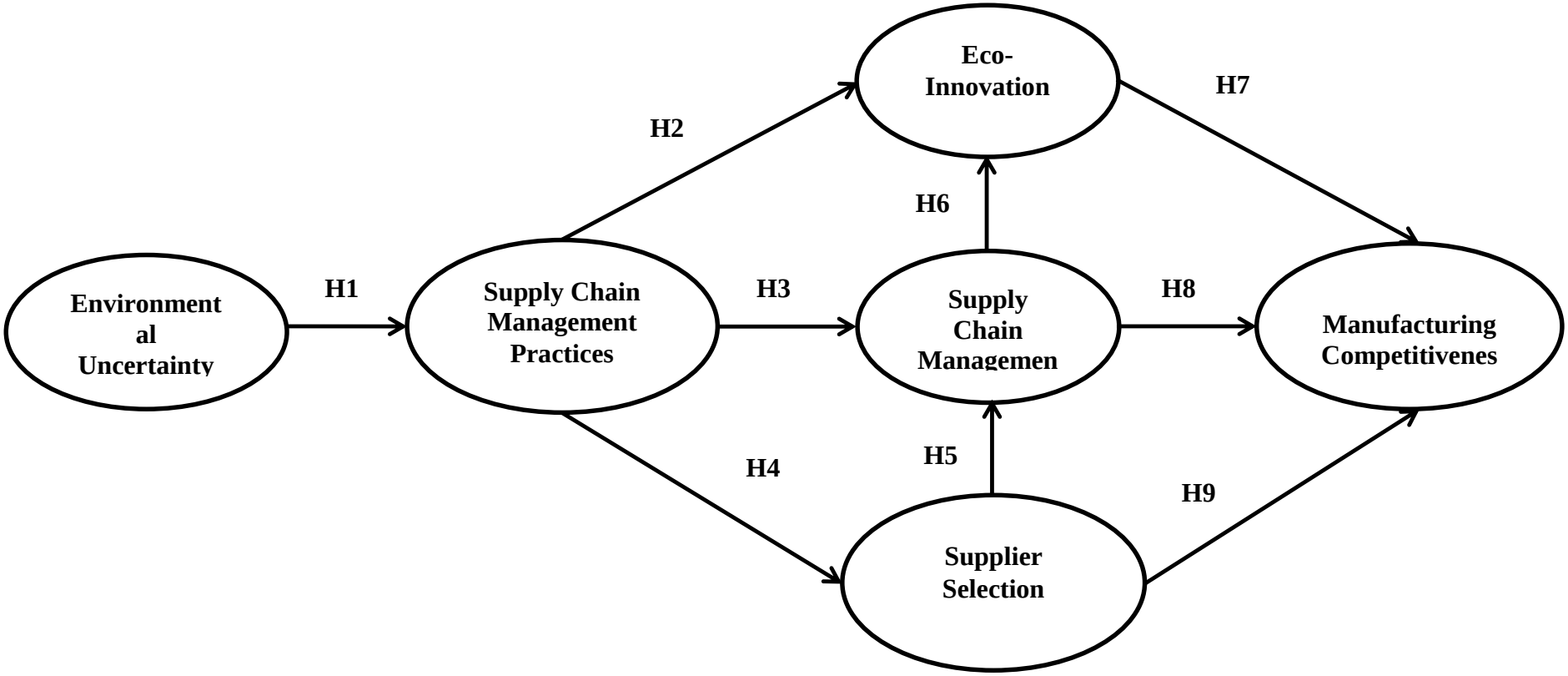


Figure 6.1 A Proposed Research Model (detailed)

6.1 Convergent and Discriminant Validity of Research Instruments

The manufacturing competitiveness has been assessed by adopting a 21-items scale developed and validated. The name of original scale developed as manufacturing competitiveness scale which is designed to measure the competitiveness of manufacturing in an organization. The first order measurement model of the present study is shown in Figure 6.2. For the measurement of the manufacturing competitiveness, the six dimensions has been used, they are eco-innovation (ECO), environment uncertainty (EU), SCM performance (SCMP), SCM Practices (SCMPR), supplier selection (SS), and Manufacturing Competitiveness (MC). The details of dimensions and their items have been displaced in Table 6.2. The confirmatory factor analysis (CFA) has been deployed at the scale, to test the convergent and discriminant validity of the scale in Indian context. According to Hair et al. (2013), "Convergent validity means the extent to which indicators of a specific construct converge or share a high proportion of variance in common".

For testing the convergent validity of the manufacturing competitiveness scale, a confirmatory factor analysis has been done to test the measurement model with six dimension, i.e., (Environmental Uncertainty (EU), SCM Practices (SCMPR), Eco-Innovation (ECO), SCM Performance (SCMP), Supplier Selection (SS), and Manufacturing Competitiveness (MC) are shown in Figure 6.2. The model fit measures for first order are: Chi square= 329.665, df=167, GFI=0.922, AGFI=0.892, NFI=0.952, and RMSEA =0.053, and the model fit measures for second order are Chi square= 368.256, df=176, GFI=0.914, AGFI=0.886, NFI=0.946, and RMSEA =0.056 as shown in Table 6.1., the value of GFI, AGFI and NFI are more than recommended value of 0.90, expect AGFI and RMSEA is also a significant as per recommended value of 0.08. The goodness of fit indexes for the first order model is more accurate as compared to second order model as shown in Table 6.1. So, in this study, the goodness of fit indexes for the first order model has been considered.

The regression weight of the item is as shown in Table 6.2. All the items relationship of items has been significant $p>0.01$.

Table 6.1 Goodness of Fit Indexes for First Order Model

Model	Chi-Square (df)	Chi-Square/ (df)	NFI	GFI	AGFI	RMSEA
First Order	329.665	167	0.952	0.922	0.892	0.053

Table 6.2 Regression Weights of Items

Items Relation			Estimate	S.E.	C.R. or t value	P
EU4	<---	EU	1			
EU1	<---	EU	1.125	0.05	22.656	***
EU2	<---	EU	1.118	0.053	21.025	***
EU3	<---	EU	0.962	0.035	27.492	***
EU5	<---	EU	1.052	0.058	18.27	***
EU6	<---	EU	1.171	0.063	18.57	***
ECO1	<---	ECO	1			
ECO5	<---	ECO	0.999	0.006	162.212	***
ECO3	<---	ECO	0.934	0.019	49.598	***
ECO4	<---	ECO	0.58	0.042	13.646	***
ECO2	<---	ECO	0.578	0.043	13.462	***
SCMPR1	<---	SCMPR	1			
SCMPR2	<---	SCMPR	1.118	0.097	11.551	***
SCMPR4	<---	SCMPR	1.358	0.146	9.295	***
MC1	<---	MC	1			
MC4	<---	MC	1.122	0.098	11.457	***
MC2	<---	MC	0.819	0.083	9.878	***
SS1	<---	SS	1			
SS4	<---	SS	1.096	0.089	12.283	***
SCMP3	<---	SCMP	1			
SCMP5	<---	SCMP	1.925	0.57	3.378	***

The Mean, Standard Deviation, Factor loadings, composite reliability (CR), the average variance extracted (AVE), maximum shared variance (MSV), and average shared variance (ASV) are shown in Table 6.3. The items loaded are significantly on its respective dimensions. According, to Hair et al. (2013), convergent validity of a construct is established if it prevails that composite reliability (CR) of the construct is greater than its average variance extracted

(AVE) and AVE is greater than 0.05. The composite reliability is greater than the average variance extracted for all the constructs as shown in Table 6.3., indicating the constructs to be convergent validity. Further, discriminant validity means the extent to which a construct is truly distinct from other constructs (Hair et al., 2013). The discriminant validity can be established by comparing the maximum shared variance (MSV) and average shared variance (ASV) with an average variance extracted (AVE). As prescribed, discriminant validity exists when the values of MSV and ASV are smaller than the values of AVE (Hair et al., 2013). As can be seen from the Table 6.3 below, all the values satisfies these above mentioned conditions. Thus, discriminant validity of the factor model is again confirmed in the present study.

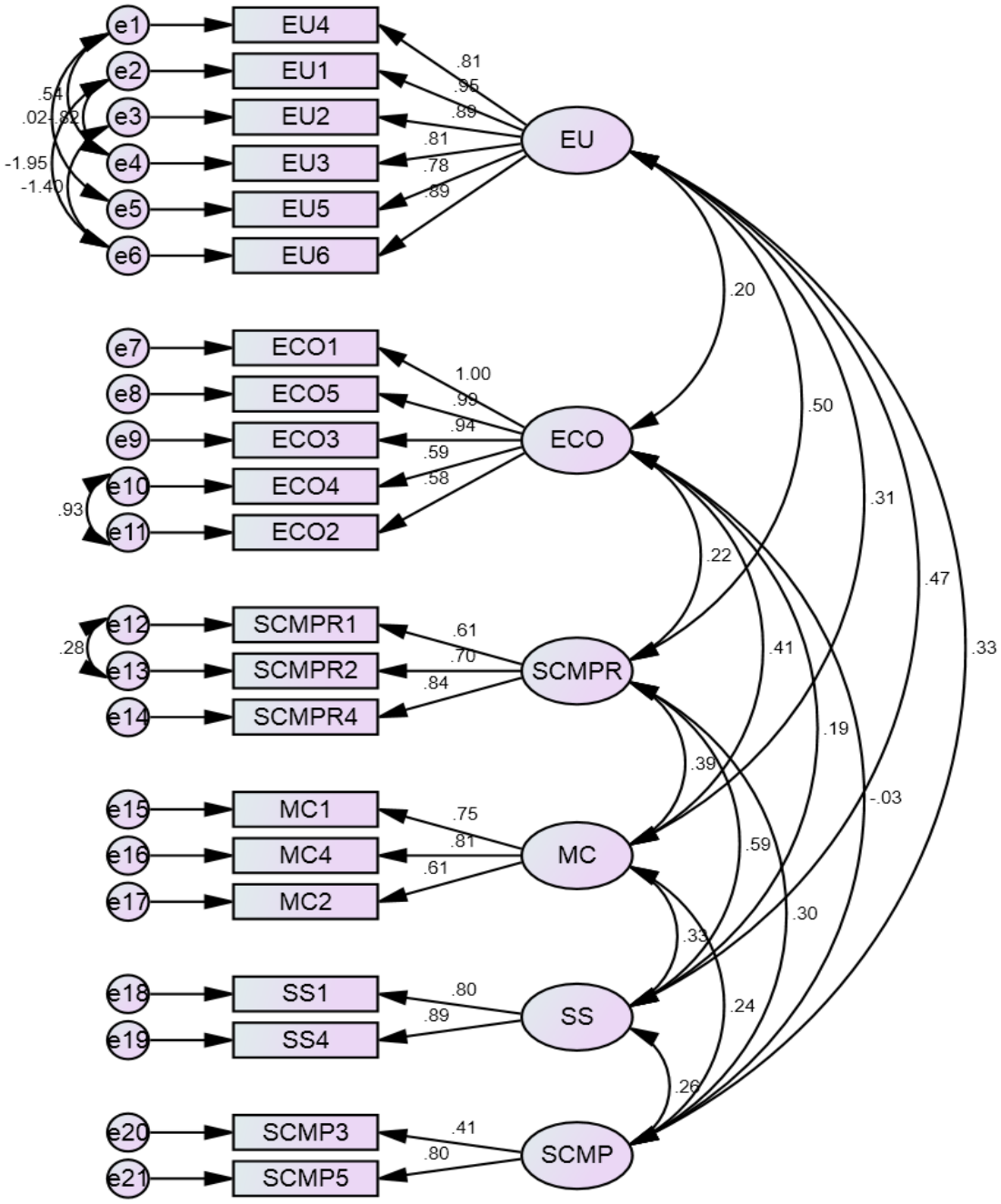


Figure 6.2 First Order Measurement Model- Results

Table 6.3 Results of Confirmatory Factor Analysis and Overall Reliability and Validity Indices

Dimensions	Items Code	Item Descriptions	Mean	Std. Deviation	Factor Loadings	Composite Reliability (α)	AVE	MSV	ASV
Eco-Innovation (ECO)	**ECO1**	Our company made eco-innovation products	2.794	1.293	0.926	0.921	0.711	0.167	0.059
	ECO2	Environmental patent applications position among peers	2.780	1.278	0.785				
	ECO3	After-tax returns among peers	2.789	1.290	0.897				
	ECO4	Reductions of energy compared to peer companies	2.777	1.270	0.792				
	ECO5	Waste reduction ratio compares with peer companies	2.774	1.299	0.923				
Environmental Uncertainty (EU)	**EU1**	Our company is characterized by rapidly shifting technology.	2.966	1.130	0.874	0.944	0.737	0.252	0.143
	EU2	Our company frequently changes our process and production technology. So the rate of process obsolescence is high in our company	2.889	1.202	0.868				
	EU3	Our master production schedule has a high percentage of variation in demand	2.940	1.128	0.848				
	EU4	Our demands are fluctuating radically from week to week	2.869	1.190	0.887				
	EU5	We maintain our inventory of critical material to fulfill the changing demand	3.000	1.289	0.749				
	EU6	Stability of quality of critical material	2.971	1.260	0.718				

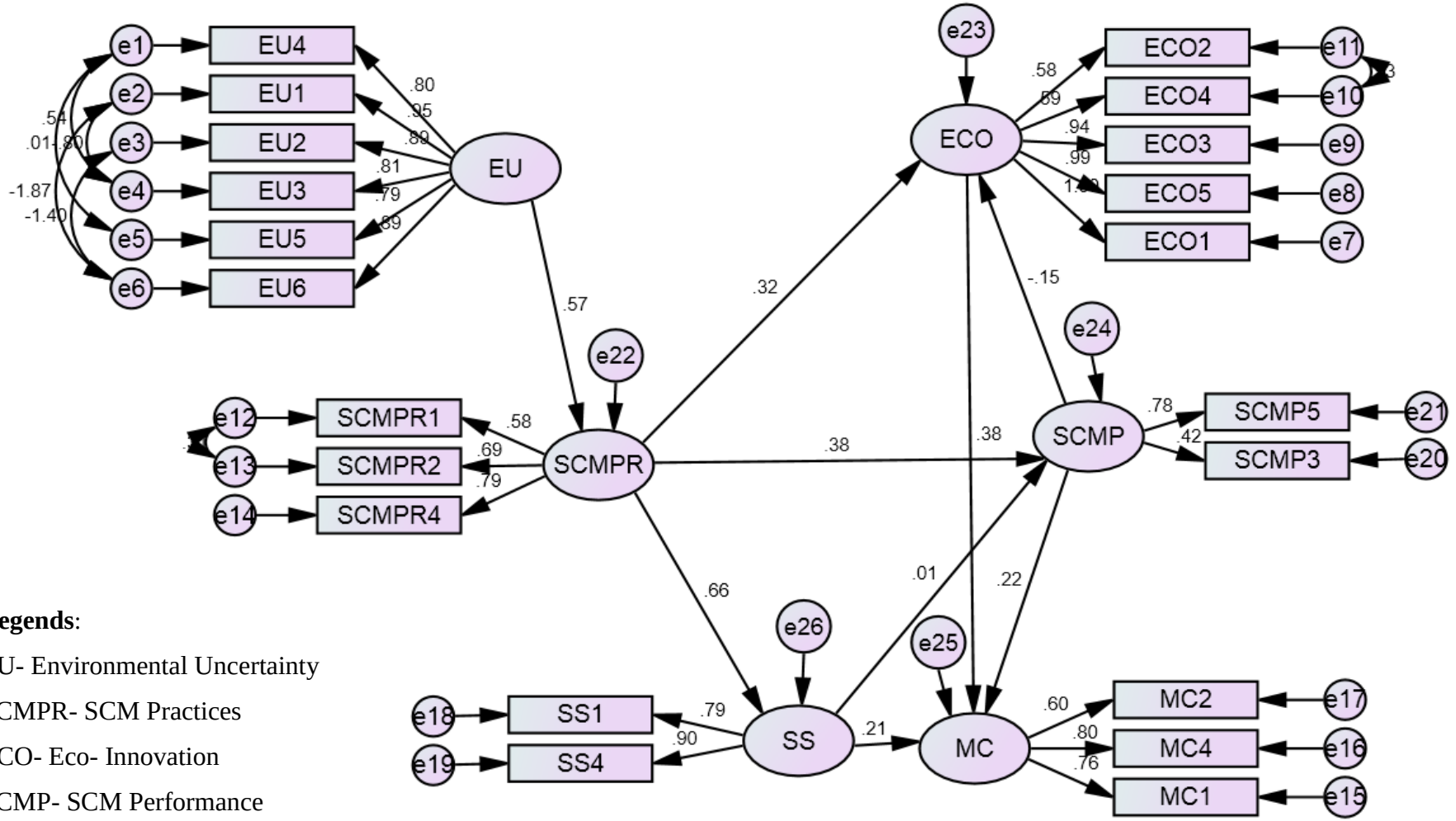
Manufacturing Competitiveness (MC)	**MC1**	Our company offers, product at competitive price/cost, lower than our competitors	2.934	1.215	0.837	0.767	0.527	0.167	0.116
	MC2	We try to reduce the R&D and production price/cost of the product	2.743	1.236	0.745				
	MC4	Our company uses empowers employees for continuous improvement	2.989	1.271	0.768				
SCM Performance (SCMP)	**SCMP3**	Our company supply chain is successful in minimizing inventory levels and overall cost	3.066	1.304	0.825	0.702	0.501	0.112	0.066
	SCMP5	Our company supply chain is successful in meeting quality specifications	3.103	1.292	0.747				
SCM Practice (SCMPR)	**SCMPR1**	We regularly assess the formal and informal complaints of our customers	2.834	1.183	0.840	0.763	0.522	0.346	0.178
	SCMPR2	We often interact with clients to determine reliability, responsiveness other standards for us	2.803	1.160	0.772				
	SCMPR4	Our trading partners share proprietary information with us	2.826	1.168	0.701				
Supplier Selection (SS)	**SS1**	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers	2.860	1.199	0.825	0.831	0.712	0.346	0.155
	SS4	Our suppliers provide high quality, responsive service to us.	2.860	1.178	0.789				

Notes: N= 350, AVE: Average variance extracted, MSV: Maximum shared variance, ASV: Average shared variance

6.2 Structural Equation Model (SEM) Result Using AMOS

The Structural Equation Modeling (SEM) is used to analyze the data and to test hypothesized relationships among the variables. The data for this study consist primarily of perceptual measures, and the hypotheses represent a series of simultaneous relationships that include exogenous and endogenous variables. SEM techniques offer more advantages over discriminant analysis and multiple regressions, because SEM have more flexibility to represent the interplay between data and theory. Hair et al. (1998), focused that "SEM is an appropriate technique to examine a series of interrelationships between simultaneous endogenous and exogenous variables in defining multifaceted constructs and studying path dependent variances". The analysis of data is tested by two steps, first, measurement model is tested to establish the validity and reliability and second, the structural relationships are tested (Budhwar and Debrah, 2001). The details of the proposed research model and structural relationships are discussed next.

The path diagram resulting from the structural modeling is displaying analysis using AMOS 20. as shown in Figure 6.3. The model fit index measures are: GFI=0.913, AGFI=0.883, NFI=0.947, and RMSEA=0.056. GFI and NFI are above the recommended value of 0.90; RMSEA is below the suggested maximum value of 0.08; only the AGFI is slightly below the recommended 0.90 levels. These results indicate a good fit of the model to the data.



Legends:

EU- Environmental Uncertainty

SCMPR- SCM Practices

ECO- Eco- Innovation

SCMP- SCM Performance

SS- Supplier Selection

MC- Manufacturing Competitiveness

Figure 6.3 Structural Equation Model- Results

These results indicate a good fit of the proposed model to the data. The findings of the structural equation model are presented in Table 6.4. In this study, 9 hypothesis have been used. Out of 9 hypothesized relationships, 7 were found to be significant at the 0.01 level. The hypothesis include H1 (direct impact of Environmental Uncertainty on and SCM Practices, hypothesis H2 (direct impact of SCM Practices on Eco-Innovation), hypothesis H3 (direct impact of SCM Practices on SCM Performance), hypothesis H4 (direct impact of SCM Practices on Supplier Selection (SS), hypothesis H5 (direct impact of Supplier Selection on SCM Performance (SCMP), hypothesis H6 (direct impact of SCM Performance on Eco-Innovation (ECO), hypothesis H7 (direct impact of Eco-Innovation (ECO) on Manufacturing Competitiveness (MC), hypothesis H8 (direct impact of SCM Performance on Manufacturing Competitiveness), hypothesis H9 (direct impact of Supplier Selection on Manufacturing Competitiveness), etc., as shown in Figure 6.1.

The findings of the structural equation model are presented in Table 6.4. The hypothesis H1, H2, H3, H4, H7, H8, and H9 are supported and H5 and H6 are not supported as shown in Table 6.4. Among the seven significant relationships of hypothesis, the top to the bottom of most standardized coefficients are 0.675 (H4- SCM Practices to Supplier Selection), 0.574 (H1- Environmental Uncertainty to SCM Practices, 0.388 (H3- SCM Practices to SCM Performance), 0.377 (H7- Eco-Innovation to Manufacturing Competitiveness), 0.259 (H2- SCM Practices to Eco-Innovation). On the other hand, the bottom three standardized coefficients are 0.209 (H9- Supplier Selection to Manufacturing Competitiveness), 0.167 (H8- SCM Performance to Manufacturing Competitiveness), 0.012 (H5- Supplier Selection to SCM Performance), and -0.15 (H6- SCM Performance with Eco-Innovation) have indicated no direct relationship between SCM performance and eco-innovation as shown in Table 6.4. The hypothesis H4- SCM Practices to Supplier Selection have the strongest link in the proposed model.

Hence, it can be concluded that there is a strong relationship between SCM Practices and supplier selection (H4) as shown in Table 6.4. The SCM Practices will greatly lead to improved supplier selection and are statistically significant. These two constructs (SCM Practices and supplier selection) are more significant to enhance the manufacturing competitiveness.

Table 6.4 Structural Equation Model - Results

Hypothesis	Relationship	Direct Effects	Indirect Effects	Total Effects	Hypothesis Results
H1	EU → SCMPR	0.574		**0.574**	**Supported**
H2	SCMPR → ECO	0.318	- 0.059	**0.259**	**Supported**
H3	SCMPR → SCMP	0.380	0.008	**0.388**	**Supported**
H4	SCMPR → SS	0.675		**0.657**	**Supported**
H5	SS → SCMP	0.012		**0.012**	**Not Supported**
H6	SCMP → ECO	**(- 0.152)**		**(- 0.152)**	**Not Supported**
H7	ECO → MC	0.377		**0.377**	**Supported**
H8	SCMP → MC	0.224	- 0.057	**0.167**	**Supported**
H9	SS → MC	0.207	0.002	**0.209**	**Supported**
		Note: * significant at a <0.05, ** significant at a <0.01 (one-tailed test), t-values are in parentheses.			

6.2.1 Hypotheses with Direct and Indirect Effects

It has been observed from the Table 6.4 that SCM Practices has an indirect relationship, but it has significant influence on Eco-Innovation. The coefficients of the indirect effect and total effect are -0.059 and 0.259 respectively. Both the effects are significant at 0.05 level. This indicates that SCM Practices has a direct influence on Eco-Innovation.

SCM Practices has an indirect relationship to SCM Performance and their coefficient of the indirect effect and total effects are 0.008 and 0.388 respectively. Both the effects are significant at 0.05 level.

SCM Performance has an indirect relationship to Manufacturing Competitiveness, and their coefficient of the indirect effect and total effects are - 0.057 and 0.167 respectively. Both the effects are significant at 0.05 level.

Supplier Selection has an indirect relationship to Manufacturing Competitiveness and their coefficient of the indirect effect and total effects are 0.002 and 0.209 respectively. Both the effects are significant at 0.05 level as shown in Table 6.4. Hence, it is clear from the analysis that the SCM performance and supplier selection can directly impact on manufacturing competitiveness.

6.3 Discussion of Structural Equation Model and Hypotheses Testing Result

The Amos structural modeling hypotheses testing results on the proposed model have been discussed in the previous section. The 7 hypothesized relationships were significant at the 0.05 level out of 9 hypotheses, and the final structural model displayed very good fit to the data. Meanwhile, the statistical significant and model fit are not a main objective of this academic research. They are just the means to achieve the end, which is better understanding of the subject under investigation and discovery of new relationships. The results from this research can be used not only by academicians in further exploring and testing the causal relations (linkages) in supply chain management, but also by practitioners for guiding the implementation of SCM Practices and the evaluation of SCM performance. The theoretical and practical implications of the analysis of each hypothesis was discussed in this section.

Hypothesis l: ***Environmental uncertainty positively affects the supply chain management practices.***

This relationship was found to be significant with standardized coefficients (γ) = 0.574, critical ratio (t) = 8, which indicates that there is a direct positive relationship between environmental uncertainty and SCM Practices. It has been observed from the literature that researches and academicians have considered environmental uncertainty as an important driver to enhance the implementation of SCM Practices (Chandra & Kumar, 2000). In present scenario, the market is very uncertain and unstable, so many of the organizations are adopting various SCM Practices. Scanning the environment of an organization is necessary in making appropriate decisions and adapting strategies in a context of constant evolution (Sun et al., 2009). The three possible dimensions of environmental uncertainty are market demand, supply and technology uncertainty for strengthening strategic supply management (Paulraj and Chen, 2007). The author Lee (2002) focused on environmental uncertainty framework for companies within a SC when seeking to devise the right SC strategy. Demand uncertainty is linked to the predictability of demand for a product (Fisher, 1997). In the supply process of the product supply uncertainty is another kind of uncertainty revolving around the supply process and is an equally important driver for the right SC practices (Lee, 2002). Hence it was hypothesized that environmental uncertainty positively affects the supply chain management practices. This study provides untested statements

regarding the impacts of environmental uncertainty and SCM practices and supporting evidence to the conceptual and prescriptive literature previous untested statements regarding the impacts of SCM practices. The results show that the environmental uncertainty positively affects the supply chain management practice, and further enhanced manufacturing competitiveness. The results of this study give empirical support and further provide the justifications for the same. It can be concluded that environmental uncertainty is a very effective construct to enhance the manufacturing competitiveness in India and will provide sustainable competitive advantage for the manufacturing organizations in the 21st century.

Hypothesis 2: ***The SCM Practices positively affects the eco-innovation***

This relationship was found to be significant with standardized coefficients (γ) = 0.259, critical ratio (t) = 4.293, which indicates that there is a direct positive relationship between SCM practices and eco-innovation (Popp, 2001; Rehfeld, et al., 2007; Frondel, et al., 2008). There are strong relationship between supply chain collaboration and eco-innovation (Ding, 2014; Geffen and Rothenberg, 2000). Hence, it was hypothesized that SCM practices positively affects the eco-innovation. The SCM practices positively affect the eco-innovation (Frondel, et al., 2008). This is a very valuable findings since the collaboration of SCM practices and eco-innovation has received less attention in the manufacturing organization. The innovation is an economic and social progress driver of national (macro) level and a driver of business success and competitive advantage of the firm (micro) level (Ding, 2014). Many governments now regard eco-innovation as part of their growth strategy. Finally, it can be concluded that eco-innovation is major drivers to enhance competitive advantage in India and will sustain for the Indian manufacturing industries in the 21st century.

Hypothesis 3: ***Supply chain management practices positively affects the supply chain management performance.***

The relationship of SCM Practices and SCM performance is found to be significant (γ) = 0.388, critical ratio (t) =2.542. After the empirical analysis, it has been confirmed the theoretical notion that a well-managed and well-executed supply chain directly leads to improved SCM performance. The literature shows that there is a positive links between SCM Practices and organizational performance (Shin et al., 2000; Narasimhan and Jayaram, 1998; Tan et al., 1998) without explicitly considering any intermediate variable such as SCM performance and

(Talwar, 2008) advantage. The result shows that there exists an immediate impact of SCM practices on the performance of SCM. The literature reveals that SCM practices and SCM performance are two major construct which can be directly or indirectly supported to each other and it also helps to enhance the competitiveness of Indian manufacturing sectors (Dewangan et al., 2015a). The research identified there is a positive relationship between SCM practices and SCM performance. Hence, it can be concluded that this two construct are more important drivers for manufacturing competitiveness in 21st century.

Hypothesis 4: ***Supply chain management practices positively affects the supplier selection.***

There is a strong relationship between SCM practices and supplier selection is found to be significant (γ) = 0.675, critical ratio (t) =7.433. Supplier selection is an important requirement in the flow of supply chain (Dewangan et al., 2015b; Dewangan et al., 2015d; Punniyamoorty et al., 2012). The role of supplier selection is very crucial in supply chain management (Lee et al., 2001). The coordination between a manufacturer and suppliers is very difficult and important link in the channel of distribution in supply chains. Literature shows that supplier selection is one of the most important drivers for supply chains and it is also supportive drivers to enhance the manufacturing competitiveness in India. The result shows that it was hypothesized that SCM practices positively affects the supplier selection. Hence it can be concluded that supplier selection is more important drivers for manufacturing competitiveness in 21st century.

Hypothesis 5: ***Supplier selection positively affects the supply chain management performance.***

There is a relationship between supplier selection and SCM performance and is found to be non-significant (γ) = 0.012, critical ratio (t) =0.118, which indicates that there is no direct, positive relationship between supplier selection and SCM performance. This non-significant relationship may be explained by the following: There are a wide variety of supplier selection and evaluation criteria in the supply chain for competitive advantage.

The main objective of the process of the supplier selection is cost reduction, optimize overall performance, build a long term relationship to the trading (Monczka et al., 1998). Thus, once a supplier becomes part of a well-managed and established supply chain, the relationship between supplier and manufacturer have a long term effect on the manufacturing competitiveness

of the entire supply chain performance. For the preparation of their products, the company procures raw materials from different suppliers. Merely, the question arises which supplier is the best for the company. However, it seems that there should be a positive relationship between supplier selection and SCM performance. But, the current research does not support this hypothesis and therefore, it is recommended to create awareness for the Indian manufacturing companies to understand the importance of supplier selection. As, supplier selection will effects low cost, flexibility, new product development, lead time and all these parameters are major constituents of SCM performance.

Hypothesis 6: ***The SCM performance positively affects the eco-innovation.***

It has to be found from the analysis that there is a no relationship between SCM performance and eco-innovation is found to be insignificant (γ) = -0.152, critical ratio (t) = -1.954, which indicates that there is no direct, positive relationship between SCM performance and eco-innovation. Eco-innovation issues are related to environmental, which consists of modified processes, practices, systems and products which gives advantages to the environment and for sustainability (Rennings, 2000). A very few of the industries have been fulfilling the requirement for the implementation of the eco-innovation. Due to the lack of eco-innovative products, the most of the manufacturing industries face lots of troubles in their supply chain with respect to the customer satisfaction and environmental issues (Dewangan et al., 2015c). With the help of literature review and expert discussions, it was hypothesized that SCM performance affects the eco-innovation. But current research doesn't support this hypothesis. Actually, the concept of eco-innovation is not well known by Indian manufacturing organizations. During the research it was felt that Indian manufacturing companies have a negative perception about ecological issues. They consider any initiative in the direction of eco-innovation as extra cost of their manufacturing system. Therefore, it was felt that most of the respondents were following eco-practices only under the rule of law. Unfortunately, no respondent was practicing anything innovative with respect to environmental issues on its own. Therefore, more such practical evidences are required, which can high light the benefits of eco-logically innovative practices. SCM performance can be a very good instrument in giving the message of importance of eco-innovation.

Hypothesis 7: ***Eco-Innovation positively affects the manufacturing competitiveness.***

There is a relationship between eco-innovation and manufacturing competitiveness and is found to be significant (γ) = 0.377, critical ratio (t) =6.4. Now a day's eco-innovation has played an important role in enhancing the manufacturing competitiveness in India (Dewangan et al., 2015c). Due to the excessive pressure in global markets and regional players, application of technology becomes more competitive. It has been observed that without the major efforts for innovation, R&D, marketing and financial approaches, the manufacturing sector loses its competence and its competitiveness in the global market (Raymond et al., 2014; Lau et al., 2013). The literature reveals that few work was done that show the relationship between eco-innovation and manufacturing competitiveness in India. Today's scenario, eco-innovation has played a crucial role in enhancing the manufacturing competitiveness in India (Dewangan et al., 2015a; Dewangan et al., 2015c). The literature reveals that the manufacturing sector loses its competence and its competitiveness in the global market without the major efforts of eco- innovation, R&D, marketing and financial approaches (Raymond et al., 2014; Lau et al., 2013). All the media reports and top global leaders are regularly emphasizing the need of ecological innovations. Ecological innovations will result in minimization of waste, optimization utilization of energy, minimization of the carbon footprint of an entire cycle life product. All these things will help the organization to reduce the cost of the product considerably. Thus, eco-innovation will be a major driver for manufacturing competitiveness in the 21st century.

Hypothesis 8: ***The supply chain management performance positively affects the manufacturing competitiveness.***

There is a relationship between SCM performance and manufacturing competitiveness and is found to be significant (γ) = 0.167, critical ratio (t) =2.822. The dual purpose of SCM is to enhance the performance of an individual, organization and that of the entire supply chain (Li, Ragu-Nathan et al., 2006). The SCM integrates information and goods flow seamlessly between trading partners as an effective competitive weapon (Childhouse & Towill, 2003; Feldmann and Muller, 2003). The main objective of SCM performance is to provide a strategic weapon to build up and enhance sustainable competitive advantage by cost reduction without compromising customer satisfaction (Mentzer et al., 2001). It has been observed from the literature that the SCM integrates the information and flow of goods seamlessly between trading partners as an effective

competitive weapon (Childhouse & Towill, 2003). The main goal of SCM performance is to provide a strategic weapon to build up and enhance sustainable manufacturing competitive by cost reduction without compromising customer satisfaction (Mentzer et al., 2001). SCM is most important driver to boost up the manufacturing competitiveness and reduce the cost of the products in the 21st century.

Hypothesis 9: ***Supplier selection positively affects the manufacturing competitiveness.***

There is a relationship between supplier selection and manufacturing competitiveness and is found to be significant (γ) = 0.209, critical ratio (t) =3.099. In today's global competitive scenario, supplier selection is very crucial for a competitive advantage in manufacturing sector in India. There are a wide variety of supplier selection and evaluation criteria in the supply chain for competitive advantage, due to the diversity of the purchasing context (Dewangan et al., 2015b). The effective supplier selection process will help to enhance the manufacturing competitiveness in India. Thus, from the analysis it has been observed that supplier selection have positively affected the manufacturing competitiveness. Literature shows that there are a variety of the evaluation criteria for supplier selection to enhance the manufacturing competitiveness in India (Dewangan et al., 2015b). Literature shows that right supplier selection is also one of the best criteria to boost up the competitive advantage in manufacturing industries in the 21st century.

6.4 Summary of Results

The overall analysis indicates that environmental uncertainty will lead to SCM practices and finally on the way to enhance the manufacturing competitiveness. The SCM practices will lead to improved eco-innovation, SCM performance, and supplier selection will enhance the manufacturing competitiveness. However, the findings did not support the direct impact of supplier selection to SCM performance, and SCM performance have also not directly associated with eco-innovation. Moreover, the findings reveal that manufacturing competitiveness is directly associated with the eco-innovation, SCM performance, and supplier selection.

6.5 Conclusion

The chapter started with the brief background causal model and hypothesis testing. A measurement scale has been developed which envelops the measuring issue of the research problem. To serve this purpose, A structural equation modeling (SEM) has been used for testing the hypotheses and different process has been followed. Various reliability and validity tests have been conducted for the refinement and validation of the scale. In addition, to this, hypothesis testing was also performed by using structural equation modeling (SEM) 20, software. A proposed structural model, and the overall goodness-of-fit of the entire structural equation model have been tested. Finally, the results of the study have been discussed. The next chapter will conclude with the summary of research findings and major contributions, implications for managers, limitations of the research, and recommendations for future research.

CHAPTER – 7
RESEARCH SUMMARY, IMPLICATIONS, LIMITATIONS AND FUTURE SCOPE

Preview

This chapter provides an overview of the research work conducted in the present study by discussing major research outcomes and key results. The research findings and major contributions of this research are discussed. The implications of results from different methodologies are also provided. These implications of this study will ensure its use by both practitioners and academicians. The limitations associated with this research are provided and discussion of future research questions that have been brought about by this research study.

7. Outline of the Present Research

This study is an attempt to fill the gaps identified in the available literature on the association of SCM performance and manufacturing competitiveness. The present study measured the SCM performance and its impact on manufacturing competitiveness in the Indian manufacturing sector. The different models have been designed to investigate and measure the SCM performance and its impact on manufacturing competitiveness. For investigation purposes, a qualitative model has been developed and presented in (Chapter 3). The model is prioritized the various factors of manufacturing competitiveness in the context of the manufacturing sector. Further, the measurement aspect of manufacturing competitiveness was addressed by the development of a quantitative model shown in Chapter 6. The measurement model has been utilized to develop and validate the scale for the measurement of manufacturing competitiveness of the Indian manufacturing companies. The present study consists of the following:

A very broad and thorough literature review has been conducted on the association of SCM performance and manufacturing competitiveness. The literature review consists of evolution and definitions of SCM, the theoretical backgrounds which is supported to SCM, eco-innovation, supplier selection, manufacturing competitiveness, etc. Based on the basis of literature review, various gaps, and research agenda has been identified which provided a sound base to conduct the present study.

A literature review of the different methodologies used in this field of study was also conducted. These methodologies were Exploratory and Confirmatory Factor analysis, Correlation analysis, and Structural Equation Modeling. These methodologies were further discussed.

On the basis of literature review, a brainstorming session, interviews and meetings with the academicians and industry experts was carried out to get information regarding the different issues related to SCM performance and manufacturing competitiveness.

A model has been developed to measure the manufacturing competitiveness of the Indian manufacturing sector. For the measurement of the manufacturing competitiveness, the measurement scale was developed with the help of identifying factors and their underlying items. This model is very useful to assess the impact of SCM performance on manufacturing competitiveness. For the scale development, the data were extracted from the available literature for each construct.

The items for the scale development were extracted from the available literature on each factor of manufacturing competitiveness. After the generation of the items, face validity and content validity of these items were evaluated. During this process a large number of items were deleted. A questionnaire was developed with the remaining items. The questionnaire has been sent to the respondents through e-mail (Budhwar, 2000). For the refinements of the items a pilot survey was conducted. Then initial items were pre-tested with twenty practitioners and seven academicians. After pre-tested by the experts, interactions with respondent and asked to provide the feedback regarding the clarity of questions, instructions, as well as the length of the questionnaires. To ensure the internal consistency and reliability of the items up to the standardization of the scale, exploratory factor analysis (EFA) have been performed.

After the EFA, a confirmatory factor analysis (CFA) has been performed for the validation and purification of the scale. For this the data has been collected from 350 respondents from Indian manufacturing companies. The validity of the scale has been examined after the assessment of uni-dimensionality and reliability of the refined items. Further, the convergent and discriminant validity of the scale were evaluated. Finally, six factors and 21 items scale have been built up for the measurement of manufacturing competitiveness of Indian manufacturing companies. Further, the Amos structural modeling hypotheses testing results on the proposed model have been discussed.

7.1. Research Contribution

The manufacturing competitiveness is moving from among organizations to between supply chains, more and more organizations are increasingly adopting SCM Practices, in the hope of reducing SCM cost and securing competitive advantage. But there exist doubts about the potential benefits from SCM. The results of this research assure the practitioners that SCM is an effective way of competing, and the implementation of SCM Practices does have a strong impact on manufacturing competitiveness and organizational performance. The final outcomes of the present research add to the existing body of literature on manufacturing competitiveness measurement. The outcomes of the research work provide a path for the both academicians and practitioners for the improvement of SCM performance in the long run as well its impact on a manufacturing competitiveness bottom line.

The main objective of this current study was to provide a measurement model for manufacturing competitiveness and a possible association between SCM performance and manufacturing competitiveness. In this study, both qualitative and quantitative models were developed with the help of academicians, industry practitioners and decision makers of the manufacturing sector in India. The model of this study will also help those researchers whose are working in this field. Hence, the model of this study is an attempt to fulfil the gaps in the existing literature, and also help to achieve the objective of the present study.

7.1.1 Implications/ Contribution for Academia

The present research is a useful contribution from the point of view of future researchers. The present research has used qualitative as well quantitative method. In qualitative method, the three most common methods were used, i.e., participant observation, in-depth interviews, and focus group discussion. Each method is particularly suited for obtaining a specific type of data. In quantitative methods a systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques was used. The objective of quantitative research is to develop and employ mathematical models, theories and/or hypotheses pertaining to phenomena. This will help academicians to understand the use of qualitative as well quantitative methodology simultaneously. The research has also identified a large number of factors which will affect manufacturing competitiveness in the 21^{st} century in India. These factors are developed on the basis of expert discussions as well as literature review.

The different factors of manufacturing competitiveness were derived from a further perusal of the present study. These factors are environmental uncertainty, SCM Practices, eco-innovation, SCM performance, and supplier selection, etc. Academician will take the advantage of this research to directly get the factors from these research for future researches.

After the identification of different factors of manufacturing competitiveness in the context of the manufacturing sector, a qualitative model has been developed. The model of this study covers two aspects, First, the measurement of SCM performance and Second, to evaluate the association between SCM performance and manufacturing competitiveness.

After the analysis, the scales are shown to fulfil the requirements for reliability and validity and thus, can be utilized in future research. The valid and reliable scales for manufacturing competitiveness with different dimensions have been otherwise lacking in the literature of empirical research. The development of these theory/measurements will greatly stimulate and facilitate the theory development in the field of SCM and manufacturing competitiveness.

A well-defined scale development procedure has been adopted for the development of the scale. The scale development process consists of two stages; item generation and selection, scale refinement and validation.

In the primary stage, items which are related to the different factors were extracted from the existing literature. For this purpose different techniques were adopted such as content analysis, production of the primary pool of items and evaluation of content and face validity through academician and industry expert's judgment. The present research presents the use of advanced statistical techniques using latest software such as SPSS 20., and AMOS 20., for The academician and future researchers can learn the use of such techniques from the present research.

Further, a pilot survey has been conducted for the analysis of items with the help of exploratory factor analysis (EFA) and reliability of the items.

This initial refinement process has been done for the purification stage. In this stage reliability, CFA, uni-dimensionality, convergent and discriminant validity assessment has been done. The scale has been developed for the measurement of manufacturing competitiveness of the Indian manufacturing industry. The different test has been used to test the internal consistency and reliability.

In the present study, the exclusivity is that it has strived to fill major gaps in existing field of manufacturing competitiveness measurement. In this study, the modeling techniques, developed a reliable and valid measurement of scale for manufacturing competitiveness measurement has

been used. This scale has not been developed in any study in the existing literature. Apart from that, this research is also an extension of the highly debatable issue, i.e. the relationship between SCM performance and manufacturing competitiveness measurement in context of Indian manufacturing sector.

The present research has identified various factors for manufacturing competitiveness. One of the factor i.e. environmental uncertainties is one of the important factors in the list. This will result in more future researches where advanced modelling can be used to handle environmental uncertainties. The research also tells that country like India can't run behind for concepts like make in India unless until issues related to environmental uncertainties are properly addressed.

7.1.2 Structural Equation Modeling (SEM) output

The scale of measuring the relationship of supply chain performance with manufacturing competitiveness will help academicians to develop theories and empirically validate various constructs of scale for different types of industrial setups.

The manufacturing competitiveness or competing through manufacturing is not a widely discuss the subject. Most of the people even from the operations management background believe that the role of operation management is reactive but as proposed by Skinner (1969) "missing link is the corporate strategy". The current research can ignite interest of academia to further investigate into the issues related to manufacturing competitiveness.

7.1.3 Implications/Contributions for Practitioners

The research is incomplete if it doesn't have practical implications. Though, research done for PhD. degrees should mainly contribute to theory development. But, at the same time research should also have practical utility. The present research is directly useful to the industries in more than one way. The present research gives factors to the environmental uncertainty, SCM practices, eco-innovation, SCM performance, supplier selection, and manufacturing competitiveness, etc. such factors which will define the manufacturing competitiveness of the 21st century. Therefore, Indian manufacturer should work hard to achieve these enablers of manufacturing competitiveness. This research has done through nine hypotheses, which is established important relationship between SCM performance and manufacturing competitiveness. Therefore, in order to improve the manufacturing competitiveness, which is an important agenda of the Government of India also, that SCM practices need to strengthen. Government of India

should develop better infrastructures for speedy movement of the products, development of infrastructure, storage and distribution channels, economical and environmentally supportive, mode of transportation need to be developed.

Practitioners of the research want economic benefits and then only suggestions of the research can be implemented in a sustained manner. The present research is helpful in improving the competitiveness which is directly getting the benefit to the industries for the improvement of market share, competitions, to achieve better customer satisfaction. Therefore, it is expected that industry will accept the result of this research with open arms.

Indian is working rapidly towards becoming a manufacturing hub. To become a manufacturing hub enabling environment which includes supply chain and logistics infrastructure is mandatory. It is, therefore, required to have good supply chain for the competitiveness of manufacturing. But, all the same time it is known to all us that supply chain cost is among the highest in India. Therefore, the Indian manufacturing industry is not that competitive. Working on the factors identified in this research supply chain systems can be improved which will help Indian manufacturing to become globally competitive.

7.2 Limitations of the Research

The current research made significant contributions from both a theoretical and practical point of view, it also has some limitations. This limitation may be a time limitation, sample, availability of data, techniques applied, etc. The limitations of the present study may provide various useful inputs that can be addressed in future studies. The limitation of this research work which are described below.

First, this research only focuses on the certain big companies by applying various dimensions in the sample selection. In this study, the sample size was limited to manufacturing companies, which potentially limits its application for small firms and service companies.

Second, in this research, single respondent (Chief Executive Officer/President, Vice President or Director, Operation Managers, Supply Chain Managers, and Purchasing Managers, etc.) in an organization was asked to respond to complex SCM issues dealing with all the participants along the supply chain, including upstream suppliers and downstream customers. But none of the respondent has the appropriate position, hold in the manufacturing organization, for example, suppose purchasing managers are mainly responsible for purchasing and supply operations side, and then has not in appropriate position who resolve the customers-related

questions. Meanwhile, the main area of manufacturing managers is production area, but they don't have much knowledge of their other parameters like supplier and customers. Hence, the single respondent may create some measurement inaccuracy.

Third, the supplier selection, SCM performance and eco-innovation constructs in this research suffered from measurement issues. Because of this limitation, this research have been not able to verify the impact of supplier selection on SCM performance and SCM performance on eco-innovation. There is a need to revise these constructs from the measurement angle and then explore the relationships among these constructs. In this research, there are a limited number of observations (350), the revalidation of the constructs was not carried out.

Fourth, the scale development is a generalized scale of the entire manufacturing sector. There may be variations in the terms of factors from manufacturing industry to industry. Hence, the study is conducted in the Indian scenario, the result may be different in the case of the other country.

Fifth, in this research, the constructs and dimensions are identified from reputed articles, inputs from manufacturing industry experts and discussed by academicians rather than more dimensions have not been contemplated and classified. The outcomes of this study are obtained through the judgments of academician and few industry experts.

Sixth, this research is totally based on the data collected from India only; therefore, it is necessary to validate the results before generalizing the study to other countries also. Further, this study may be extended for the Small Medium Enterprises (SMEs) to obtain better and more generalized results for the manufacturing sector.

Finally, this study is entirely subjective judgment and one of the most important things in this study is that the causal relationships of construct have achieved in the course of the judgment of industry experts as well as reputed academicians, and it is kind of personal judgment, and any prejudicing by the individual who is judging the SCM performance and manufacturing competitiveness might manipulate the final conclusion.

7.3 Recommendations for Future Research

Some of the important dimensions for future will emerge. Limitations of the current research are discussed in previous sections. The future research is expected to identify more dimensions which are specific to a particular manufacturing sector. The current research is a kind of generalized research on overall Indian manufacturing, but it is recommended that sector specific

researches will have better usefulness to the practitioners. Some more specific recommendation for future research as follows:

First, as previously pointed out in this study, supplier selection suffered from the measurement issues and may not be appropriate for SCM performance (Theodorakopoulos et al., 2013). So, there is need of attention for better construct definition and measurement items should be developed supplier selection construct.

Second, SCM performance suffered from the measurement issues and it has not given the positive effects on eco-innovation. Hence, it is required to better definition of constructs and measurement items, and should be developed for SCM performance and eco-innovation. In the future research, there is a need for attention to verify and developing better definition and sub-dimensions of this construct.

Third, after the finalization, if the constructs and sub-construct as mentioned above, there is a need to re-validate measurement scales developed through different populations.

Fourth, for future research direction, to enhance the reliability of the research findings, it will require to utilize multiple respondents from each participating in an organization. Hence, once a construct is measured with multiple methods, random error and method variance may be assessed using a multitrait-multi method approach.

Fifth, the drivers and barriers can be identified for improving manufacturing competitiveness. The interrelationship issues among three dimensions, i.e. (supplier selection, SCM performance and eco-innovation) need to address in the future studies.

Sixth, to identifying different types of dimensions for existing constructs of different industries of different sectors in India or abroad. Further, multiple criteria decision analysis making (MCDM) techniques like other integrated techniques like Fuzzy MICMAC, Analytic Network Process (ANP), Fuzzy Analytical Hierarchy Process (AHP), Fuzzy ANP, Fuzzy Axiomatic Design (FAD), Quality Function Deployment (QFD), Fuzzy QFD, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) can be applied to verify the results of this study.

Finally, the developmental scale can be used, to conduct a comparative study between two different sectors. Further, this scale can be modified as per the requirement of a particular manufacturing sector for the assessment of manufacturing competitiveness.

7.4 Conclusion

This chapter provides an amalgamate picture of the entire study. It also provides the outline of the present research, significant research contribution and key findings, the implications of the present study, implication for academicians, implications for practitioners, limitations and recommendations for future research. It is expected that the modified scale of this study will work as an attracting tool to measure the manufacturing competitiveness in the Indian manufacturing sector. This study helps to develop a strategy and policy formulation to enhance the manufacturing competitiveness.

BIBLIOGRAPHY

1. Achrol, R. S., & Stern, L. W. (1988). Environmental determinants of decision-making uncertainty in marketing channels. *Journal of Marketing Research*, 36-50.
2. Aeron, H., Bhaskar, T., Sundararajan, R., Kumar, A., & Moorthy, J. (2008). A metric for customer lifetime value of credit card customers. *Journal of Database Marketing & Customer Strategy Management, 15*(3), 153-168.
3. Aeron, H., Kumar, A., & Janakiraman, M. (2010). Application of data mining techniques for customer lifetime value parameters: a review. *International Journal of Business Information Systems, 6*(4), 514-529.
4. Aeron, H., Kumar, A., & Moorthy, J. (2012). Data mining framework for customer lifetime value-based segmentation. *Journal of Database Marketing & Customer Strategy Management*, *19*(1), 17-30.
5. Aggarwal, S. (1997). Flexibility management: the ultimate strategy. *Industrial Management-Chicago Then Atlanta*, *39*(1), 26-31.
6. Ahluwalia, M. S. (2002). Economic reforms in India since 1991: has gradualism worked?. *The Journal of Economic Perspectives*, *16*(3), 67-88.
7. Aissaoui, N., Haouari, M., & Hassini, E. (2007). Supplier selection and order lot sizing modeling: A review. *Computers & Operations Research, 34*(12), 3516-3540.
8. Åke Hörte, S., Börjesson, S., & Tunälv, C. (1991). A panel study of manufacturing strategies in Sweden. *International Journal of Operations & Production Management*, *11*(3), 135-144.
9. Aldrich, H. E. (1979). *Organizations and Environments*. NJ:Prentice-Hall, Inc., Englewood Cliff.
10. Alfalla-Luque, R., Medina-Lopez, C., & Dey, P. K. (2013). Supply chain integration framework using literature review. *Production Planning & Control, 24*(8-9), 800-817.
11. Alonso-Ayuso, A., Escudero, L. F., Garın, A., Ortuño, M. T., & Pérez, G. (2005). On the product selection and plant dimensioning problem under uncertainty. *Omega, 33*(4), 307-318.

12. Alvarado, U. Y., & Kotzab, H. (2001). Supply chain management: the integration of logistics in marketing. *Industrial marketing management*, *30*(2), 183-198.
13. Alvarez, D. (1994). Solving the Puzzle of Industry's Rubic Cube: Effective Supply-Chain Management. *Logistics Focus*, *2*, 2-2.
14. Álvarez, I., Marin, R., & Fonfría, A. (2009). The role of networking in the competitiveness of firms. *Technological Forecasting and Social Change*, *76*(3), 410-421.
15. Amaratunga, D., Baldry, D., & Sarshar, M. (2001). Process improvement through performance measurement: the balanced scorecard methodology. *Work study*, *50*(5), 179-189.
16. Amid, A., Ghodsypour, S. H., & O'Brien, C. (2011). A weighted max–min model for fuzzy multi-objective supplier selection in a supply chain. *International Journal of Production Economics*, *131*(1), 139-145.
17. Amoako-Gyampah, K. (2003). The relationships among selected business environment factors and manufacturing strategy: insights from an emerging economy. *Omega*, *31*(4), 287-301.
18. Amoako-Gyampah, K., & Acquaah, M. (2008). Manufacturing strategy, competitive strategy and firm performance: An empirical study in a developing economy environment. *International Journal of Production Economics*, *111*(2), 575-592.
19. Anand, G., & Ward, P. T. (2004). Fit, flexibility and performance in manufacturing: coping with dynamic environments. *Production and Operations Management*, *13*(4), 369-385.
20. Andersen, M., & Skjoett-Larsen, T. (2009). Corporate social responsibility in global supply chains. *Supply Chain Management: An International Journal*, *14*(2), 75-86.
21. Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411.
22. Anderson, J. C., Cleveland, G., & Schroeder, R. G. (1989). Operations strategy: a literature review. *Journal of Operations Management*, *8*(2), 133-158.
23. Andersson, L. M., & Bateman, T. S. (1997). Cynicism in the workplace: Some causes and effects. *Journal of Organizational Behavior*, *18*(5), 449-469.

24. Angelo, F. D., Jabbour, C. J. C., & Galina, S. V. (2012). Environmental Innovation: In Search of a Meaning. *World Journal of Entrepreneurship, Management and Sustainable Development*, *8*(2/3), 113-121.
25. Aquilano, N. J., Chase, R. B., & Davis, M. M. (1995), Fundamentals of Operations Management, Irwin, Chicago, IL.
26. Armstrong, S., & Overton, T.S. (1977). Estimating non-response bias in mail surveys. *Journal of Marketing Research*, *14*, 396-402.
27. Arzu Akyuz, G., & Erman Erkan, T. (2010). Supply chain performance measurement: a literature review. *International Journal of Production Research*, *48*(17), 5137-5155.
28. Augusto, M. G., Lisboa, J. V., &Yasin, M. M. (2014). The mediating role of innovation on strategic orientation and performance. International Journal of Business Innovation and Research, *8*(3), 282-299.
29. Avella, L., Fernandez, E., & Vazquez, C. J. (1998). Taxonomy of the manufacturing strategies of large Spanish industrial companies. *International journal of production research*, *36*(11), 3113-3134.
30. Bagozzi, R. P., & Phillips, L. W. (1982). Representing and testing organizational theories: A holistic construal. *Administrative Science Quarterly*, 459-489.
31. Bagozzi, R. P., Yi, Y., & Nassen, K. D. (1998). Representation of measurement error in marketing variables: Review of approaches and extension to three-facet designs. *Journal of Econometrics*, *89*(1), 393-421.
32. Bagozzi, R.P. (1980). *Causal models in marketing.* Wiley, New York.
33. Bahl, S., Wali, O. P., & Kumaraguru, P. (2011, June). Information security practices followed in the Indian software services industry: an exploratory study. In *Cybersecurity Summit (WCS), 2011 Second Worldwide* (pp. 1-7). IEEE.
34. Ballou, R. H., Gilbert, S. M., & Mukherjee, A. (2000). New managerial challenges from supply chain opportunities. *Industrial Marketing Management*, *29*(1), 7-18.
35. Balsano, T. J., Goodrich, N. E., Lee, R. K., Miley, J. W., Morse, T. F., & Roberts, D. A. (2008). Identify your innovation enablers and inhibitors. *Research-Technology Management*, *51*(6), 23-33.

36. Balsmeier, P., & Voisin, W. J. (1996). Supply chain management: a time-based strategy. *Industrial Management-Chicago Then Atlanta*, *38(5)*, 24-27.
37. Baykasoglu, A., & Özbakir, L. (2008). Analysing the effect of flexibility on manufacturing systems performance. *Journal of Manufacturing Technology Management*, *19*(2), 172-193.
38. Beach, R., Muhlemann, A. P., Price, D. H. R., Paterson, A., & Sharp, J. A. (2000a). A review of manufacturing flexibility. *European Journal of Operational Research*, *122*(1), 41-57.
39. Beach, R., Muhlemann, A. P., Price, D. H., Paterson, A., & Sharp, J. A. (2000b). Manufacturing operations and strategic flexibility: survey and cases. *International Journal of Operations & Production Management*, *20*(1), 7-30.
40. Beamon, B. M. (1998). Supply chain design and analysis: Models and methods. *International journal of production economics*, *55*(3), 281-294.
41. Beamon, B. M. (1999). Measuring supply chain performance. *International Journal of Operations & Production Management*, *19*(3), 275-292.
42. Bechtel, C., & Jayaram, J. (1997). Supply chain management: a strategic perspective. *The International Journal of Logistics Management*, *8*(1), 15-34.
43. Benito, J. and Benito, O. (2005). Environmental pro-activity and business performance: an empirical analysis. *Omega*, 33(1),1-15.
44. Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*(3), 588.
45. Berkhout, F. (2011). Eco-innovation: Reflections on an evolving research agenda. *International Journal of Technology, Policy and Management*, 11, 191–197.
46. Berry, D., Towill, D. R., & Wadsley, N. (1994). Supply chain management in the electronics products industry. *International Journal of Physical Distribution & Logistics Management*, *24*(10), 20-32.
47. Berry, W. L., & Cooper, M. C. (1999). Manufacturing flexibility: methods for measuring the impact of product variety on performance in process industries. *Journal of Operations Management*, *17*(2), 163-178.
48. Berry, W. L., Hill, T. J., & Klompmaker, J. E. (1995). Customer-driven manufacturing. *International Journal of Operations & Production Management*, *15*(3), 4-15.

49. Bhattacharya, A., Mohapatra, P., Kumar, V., Dey, P. K., Brady, M., Tiwari, M. K., & Nudurupati, S. S. (2014). Green supply chain performance measurement using fuzzy ANP-based balanced scorecard: a collaborative decision-making approach. *Production Planning & Control*, *25*(8), 698-714.

50. Bhuiyan, N., & Baghel, A. (2005). An overview of continuous improvement: from the past to the present. *Management Decision*, *43*(5), 761-771.

51. Bloom, N., Draca, M., & Van Reenen, J. (2011). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity (No. w16717). *National Bureau of Economic Research*.

52. Boltho, A. (1996). The assessment: international competitiveness. Oxford review of economic policy, 1-16. *Brookings Papers on Economic Activity*, 31, 125–236.

53. Bommer, M., O'Neil, B., & Treat, S. (2001). Strategic assessment of the supply chain interface: a beverage industry case study. *International Journal of Physical Distribution & Logistics Management*, *31*(1), 11-25.

54. Bowen, F. E., Cousins, P. D., Lamming, R. C., & Farukt, A. C. (2001). The role of supply management capabilities in green supply. *Production and operations management*, *10*(2), 174-189.

55. Boyacı, T., & Gallego, G. (2002). Coordinating pricing and inventory replenishment policies for one wholesaler and one or more geographically dispersed retailers. *International Journal of Production Economics*, *77*(2), 95-111.

56. Boyer, K. K., & Lewis, M. W. (2002). Competitive priorities: investigating the need for trade-offs in operations strategy. *Production and Operations Management*, *11*(1), 9-20.

57. Boyer, K. K., & Pagell, M. (2000). Measurement issues in empirical research: improving measures of operations strategy and advanced manufacturing technology. *Journal of Operations Management*, *18*(3), 361-374.

58. Boyer, K. K., Leong, G. K., Ward, P. T., & Krajewski, L. J. (1997). Unlocking the potential of advanced manufacturing technologies. *Journal of Operations Management*, *15*(4), 331-347.

59. Boyle, T. A., & Scherrer-Rathje, M. (2009). An empirical examination of the best practices to ensure manufacturing flexibility: Lean alignment. *Journal of Manufacturing Technology Management*, *20*(3), 348-366.

60. Braunscheidel, M. J., & Suresh, N. C. (2009). The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management*, *27*(2), 119-140.

61. Brown, S., & Bessant, J. (2003). The manufacturing strategy-capabilities links in mass customisation and agile manufacturing-an exploratory study. *International Journal of Operations & Production Management*, *23*(7), 707-730.

62. Brown, S., 1999, The role of manufacturing strategy in mass customization and agile manufacturing, *International Conference POMS-99 (India)*, 35-50.

63. Browne, J., Dubois, D., Rathmill, K., Sethi, S. P., & Stecke, K. E. (1984). Classification of flexible manufacturing systems. *The FMS magazine*, *2*(2), 114-117.

64. Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. *Sage Focus Editions*, *154*, 136-136.

65. Bruch, J., & Bellgran, M. (2014). Integrated portfolio planning of products and production systems. *Journal of Manufacturing Technology Management*, *25*(2), 155-174.

66. Budhwar, P. S. (2000). Evaluating levels of strategic integration and devolvement of human resource management in the UK. *Personnel Review*, *29*(2), 141-157.

67. Budhwar, P. S., & Boyne, G. (2004). Human resource management in the Indian public and private sectors: an empirical comparison. *The International Journal of Human Resource Management*, *15*(2), 346-370.

68. Budhwar, P. S., & Debrah, Y. (2001). Rethinking comparative and cross-national human resource management research. *International Journal of Human Resource Management*, *12*(3), 497-515.

69. Buffa, E. S. (1980). Research in operations management. *Journal of Operations Management*, *1*(1), 1-7.

70. Buganza, T., Gerst, M., & Verganti, R. (2010). Adoption of NPD flexibility practices in new technology-based firms. *European Journal of Innovation Management*, *13*(1), 62-80.

71. Burdon, S., Al-Kilidar, H., & Mooney, G. (2013). Evaluating an organisation's cultural readiness for innovation. *International Journal of Business Innovation and Research*, *7*(5), 572-589.
72. Burgess, R. (1998). Avoiding supply chain management failure: lessons from business process re-engineering. *The International Journal of Logistics Management*, *9*(1), 15-23.
73. Business Standard (2013). Industry seeks efforts to up share of manufacturing in GDP. 24 June, available at: http://www.business-standard.com/article/economy-policy/industry-seeks-efforts-to-up-share-of-manufacturing-in-gdp-13062401008_1.html (accessed 26 June, 2013)
74. Butler, T. (2004). *Leveraging sustainability: How companies enhance their eco-innovation success*. Rensealaer Polytechnic Institute, New York.
75. Cagliano, R., Acur, N., & Boer, H. (2005). Patterns of change in manufacturing strategy configurations. *International Journal of Operations & Production Management*, *25*(7), 701-718.
76. Calantone, R., & Dröge, C. (1999). Supply chain flexibility: an empirical study. *Journal of Supply Chain Management*, *35*(2), 16-24.
77. Calantone, R., Dröge, C., & Vickery, S. (2002). Investigating the manufacturing–marketing interface in new product development: does context affect the strength of relationships?. *Journal of Operations Management*, *20*(3), 273-287.
78. Camisón, C., & Villar López, A. (2010). An examination of the relationship between manufacturing flexibility and firm performance: The mediating role of innovation. *International Journal of Operations & Production Management*, *30*(8), 853-878.
79. Campbell, J., & Sankaran*, J. (2005). An inductive framework for enhancing supply chain integration. *International Journal of Production Research*, *43*(16), 3321-3351.
80. Carpinetti, L. C., Gerólamo, M. C., & Dorta, M. (2000). A conceptual framework for deployment of strategy-related continuous improvements. *The TQM Magazine*, *12*(5), 340-349.
81. Carr, A. S., Kaynak, H., Hartley, J. L., & Ross, A. (2008). Supplier dependence: impact on supplier's participation and performance. *International Journal of Operations & Production Management*, *28*(9), 899-916.

82. Carrillo-Hermosilla, J., Del Río, P., & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, *18*(10), 1073-1083.

83. Casey, R. J., & Lindstone, L. L. (1998). Concurrent Engineering in OpenGL's Product Development. *Hewlett Packard Journal*, *49*, 41-45.

84. Chakraborty, S., Sarker, S., Rai, S., Sarker, S., & Nadadhur, R. (2011b). Offshore Vendors' Software Development Team Configurations: An Exploratory Study. *Journal of Global Information Management (JGIM)*, *19*(3), 1-29.

85. Chan, F. T. S., Bhagwat, R., & Wadhwa, S. (2006). Increase in flexibility: productive or counterproductive? A study on the physical and operating characteristics of a flexible manufacturing system. *International Journal of Production Research*, *44*(7), 1431-1445.

86. Chan, F. T., & Chan, H. K. (2005). The future trend on system-wide modelling in supply chain studies. *The International Journal of Advanced Manufacturing Technology*, *25*(7-8), 820-832.

87. Chandra, C., & Kumar, S. (2000). Supply chain management in theory and practice: a passing fad or a fundamental change?. *Industrial Management & Data Systems*, *100*(3), 100-114.

88. Chandrasekar Subramaniam, M. J. S. (2002). A study of the value and impact of B2B e-commerce: the case of web-based procurement. *International Journal of Electronic Commerce*, *6*(4), 19-40.

89. Chang, S. C., Yang, C. L., Cheng, H. C., & Sheu, C. (2003). Manufacturing flexibility and business strategy: an empirical study of small and medium sized firms. *International Journal of Production Economics*, *83*(1), 13-26.

90. Chase, R. B. J., & Aquilano, F. R. (2009). *Administración de operaciones: producción y cadena de suministros* (No. Sirsi) a453314).

91. Chase, R. B., Aquilano, N. J., and Jacobs, R. (2000), *Operations Management for Competitive Advantage,* Irwin / McGraw-hill, Boston, MA.

92. Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management*, *22*(2), 119-150.

93. Chen, I. J., & Paulraj, A. (2004). Understanding supply chain management: critical research and a theoretical framework. *International Journal of Production Research*, *42*(1), 131-163.

94. Chengen, W. A. N. G. (2000). On the possibility of manufacturing system reconfiguration. *Computer Integrated Manufacturing Systems-Beijing-*, *6*(4), 1-5.

95. Childerhouse, P., & Towill, D. R. (2003). Simplified material flow holds the key to supply chain integration. *Omega*, *31*(1), 17-27.

96. Chizzo, S. A. (1998). Supply chain strategies: solutions for the customer-driven enterprise. *Supply Chain Management Directions*, *1*(1), 4-9.

97. Choi, T. Y., & Hong, Y. (2002). Unveiling the structure of supply networks: case studies in Honda, Acura, and DaimlerChrysler. *Journal of Operations Management*, *20*(5), 469-493.

98. Chopra, S. (2003). Designing the distribution network in a supply chain. *Transportation Research Part E: Logistics and Transportation Review*, *39*(2), 123-140.

99. Chopra, S., & Meindl, P. (2007). *Supply chain management. Strategy, planning & operation* (pp. 265-275). Gabler.

100. Chung, W., & Swink, M. (2009). Patterns of advanced manufacturing technology utilization and manufacturing capabilities. *Production and Operations Management*, *18*(5), 533-545.

101. Chopra, S., & Meindl, P. (2010). *Supply chain management: Strategy, planning, and operation (4th ed.)*. Upper Saddle River, New Jersey. Pearson Education, Inc.

102. Chopra, S., and Meindl, R. (2001). *Supply Chain Management: Strategy, Planning, and Operation.* Upper Saddle River, NJ: Prentice-Hall.

103. Chou, S. Y., & Chang, Y. H. (2008). A decision support system for supplier selection based on a strategy-aligned fuzzy SMART approach. *Expert Systems with Applications*, *34*(4), 2241-2253.

104. Chou, S.Y., & Chang, Y.H., 2008. A decision support system for supplier selection based on a strategy-aligned fuzzy SMART approach. *Expert Systems with Applications*, *34*(4), 2241–2253.

105. Christopher, M. (1998), Logistics and Supply-Chain Management: Strategies for Reducing Cost and Improving Service, *Prentice-Hall*, London.

106. Christopher, M. G. (1992), *Logistics and Supply Chain Management*, Pitman Publishing, London, UK.

107. Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management*, *15*(2), 1-14.

108. Christopher, M., Lowson, R., & Peck, H. (2004). Creating agile supply chains in the fashion industry. *International Journal of Retail & Distribution Management*, *32*(8), 367-376.

109. Churchill Jr, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research*, 64-73.

110. Clark, G. L., & Hebb, T. (2005). Why should they care? The role of institutional investors in the market for corporate global responsibility. *Environment and Planning A*, *37*(11), 2015.

111. Clark, T. H., & Lee, H. G. (2000). Performance, interdependence and coordination in business-to-business electronic commerce and supply chain management. *Information Technology and Management*, *1*(1-2), 85-105.

112. Claycomb, C., Dröge, C., & Germain, R. (1999). The effect of just-in-time with customers on organizational design and performance. *The International Journal of Logistics Management*, *10*(1), 37-58.

113. Cleff, T., & Rennings, K. (1999). Determinants of environmental product and process innovation. *European Environment*, *9*(5), 191-201.

114. Cleveland, G., Schroeder, R. G., & Anderson, J. C. (1989). A Theory of Production Competence*. *Decision Sciences*, *20*(4), 655-668.

115. Cohen, M. A., & Lee, H. L. (1988). Strategic analysis of integrated production-distribution systems: Models and methods. *Operations research*, *36*(2), 216-228.

116. Cohen, M.A., & Lee, H.L. (1989). Resource deployment analysis of global manufacturing and distribution networks. *Journal of Manufacturing and Operations Management*, 2, 81-104.

117. Cohen, M.A., & Moon, S. (1990). Impact of production scale economies, manufacturing complexity, and transportation costs on supply chain facility networks. *Journal of Manufacturing and Operations Management*, 3, 269-92.

118. Collins, J. D., Worthington, W. J., Reyes, P. M., & Romero, M. (2010). Knowledge management, supply chain technologies, and firm performance. *Management Research Review*, *33*(10), 947-960.

119. Collins, R., & Bechler, K. (1999). Outsourcing in the chemical and automotive industries: choice or competitive imperative?. *Journal of Supply Chain Management*, *35*(3), 4-11.

120. Colwell, S. R., & Joshi, A. W. (2013). Corporate Ecological Responsiveness: Antecedent Effects of Institutional Pressure and Top Management Commitment and Their Impact on Organizational Performance. *Business Strategy and the Environment*, *22*(2), 73-91.

121. Cooper, M. C., Ellram, L. M., Gardner, J. T., & Hanks, A. M. (1997). Meshing multiple alliances. *journal of Business Logistics*, *18*(1), 67.

122. Cooper, R. G. (1990). Stage-gate systems: a new tool for managing new products. *Business Horizons*, *33*(3), 44-54.

123. Corbett, C., Van Wassenhove, L., & de Constance, B. (1993). Trade-offs? What trade-offs?. *California Management Review*, (Summer), 107-22.

124. Cordero, R., Walsh, S. T., & Kirchhoff, B. A. (2009). Organization technologies, AMT and competent workers: exploring relationships with manufacturing performance. *Journal of Manufacturing Technology Management*, *20*(3), 298-313.

125. Cormican, K., & Cunningham, M. (2007). Supplier performance evaluation: lessons from a large multinational organisation. *Journal of Manufacturing Technology Management*, *18*(4), 352-366.

126. Cox Iii, J.F., and Blackstone, J.H., 1998, *APICS Dictionary* (9th edition), Falls Church, VA.

127. Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334.

128. Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin*, *52*(4), 281.

129. Croom, S., Romano, P., & Giannakis, M. (2000). Supply chain management: an analytical framework for critical literature review. *European Journal of Purchasing & Supply Management*, *6*(1), 67-83.

130. Czurchy, A.J, Yasin, M.M., & Peisl, T.C. (2009). A systematic approach to promoting effective innovation: a conceptual framework and managerial implications. *International Journal of Business Innovation and Research, 3*(6), 575–595.

131. Dacko, S. G. (2000). Benchmarking competitive responses to pioneering new product introductions. *Benchmarking: An International Journal, 7*(5), 324-342.

132. Dana Jr, J. D. (2001). Monopoly price dispersion under demand uncertainty. *International Economic Review*, *42*(3), 649-670.

133. Dana Jr, J. D., & Spier, K. E. (2001). Revenue sharing and vertical control in the video rental industry. *The Journal of Industrial Economics*, *49*(3), 223-245.

134. Dangayach, G. S., & Deshmukh, S. G. (2001). Manufacturing strategy: literature review and some issues. *International Journal of Operations & Production Management*, *21*(7), 884-932.

135. Dangayach, G. S., & Deshmukh, S. G. (2003). Evidence of manufacturing strategies in Indian industry: a survey. *International Journal of Production Economics*, *83*(3), 279-298.

136. Dangelico, R. M., &Pujari, D. (2010). Mainstreaming Green Product Innovation: Why And How Companies Integrate Environmental Sustainability. *Journal of Business Ethics*, *95*(3), 471-486.

137. David, L.; Philip, K.; and Edith, L. (2001). Designing and Managing the Supply Chain: Concepts, Strategies and Case Study. New York: McGraw-Hill.

138. Davidrajuh, R. (2003). Modeling and implementation of supplier selection procedures for e-commerce initiatives. *Industrial Management & Data Systems, 103*(1), 28-38.

139. Davis, T. (1993). Effective supply chain management. *Sloan Management Review*, *34*, 35-35.

140. De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research Policy*, *41*(3), 614-623.

141. De Meyer, A., & Ferdows, K. (1991). Removing the barriers in manufacturing: The 1990 European manufacturing futures survey. *European Management Journal*, *9*(1), 22-29.

142. De Meyer, A., Nakane, J., Miller, J. M., & Ferdows, K. (1989). Flexibility: the next competitive battle: the manufacturing futures survey. *Strategic Management Journal*, *10*(2), 135-144.

143. De-hai, Z. H. A. N. G. (2009). Analysis on Multi-task Principal-agent Model for Cooperation Innovation of Green Supply Chain. *Scientific Decision Making*, *12*, 006.

144. Deloitte (2012). Current state of Indian economy a balancing act, Available at: http://www.deloitte.com/assets/DcomIndia/Local%20Assets/Documents/Thoughtware/State%20of%20economy.pdf (accessed 10 April, 2013).

145. Demeter, K. (2003). Manufacturing strategy and competitiveness. *International Journal of Production Economics*, *81*, 205-213.

146. Deneckere, R., Marvel, H. P., & Peck, J. (1997). Demand uncertainty and price maintenance: markdowns as destructive competition. *The American Economic Review*, 619-641.

147. Despeisse, M., Oates, M. R., & Ball, P. D. (2013). Sustainable manufacturing tactics and cross-functional factory modelling. *Journal of Cleaner Production*, *42*, 31-41.

148. Devaraj, S., Hollingworth, D. G., & Schroeder, R. G. (2001). Generic manufacturing strategies: an empirical test of two configurational typologies. *Journal of Operations Management*, *19*(4), 427-452.

149. Devaraj, S., Hollingworth, D. G., & Schroeder, R. G. (2004). Generic manufacturing strategies and plant performance. *Journal of Operations Management*, *22*(3), 313-333.

150. Dewangan, D. K., Agrawal, R., & Sharma, V. (2015a). Enablers for Competitiveness of Indian Manufacturing Sector: An ISM-Fuzzy MICMAC Analysis. *Procedia-Social and Behavioral Sciences*, *189*, 416-432.

151. Dewangan D. K., Agrawal R., & Sharma, V. (2015b). Supplier Selection for Competitive Advantage in Supply Chain: An Integrated Fuzzy Analytic Hierarchy Process Using Simulation Approach. International Journal of Automation and Logistics, Special Issue on: *Supply Chain Sustainability and Mitigating Risks*, **Inderscience** (accepted).

152. Dewangan D. K., Agrawal R., &Sharma, V. (2015c). Enablers of Eco-Innovation to Enhance the Competitiveness of Indian Manufacturing Sector: An Integrated ISM-Fuzzy MICMAC Approach. *International Journal of Business Innovation and Research*, **Inderscience** (accepted).

153. Dewangan D. K., Agrawal R., Sharma V., (2015d). An approach of Modeling for Humanitarian Supplies. Edited Book on *Managing Humanitarian Logistics, Springer Proceedings in Business and Economics,* to be published by Springer Publications. (DOI 10.1007/978-81-322-2416-7_11).
154. Dey, P. K. (2002). Supply chain management in construction through partnership. *AACE International Transactions*, PM191.
155. Dickson, G. W. (1966). An analysis of vendor selection and the buying process. *Journal of Purchasing*, *2*(1), 5-17.
156. Dillman, Smyth, and Christian. (2009). Internet, mail, and mixed-mode surveys. *The Tailored Design Method*, Third Edition.
157. Ding, M. (2014 October). Supply chain collaboration toward eco-innovation: An SEM analysis of the inner mechanism. In *Service Operations and Logistics, and Informatics (SOLI), 2014 IEEE International Conference on* (pp. 129-134). IEEE.
158. Donlon, J. P. (1996). Maximizing value in the supply chain. *Chief Executive*, *117*(1), 54-63.
159. Doyle, M. (1998). Overcoming Communication Barriers. *Transportation and Distribution*, *39* (10), 91.
160. D'Souza, D. E., & Williams, F. P. (2000). Toward a taxonomy of manufacturing flexibility dimensions. *Journal of Operations Management*, *18*(5), 577-593.
161. Duclos, L. K., Vokurka, R. J., & Lummus, R. R. (2003). A conceptual model of supply chain flexibility. *Industrial Management & Data Systems*, *103*(6), 446-456.
162. Dwivedi, A. K., Ghosh, P., & Dangayach, G. S. (2013). Efficiency measurement of Indian steel industry using data envelopment analysis. *International Journal of Operational Research*, *18*(4), 386-400.
163. Easton, F. F., & Moodie, D. R. (1999). Pricing and lead time decisions for make-to-order firms with contingent orders. *European Journal of Operational Research*, *116*(2), 305-318.
164. Edition, A. D. N. (1998). *APICS*. Falls Church, VA, USA.
165. Elkington, J. (1998a). Cannibals with Forks: The Triple Bottom Line of the 21st Century.
166. Elkington, J. (1998b). Partnerships from cannibals with forks: The triple bottom line of 21st-century business. *Environmental Quality Management*, *8*(1), 37-51.

167. Ellram, L. M. (1990). The supplier selection decision in strategic partnerships. *Journal of Supply Chain Management*, *26*(4), 8.

168. Ellram, L. M. (1991). Supply-chain management: the industrial organisation perspective. *International Journal of Physical Distribution & Logistics Management*, *21*(1), 13-22.

169. Ellram, L. M. (1995). Total cost of ownership: an analysis approach for purchasing. *International Journal of Physical Distribution & Logistics Management*, *25*(8), 4-23.

170. Eng, T. Y. (2006). An investigation into the mediating role of cross-functional coordination on the linkage between organizational norms and SCM performance. *Industrial Marketing Management*, *35*(6), 762-773.

171. Epatko, E. (1994). Suppliers can help meet customer desires. *Purchasing*, 117(8), 9-11.

172. Erdos, P. L., & Morgan, A. J. (1970). *Professional mail surveys*. New York: McGraw-Hill.

173. Ettlie, J. E., & Penner-Hahn, J. D. (1994). Flexibility ratios and manufacturing strategy. *Management Science*, *40*(11), 1444-1454.

174. Ettlie, J. E., & Reza, E. M. (1992). Organizational integration and process innovation. *Academy of Management Journal*, *35*(4), 795-827.

175. Evans, G. N., Naim, M. M., & Towill, D. R. (1993). Dynamic supply chain performance: Assessing the impact of information systems. *Logistics Information Management*, *6*(4), 15-25.

176. Evans, P. B. and Wurster, T. S. (1997). Strategies and the New Economics of Information., *Harvard Business Review*, 75(5), 71-82.

177. Fai Pun, K. (2004). A conceptual synergy model of strategy formulation for manufacturing. *International Journal of Operations & Production Management*, *24*(9), 903-928.

178. Fai Pun, K. (2004). A conceptual synergy model of strategy formulation for manufacturing. *International Journal of Operations & Production Management*, *24*(9), 903-928.

179. Fang, S. C., & Jue-Fan, W. (2006). Effects of organizational culture and learning on manufacturing strategy selection: an empirical study. *International Journal of Management*, *23*(3), 503.

180. Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*, *32*(5), 339-361.

181. Feldmann, M., & Müller, S. (2003). An incentive scheme for true information providing in supply chains. *Omega*, *31*(2), 63-73.

182. Feng, B., Fan, Z. P., & Li, Y. (2011). A decision method for supplier selection in multi-service outsourcing. *International Journal of Production Economics*, *132*(2), 240-250.

183. Ferdows, K., & De Meyer, A. (1987). European manufacturers: The dangers of complacency. *INSEAD*.

184. Ferdows, K., & De Meyer, A. (1990). Lasting improvements in manufacturing performance: in search of a new theory. *Journal of Operations management*, *9*(2), 168-184.

185. Ferdows, K., & Lindberg, P. (1987). FMS as Indicator of the Strategic Role of Manufacturing. *International Journal of Production Research*, *25*(11), 1563-1571.

186. Ferdows, K., Miller, J. G., Nakane, J., & Vollmann, T. E. (1986). Evolving global manufacturing strategies: projections into the 1990s. *International Journal of Operations & Production Management*, *6*(4), 6-16.

187. Fine, C. H., & Hax, A. C. (1985). Manufacturing strategy: a methodology and an illustration. *Interfaces*, *15*(6), 28-46.

188. Fisher, M. L. (1997). What is the right supply chain for your product?. *Harvard Business Review*, *75*, 105-117.

189. Fisher, M., Hammond, J., Obermeyer, W., & Raman, A. (1997). Configuring a supply chain to reduce the cost of demand uncertainty. *Production and Operations Management*, *6*(3), 211-225.

190. Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *Journal of operations management*, *28*(1), 58-71.

191. Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: a contingency and configuration approach. *Journal of operations management*, *28*(1), 58-71.

192. Flynn, B.B., Sakakibara, S., Schroeder, R.G., Bates, K.A. and Flynn, E.J. (1990). Empirical research methods in operations management. *Journal of Operations Management*. *9*(2), 250-284.

193. Flynn, L. R., & Pearcy, D. (2001). Four subtle sins in scale development: some suggestions for strengthening the current paradigm. *International Journal of Market Research*, 43(4), 409.

194. Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 382-388.

195. Forrester, J. W. (1958). Industrial dynamics: A major breakthrough for decision makers. H*arvard Business Review*, *36*(4), 37-66.

196. Forrester, J. W. (1961). Industrial Dynamics**.** Portland (OR): *Productivity Press*.

197. Forza, C. (2002). Survey research in operations management: a process-based perspective. *International Journal of Operations & Production Management*, *22*(2), 152-194.

198. Foxon, T., & Andersen, M. M. (2009). The greening of innovation systems for eco-innovation–towards an evolutionary climate mitigation policy. In *DRUID Summer Conference-Innovation, Strategy and Knowledge*.

199. Fraj-Andre´s E., Martinez-Salinas E., & Matute-Vallejo, J. (2009). A multidimensional approach to the influence of environmental marketing and orientation on the firm's organizational performance. *Journal of Business Ethics*, *88*(2), 263-286.

200. Frankel, R., Bolumole, Y. A., Eltantawy, R. A., Paulraj, A., & Gundlach, G. T. (2008). The domain and scope of SCM's foundational disciplines—insights and issues to advance research. *Journal of Business Logistics*, *29*(1), 1-30.

201. Franks, J. (2000). Supply chain innovation. *Work Study*, *49*(4), 152-155.

202. Frantzen, D. (2008). Technology, competitiveness and specialisation in OECD manufacturing. *Journal of Economic Studies*, *35*(1), 44-68.

203. Fresard, L., Hoberg, G., & Phillips, G. (2013). The incentives for vertical mergers and vertical integration. *Research Policy*, *2*, 452-466.

204. Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management*, *19*(2), 185-200.

205. Frohlich, M. T., & Westbrook, R. (2002). Demand chain management in manufacturing and services: web-based integration, drivers and performance. *Journal of Operations Management*, *20*(6), 729-745.

206. Frondel, M., Horbach, J., & Rennings, K. (2007). End-of-pipe or cleaner production? An empirical comparison of environmental innovation decisions across OECD countries. *Business Strategy and the Environment*, *16*(8), 571-584.

207. Frondel, M., Horbach, J., & Rennings, K. (2008). What triggers environmental management and innovation? Empirical evidence for Germany. *Ecological Economics*, *66*(1), 153-160.

208. Fry, T. D., Steele, D. C., & Saladin, B. A. (1994). A service-oriented manufacturing strategy. *International Journal of Operations & Production Management*, *14*(10), 17-29.

209. Fulconis, F., & Pache, G. (2005). Exploiting SCM as source of competitive advantage: the importance of cooperative goals revisited. *Competitiveness Review: An International Business Journal*, *15*(2), 92-100.

210. Fynes, B., De Burca, S., & Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, *10*(4), 179-190.

211. Galbraith, C. S. (1990). Transferring core manufacturing technologies in high-technology firms. *California Management Review*, *32*(4), 56.

212. Garg, R., Rahman, Z., & Kumar, I. (2011). Customer experience: A critical literature review and research agenda. *International Journal of Service Sciences*, 4(2), 146–173.

213. Garvin, D. A. (1993). Manufacturing strategic planning. *California Management Review*, *35*(4), 85.

214. Garwood, D. (1999). Supply chain management: new paradigms for customers and suppliers. *Hospital materiel management quarterly*, *20*(3), 1-3.

215. Geffen, C. A., & Rothenberg, S. (2000). Suppliers and environmental innovation: the automotive paint process. *International Journal of Operations & Production Management*, *20*(2), 166-186.

216. Gerwin, D. (1987). An agenda for research on the flexibility of manufacturing processes. *International Journal of Operations & Production Management*, *7*(1), 38-49.

217. Gerwin, D. (1993). Manufacturing flexibility: a strategic perspective. *Management Science*, *39*(4), 395-410.

218. Geum, Y., Kim, J., Son, C., & Park, Y. (2013). Development of dual technology roadmap (TRM) for open innovation: Structure and typology. *Journal of Engineering and Technology Management*, *30*(3), 309-325.

219. Goldman, S. L. (1995). Agile competitors and virtual organizations: strategies for enriching the customer. Van Nostrand Reinhold Company.

220. Gosain, S., Malhotra, A., & El Sawy, O. A. (2004). Coordinating for flexibility in e-business supply chains. *Journal of Management Information Systems*, *21*(3), 7-45.

221. Goyal, M., Netessine, S., & Randall, T. (2012). Deployment of manufacturing flexibility: An empirical analysis of the North American automotive industry. *Available at SSRN 2077659*.

222. Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate Behavioral Research*, *26*(3), 499-510.

223. Griffin, A. (1997). PDMA research on new product development practices: updating trends and benchmarking best practices. *Journal of Product Innovation Management*, *14*(6), 429-458.

224. Grover, V. (1993). An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems*. *Decision Sciences*, *24*(3), 603-640.

225. Gruenwald, G. (1992). *New product development (Vol. 1).* Lincolnwood, IL: NTC Business Books.

226. Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, *87*(3), 333-347.

227. Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, *21*(1/2), 71-87.

228. Gunasekaran, A., Rai, B. K., & Griffin, M. (2011). Resilience and competitiveness of small and medium size enterprises: an empirical research. *International Journal of Production Research*, *49*(18), 5489-5509.

229. Ghadge, A., Dani, S., & Kalawsky, R. (2012). Supply chain risk management: present and future scope. *The International Journal of Logistics Management*, *23*(3), 313-339.

230. Gupta, A. K., & Wilemon, D. L. (1990). Accelerating The Development Of Technology-Based New Produc. *California Management Review*, *32*(2), 24.

231. Gupta, D., & Buzacott, J. A. (1996). A "goodness test" for operational measures of manufacturing flexibility. *International Journal of Flexible Manufacturing Systems*, *8*(3), 233-245.

232. Gupta, Y. P., & Goyal, S. (1989). Flexibility of manufacturing systems: concepts and measurements. *European Journal of Operational Research*, *43*(2), 119-135.

233. Gupta, Y. P., & Lonial, S. C. (1998). Exploring linkages between manufacturing strategy, business strategy, and organizational strategy. *Production and Operations Management*, *7*(3), 243-264.

234. Gupta, Y. P., & Somers, T. M. (1992). The measurement of manufacturing flexibility. *European Journal of Operational Research*, *60*(2), 166-182.

235. Gupta, Y. P., & Somers, T. M. (1996). Business strategy, manufacturing flexibility, and organizational performance relationships: a path analysis approach. *Production and Operations Management*, *5*(3), 204-233.

236. Haapala, K. R., Zhao, F., Camelio, J., Sutherland, J. W., Skerlos, S. J., Dornfeld, D. A., & Rickli, J. L. (2013). A review of engineering research in sustainable manufacturing. *Journal of Manufacturing Science and Engineering*, *135*(4), 041013.

237. Hahn, C. K., Watts, C. A., & Kim, K. Y. (1990). The supplier development program: a conceptual model. *Journal of Purchasing and Materials Management*, *26*(2), 2-7.

238. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2013). *Multivariate Data Analysis: Pearson New International Edition*. Pearson Higher Ed.

239. Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414-433.

240. Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1998). *Multivariate Data Analysis, 5th Edition*, New Jersey: Prentice Hall.

241. Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. and Tatham, R.L. (2006). *Multivariate Data Analysis*. Pearson-Prentice Hall, Upper Saddle River, NJ.

242. Hall, G., Rosenthal, J., and Wade, J. (1993). How to Make Reengineering Really Work. *Harvard Business Review*, November-December, 119-131.

243. Hallgren, M., & Olhager, J. (2006). Quantification in manufacturing strategy: A methodology and illustration. *International journal of production economics*, *104*(1), 113-124.

244. Hallgren, M., Olhager, J., & Schroeder, R. G. (2011). A hybrid model of competitive capabilities. *International Journal of Operations & Production Management*, *31*(5), 511-526.

245. Hammer, M. (2001). The super-efficient company. *Harvard Business Review*, 79(8), 82–91.

246. Handfield, R., Walton, S.V. and Sroufe, R. (2002). Applying environmental criteria to supplier assessment: a study in the application of the analytical hierarchy process. *European Journal of Operational Research, 141*(1), 70-87.

247. Harland, C. M. (1996). Supply chain management: relationships, chains and networks. *British Journal of Management*, *7*(1), 63-80.

248. Hayes, R. H., & Wheelwright, S. C. (1984). Restoring our competitive edge: competing through manufacturing.

249. Heerwegh, D. (2005). Effects of personal salutations in e-mail invitations to participate in a web survey. *Public Opinion Quarterly*, *69*(4), 588-598.

250. Hellström, T. (2007). Dimensions of environmentally sustainable innovation: the structure of eco-innovation concepts. *Sustainable Development*, *15*(3), 148-159.

251. Henke, J. W., Krachenberg, A. R., & Lyons, T. F. (1993). Cross-functional teams: good concept, poor implementation!. *Journal of Product Innovation Management*, *10*(3), 216-229.

252. Herremans, I. M., Akathaporn, P., & McInnes, M. (1993). An investigation of corporate social responsibility reputation and economic performance. *Accounting, Organizations and Society*, *18*(7), 587-604.

253. Hill, H. (1985). Subcontracting, technological diffusion, and the development of small enterprise in Philippine manufacturing. *The Journal of Developing Areas*, 245-262.

254. Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of Management*, *21*(5), 967-988.

255. Ho, C. F., Tai, Y. M., Tai, Y. M., & Chi, Y. P. (2005). A structural approach to measuring uncertainty in supply chains. *International Journal of Electronic Commerce*, *9*(3), 91-114.

256. Ho, W., Xu, X., & Dey, P. K. (2010). Multi-criteria decision making approaches for supplier evaluation and selection: A literature review. *European Journal of Operational Research*, *202*(1), 16-24.

257. Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*, *30*(10), 847-868.

258. Horbach, J. (2008). Determinants of environmental innovation—new evidence from German panel data sources. *Research Policy*, *37*(1), 163-173.

259. Horbach, J. (2014). Do eco-innovations need specific regional characteristics? An econometric analysis for Germany. *Review of Regional Research*, *34*(1), 23-38.

260. Horbach, J., Rammer, C., & Rennings, K. (2012). Determinants of eco-innovations by type of environmental impact—The role of regulatory push/pull, technology push and market pull. *Ecological Economics*, *78*, 112-122.

261. Horte, S. A., Lindberg, P., & Tunalv, C. (1987). Manufacturing strategies in Sweden. *International Journal of Production Research*, *25*(11), 1573-1586.

262. Hum, S. H., & Leow, L. H. (1992). The perception of the strategic role of manufacturing amongst operations managers: an empirical study based on a newly industrialized economy. *International Journal of Operations & Production Management*, *12*(11), 15-23.

263. Humphreys, P. K., Li, W. L., & Chan, L. Y. (2004). The impact of supplier development on buyer–supplier performance. *Omega*, *32*(2), 131-143.

264. Hung, S. C., Hung, S. W., & Lin, M. J. J. (2014). Are alliances a panacea for SMEs? The achievement of competitive priorities and firm performance. *Total Quality Management & Business Excellence, (ahead-of-print)*, 1-13.

265. Hung, S. C., Hung, S. W., & Lin, M. J. J. (2015). Are alliances a panacea for SMEs? The achievement of competitive priorities and firm performance. *Total Quality Management & Business Excellence*, *26*(1-2), 190-202.

266. Hung, S. W. (2009). Development and innovation in the IT industries of India and China. *Technology in Society*, *31*(1), 29-41.

267. Huo, B., Zhao, X., & Zhou, H. (2014). The Effects of Competitive Environment on Supply Chain Information Sharing and Performance: An Empirical Study in China. *Production and Operations Management*, *23*(4), 552-569.

268. Hutchison, J., & Das, S. R. (2007). Examining a firm's decisions with a contingency framework for manufacturing flexibility. *International Journal of Operations & Production Management*, *27*(2), 159-180.

269. IBEF (2013). Role of manufacturing in employment generation in India, available at: http://www.ibef.org/download/Role-of-Manufacturing-in-Employment-Generation-in-India.pdf (accessed 10 June, 2013).

270. Indian Express, (2013). Manufacturing sector share to GDP likely to fall, 4 July, Available at: http://newindianexpress.com/business/news/Manufacturing-sector-share-to-GDP-likely-to-fall/2013/05/13/article1587625.ece (accessed 4 July, 2013).

271. Jaca, C., Viles, E., Paipa-Galeano, L., Santos, J., & Mateo, R. (2014). Learning 5S principles from Japanese best practitioners: case studies of five manufacturing companies. *International Journal of Production Research*, *52*(15), 4574-4586.

272. Jain, J., Dangayach, G. S., Agarwal, G., & Banerjee, S. (2010). Supply chain management: literature review and some issues. *Management*, *2*, 0.

273. Jarrell, J. L. (1998). Supply Chain Economics. *World Trade*, *11*(11), 58-61.

274. Jiménez, C. H. O., Garrido-Vega, P., & González, S. G. (2011). Manufacturing strategy–technology relationship among auto suppliers. *International Journal of Production Economics*, *133*(2), 508-517.

275. John, G. (2003). Strategic supply chain alignment. *Beijing, China*.

276. Johnson, K., Hays, C., Center, H., & Daley, C. (2004). Building capacity and sustainable prevention innovations: A sustainability planning model. *Evaluation and Program Planning*, *27*(2), 135-149.

277. Jones, T. C., & Riley, D. W. (1985). Using inventory for competitive advantage through supply chain management. *International Journal of Physical Distribution & Materials Management*, *15*(5), 16-26.

278. Jöreskog, K. G. (1993). Testing structural equation models. *Sage Focus Editions*, *154*, 294-294.

279. Jöreskog, K. G., & Sörbom, D. (1989). LISREL 7: A guide to the program and applications. *SPSS*.

280. Joseph, I. N., Rajendran, C., & Kamalanabhan, T. J. (1999). An instrument for measuring total quality management implementation in manufacturing-based business units in India. *International Journal of Production Research*, *37*(10), 2201-2215.

281. Kannan, D., Khodaverdi, R., Olfat, L., Jafarian, A., & Diabat, A. (2013). Integrated fuzzy multi criteria decision making method and multi-objective programming approach for supplier selection and order allocation in a green supply chain. *Journal of Cleaner Production*, 47, 355-367.

282. Kara, S., & Kayis, B. (2004). Manufacturing flexibility and variability: an overview. *Journal of Manufacturing Technology Management*, *15*(6), 466-478.

283. Kathuria, R., & Partovi, F. Y. (1999). Work force management practices for manufacturing flexibility. *Journal of Operations Management*, *18*(1), 21-39.

284. Kathuria, R., & Porth, S. J. (2003). Strategy-managerial characteristics alignment and performance: a manufacturing perspective. *International Journal of Operations & Production Management*, *23*(3), 255-276.

285. Kathuria, R., Partovi, F. Y., & Greenhaus, J. H. (2010). Leadership practices, competitive priorities, and manufacturing group performance. *International Journal of Operations & Production Management*, *30*(10), 1080-1105.

286. Kathuria, V. (2000). Productivity spillovers from technology transfer to Indian manufacturing firms. *Journal of International Development*, *12*(3), 343.

287. Kazan, H., Özer, G., & Tansel Çetin, A. (2006). The effect of manufacturing strategies on financial performance. *Measuring Business Excellence*, *10*(1), 14-26.

288. Keating, B., Quazi, A., Kriz, A., & Coltman, T. (2008). In pursuit of a sustainable supply chain: insights from Westpac Banking Corporation. *Supply Chain Management: An International Journal*, *13*(3), 175-179.

289. Kemp, R. (2010). Eco-innovation: Definition, measurement and open research issues. *Economia Politica*, 27, 397– 420.

290. Kemp, R., & Oltra, V. (2011). Research insights and challenges on Eco-innovation dynamics. *Industry and Innovation*, 18, 249–253.
291. Kerlinger, F. N. (1978). Similarities and differences in social attitudes in four western countries. *International Journal of Psychology, 13*(1), 25-37.
292. Kerlinger, F. N. (1986). Foundations of Behavioral Research (Holt, Rinehart and Winston, New York, NY).
293. Kiefer, A. W., & Novack, R. A. (1999). An empirical analysis of warehouse measurement systems in the context of supply chain implementation. *Transportation Journal*, 18-27.
294. Kim, J. S., & Arnold, P. (1996). Operationalizing manufacturing strategy: an exploratory study of constructs and linkage. *International Journal of Operations & Production Management*, *16*(12), 45-73.
295. Kim, M., Suresh, N. C., & Kocabasoglu-Hillmer, C. (2013). An impact of manufacturing flexibility and technological dimensions of manufacturing strategy on improving supply chain responsiveness: Business environment perspective. *International Journal of Production Research*, *51*(18), 5597-5611.
296. Kim, M., Suresh, N. C., & Kocabasoglu-Hillmer, C. (2013). An impact of manufacturing flexibility and technological dimensions of manufacturing strategy on improving supply chain responsiveness: Business environment perspective. *International Journal of Production Research*, *51*(18), 5597-5611.
297. Kimes, S. E. (2000). A strategic approach to yield management. *Yield Management*, 3-14.
298. Kleindl, B. (2000). Competitive dynamics and new business models for SMEs in the virtual marketplace. *Journal of Developmental Entrepreneurship*, *5*(1), 73-85
299. Klewitz, J., & Hansen, E. G. (2014). Sustainability-oriented innovation of SMEs: a systematic review. *Journal of Cleaner Production*, *65*, 57-75.
300. Kara, S., Ibbotson, S., & Kayis, B. (2014). Sustainable product development in practice: an international survey. *Journal of Manufacturing Technology Management*, *25*(6), 848-872.
301. Kopczak, L. R. (1997). Logistics partnerships and supply chain restructuring: survey results from the US computer industry. *Production and Operations Management*, *6*(3), 226-247.
302. Koste, L. L., & Malhotra, M. K. (1999). A theoretical framework for analyzing the dimensions of manufacturing flexibility. *Journal of Operations Management*, *18*(1), 75-93.

303. Koste, L. L., Malhotra, M. K., & Sharma, S. (2004). Measuring dimensions of manufacturing flexibility. *Journal of Operations Management*, *22*(2), 171-196.

304. Koufteros, X. A. (1995). Time-based manufacturing: developing a nomological network of constructs and instrument development. *Unpublished Dissertation, University of Toledo, Toledo, OH*.

305. Koufteros, X. A., Vonderembse, M. A., & Doll, W. J. (1997, November). Competitive capabilities: measurement and relationships. *In Proceedings Decision Science Institute*, *3*, 1067-1068).

306. Krajewski, L and Ritzman, L. (1996). Operations Management Strategy und Ana & 4th ed. Reading, MA: *Addison-Wesley Publishing*.

307. Krause, D. R. (1999). The antecedents of buying firms' efforts to improve suppliers. *Journal of Operations Management*, *17*(2), 205-224.

308. Krause, D. R., Handfield, R. B., & Scannell, T. V. (1998). An empirical investigation of supplier development: reactive and strategic processes. *Journal of Operations Management*, *17*(1), 39-58.

309. Krause, R.D. and Scannel, T.V. (2002). Supplier development practices: product and service based industry comparisons. *The Journal of Supply Chain Management, 38*(2), 13-21.

310. Kristal, M. M., Huang, X., & Roth, A. V. (2010). The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance. *Journal of Operations Management*, *28*(5), 415-429.

311. Kristianto, Y., Ajmal, M. M., & Sandhu, M. (2012). Adopting TQM approach to achieve customer satisfaction: A flour milling company case study. *The TQM Journal*, *24*(1), 29-46.

312. Kristianto, Y., Ajmal, M., Addo Tenkorang, R., & Hussain, M. (2012). A study of technology adoption in manufacturing firms. *Journal of Manufacturing Technology Management*, *23*(2), 198-211.

313. Kunnumkal, S., & Topaloglu, H. (2008). A refined deterministic linear program for the network revenue management problem with customer choice behavior. *Naval Research Logistics (NRL)*, *55*(6), 563-580.

314. Kunnumkal, S., & Topaloglu, H. (2008). Price discounts in exchange for reduced customer demand variability and applications to advance demand information acquisition. *International Journal of Production Economics*, *111*(2), 543-561.

315. Kunnumkal, S., & Topaloglu, H. (2008). Using stochastic approximation methods to compute optimal base-stock levels in inventory control problems. *Operations Research*, *56*(3), 646-664.

316. Kureshi, N., Qureshi, F. and Sajid, A. (2010). Current health of quality management practices in service sector SME- a case study of Pakistan. *The TQM Journal*, *22*(3), 317-329.

317. La Londe, B. J., & Masters, J. M. (1994). Emerging logistics strategies: blueprints for the next century. *International journal of physical distribution & logistics management*, *24*(7), 35-47.

318. Lalonde, B. J. (1998). Building a supply chain relationship. *Supply Chain Management Review*, *2*(2), 7-8.

319. Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial marketing management*, *29*(1), 65-83.

320. Lambert, D. M., & Harrington, T. C. (1990). Measuring nonresponse bias in customer service mail surveys. *Journal of Business Logistics*, *11*(2), 5-25.

321. Lambert, D. M., García-Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of process-oriented supply chain management frameworks. *Journal of business Logistics*, *26*(1), 25-51.

322. Lamming, R. (1996). Squaring lean supply with supply chain management. *International Journal of Operations & Production Management*, *16*(2), 183-196.

323. Lancioni, R. A., Smith, M. F., & Oliva, T. A. (2000). The role of the Internet in supply chain management. *Industrial Marketing Management*, *29*(1), 45-56.

324. Lau, A. K., Baark, E., Lo, W. L., & Sharif, N. (2013). The effects of innovation sources and capabilities on product competitiveness in Hong Kong and the Pearl River Delta. *Asian Journal of Technology Innovation*, *21*(2), 220-236.

325. Lau, G. T., Goh, M., & Phua, S. L. (1999). Purchase-related factors and buying center structure: An empirical assessment. *Industrial Marketing Management*, *28*(6), 573-587.

326. Lawrence, A. (1997). Customer power forces supply chain integration. *Works Management*, *50*(4), 43.

327. Lee, E. K., Ha, S., & Kim, S. K. (2001). Supplier selection and management system considering relationships in supply chain management. *Engineering Management, IEEE Transactions on*, *48*(3), 307-318.

328. Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, *44*(3), 105-119.

329. Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review*, *82*(10), 102-113.

330. Lee, H. L., & Billington, C. (1992). Managing supply chain inventory: pitfalls and opportunities. *Sloan Management Review*, *33*(3).

331. Lee, H. L., & Billington, C. (1995). The evolution of supply-chain-management models and practice at Hewlett-Packard. *Interfaces*, *25*(5), 42-63.

332. Lee, H. L., & Feitzinger, E. (1995). Product configuration and postponement for supply chain efficiency. In *Institute of Industrial Engineers, Fourth Industrial Engineering Research Conference Proceedings* (Vol. 4, pp. 43-48). *IPTS*.

333. Lee, H. L., & Ng, S. M. (1997). Introduction to the special issue on global supply chain management. *Production and Operations Management*, *6*(3), 191-192.

334. Lee, H. L., Padmanabhan, V., Whang, S. (1997). Information Distortion in a Supply Chain: The Bullwhip Effect. *Management Science*, 43(4), 46-558.

335. Lee, H. L., So, K. C., & Tang, C. S. (2000). The value of information sharing in a two-level supply chain. *Management Science*, *46*(5), 626-643.

336. Lee, H., & Whang, S. (1999). Decentralized multi-echelon supply chains: Incentives and information. *Management Science*, *45*(5), 633-640.

337. Lee, J. N., & Kim, Y. G. (1999). Effect of partnership quality on IS outsourcing success: conceptual framework and empirical validation. *Journal of Management Information Systems*, 29-61.

338. Lenny Koh, S. C., Demirbag, M., Bayraktar, E., Tatoglu, E., & Zaim, S. (2007). The impact of supply chain management practices on performance of SMEs. *Industrial Management & Data Systems*, *107*(1), 103-124.

339. Lenz, R. T. (1980). Environment, strategy, organization structure and performance: Patterns in one industry. *Strategic Management Journal*, *1*(3), 209-226.

340. Leong, G. K., Snyder, D. L., & Ward, P. T. (1990). Research in the process and content of manufacturing strategy. *Omega*, *18*(2), 109-122.

341. Levi, D. S., Kaminsky, P., & Levi, E. S. (2003). Designing and managing the supply chain: Concepts, strategies, and case studies. McGraw-Hill.

342. Li, C. C., Fun, Y. P., & Hung, J. S. (1997). A new measure for supplier performance evaluation. *IIE transactions*, *29*(9), 753-758.

343. Li, D., & O'Brien, C. (1999). Integrated decision modelling of supply chain efficiency. *International Journal of Production Economics*, *59*(1), 147-157.

344. Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107-124.

345. Li, S., Rao, S. S., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2005). Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management*, *23*(6), 618-641.

346. Liao, S. H., & Kuo, F. I. (2014). The study of relationships between the collaboration for supply chain, supply chain capabilities and firm performance: A case of the Taiwan′ s TFT-LCD industry. *International Journal of Production Economics*, *156*, 295-304.

347. Likert, R., & Bowers, D. G. (1969). Organizational theory and human resource accounting. *American Psychologist*, *24*(6), 585.

348. Lin, B. W. (2004). Original equipment manufacturers (OEM) manufacturing strategy for network innovation agility: the case of Taiwanese manufacturing networks. *International Journal of Production Research*, *42*(5), 943-957.

349. Lindberg, P. (1990). Strategic manufacturing management: a proactive approach. *International Journal of Operations & Production Management*, *10*(2), 94-106.

350. Lindberg, P., & Trygg, L. (1991). Manufacturing strategy in the value system. *International Journal of Operations & Production Management*, *11*(3), 52-62.

351. Lindberg, P., Lindér, J., & Tunälv, C. (1988). Strategic decisions in manufacturing—on the choice of investments in flexible production organizations. *The International Journal of Production Research*, *26*(10), 1695-1704.

352. Ling X. Li, L. (2000). Manufacturing capability development in a changing business environment. *Industrial Management & Data Systems*, *100*(6), 261-270.

353. Liu, Y. (2013). Sustainable competitive advantage in turbulent business environments. *International Journal of Production Research*, *51*(10), 2821-2841.

354. Lööf, H., & Johansson, B. (2014). R&D Strategy, Metropolitan Externalities and Productivity: Evidence from Sweden. *Industry and Innovation*, 21(2), 141-154.

355. Lummus, R. R., & Alber, K. L. (1997). *Supply chain management: balancing the supply chain with customer demand*. APICS Educational & Research Foundation.

356. Lummus, R. R., & Vokurka, R. J. (1999). Defining supply chain management: a historical perspective and practical guidelines. *Industrial Management & Data Systems*, *99*(1), 11-17.

357. Mabert, V. A., & Venkataramanan, M. A. (1998). Special research focus on supply chain linkages: challenges for design and management in the 21st century. *Decision Sciences*, *29*(3), 537.

358. Magretta, J. (1998). Do not copy the power of virtual integration: An Interview with Dell Computer's Michael Dell. *Harvard Business Review*, 76(2), pp.72-84.

359. Magretta, J. (1998). Fast, global, and entrepreneurial: supply chain management, Hong Kong style-an interview with Victor Fung. *Harvard business review*, *76*, 102-115.

360. Malhotra, M. K., & Sharma, S. (2002). Spanning the continuum between marketing and operations. *Journal of Operations Management*, *20*(3), 209-219.

361. Malhotra, N. K. (2008). Marketing research: An applied orientation, *5/e*. *Pearson Education India.*

362. Malhotra, N. K., & Dash, S. (2010). Marketing Research: An Applied Approach. *Dorling Kindersely*.

363. Malhotra, N.K. and Dash, S. (2009), *Marketing Research: An Applied Orientation*, Pearson Education, New Delhi.

364. Malone, T. W., & Laubacher, R. J. (1999). The dawn of the e-lance economy. In *Electronic Business Engineering* (pp. 13-24). Physica-Verlag HD.

365. Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, *30*(6), 484-497.

366. Mandal, P. C. (2014). Post–service recovery customer satisfaction in Indian retail banking: a qualitative perspective. *International Journal of Financial Services Management*, *8*(1), 1-17.

367. Mandal, P. C., & Bhattacharya, S. (2013a). Post-service recovery customer satisfaction in Indian retail banking: a qualitative approach. *International Journal of Qualitative Research in Services*, *1*(2), 97-112.

368. Mandal, P. C., & Bhattacharya, S. (2013b). Customer satisfaction in Indian retail banking: A grounded theory approach. *The Qualitative Report*, *18*(28), 1-21.

369. Mantrala, M. K., & Raman, K. (1999). Demand uncertainty and supplier's returns policies for a multi-store style-good retailer. *European Journal of Operational Research*, *115*(2), 270-284.

370. Martin, B. R. (2012). The evolution of science policy and innovation studies. *Research Policy*, *41*(7), 1219-1239.

371. Marucheck, A., Pannesi, R., & Anderson, C. (1990). An exploratory study of the manufacturing strategy process in practice. *Journal of Operations Management*, *9*(1), 101-123.

372. Mason-Jones, R., & Towill, D. R. (1997). Information enrichment: designing the supply chain for competitive advantage. *Supply Chain Management: An International Journal*, *2*(4), 137-148.

373. McAdam, R., & McCormack, D. (2001). Integrating business processes for global alignment and supply chain management. *Business Process Management Journal*, *7*(2), 113-130.

374. McGrath, M. E., & Bequillard, R. B. (1989). Integrated manufacturing strategies, managing international manufacturing.

375. McGregor, J. (2006). Flexible Scheduling: Implementing an Innovation. *School Library Media Research*, *9*.

376. McLean, R., & Antony, J. (2014). Why continuous improvement initiatives fail in manufacturing environments? A systematic review of the evidence. *International Journal of Productivity and Performance Management*, *63*(3), 370-376.

377. Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business logistics*, *22*(2), 1-25.

378. Mentzer, J. T., Min, S., & Zacharia, Z. G. (2000). The nature of interfirm partnering in supply chain management. *Journal of Retailing*, *76*(4), 549-568.

379. Metters, R. (1997). Quantifying the bullwhip effect in supply chains. *Journal of Operations Management*, *15*(2), 89-100.

380. Meybodi, M. (2006). Internal manufacturing strategy audit: the first step in integrated strategic benchmarking. *Benchmarking: An International Journal*, *13*(5), 580-595.

381. Meyer, S. M., & Collier, D. A. (2001). An empirical test of the causal relationships in the Baldrige Health Care Pilot Criteria. *Journal of Operations Management*, *19*(4), 403-426.

382. Michel, R. (1995). *Product Innovation Strategy Pure and Simple*, McGraw Hill Inc.

383. Miller, D., & Dröge, C. (1986). Psychological and traditional determinants of structure. *Administrative Science Quarterly*, 539-560.

384. Miller, J. G. (1992). *Benchmarking global manufacturing: Understanding international suppliers, customers, and competitors*. Irwin Professional Pub.

385. Miller, J. G., & Roth, A. V. (1988). *Manufacturing strategies: executive summary of the 1988 North American manufacturing futures survey*. Boston University, School of Management, Manufacturing Roundtable.

386. Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review*, *12*(1), 133-143.

387. Miltenburg, J. (2008). Setting manufacturing strategy for a factory-within-a-factory. *International Journal of Production Economics*, *113*(1), 307-323.

388. Min, S., & Mentzer, J. T. (2004). Developing and measuring supply chain management concepts. *Journal of Business Logistics*, *25*(1), 63-99.

389. Mishra, R., K. Pundir, A., & Ganapathy, L. (2014). Assessment of manufacturing flexibility: A review of research and conceptual framework. *Management Research Review*, *37*(8), 750-776.

390. Mishra, S. and Suar, D. (2010). Does corporate social responsibility influence firm performance of Indian companies?.*Journal of Business Ethics*, *95*(4), 571–601.

391. Modi, S. B., & Mabert, V. A. (2007). Supplier development: Improving supplier performance through knowledge transfer. *Journal of Operations Management*, *25*(1), 42-64.

392. Modi, S. B., & Mabert, V. A. (2010). Exploring the relationship between efficient supply chain management and firm innovation: an archival search and analysis. *Journal of Supply Chain Management*, *46*(4), 81-94.

393. Monczka, R. M., & Morgan, J. (1998). Questions you need to ask about your supply chain. *Purchasing*, *124*(8), 42-47.

394. Monczka, R. M., Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (1998). Success Factors in Strategic Supplier Alliances: The Buying Company Perspective*. *Decision Sciences*, *29*(3), 553-577.

395. Monczka, R. M., Trent, R. J., & Callahan, T. J. (1993). Supply base strategies to maximize supplier performance. *International Journal of Physical Distribution & Logistics Management*, *23*(4), 42-54.

396. Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, *2*(3), 192-222.

397. Morash, E. A., & Clinton, S. R. (1997). The role of transportation capabilities in international supply chain management. *Transportation Journal*, *36*(3), 5-17.

398. Morita, M., & Flynn, E. J. (1997). The linkage among management systems, practices and behaviour in successful manufacturing strategy. *International Journal of Operations & Production Management*, *17*(10), 967-993.

399. Moses, A. (2011). Cross-functional make or buy decision process ownership. *Management Research Review*, *34*(9), 1042-1060.

400. Motwani, J., Youssef, M., Kathawala, Y., & Futch, E. (1999). Supplier selection in developing countries: a model development. *Integrated Manufacturing Systems*, *10*(3), 154-162.

401. Nahm, A. Y. (2000). Exploring the relationship between external environment, internal environment, and manufacturing practices: an industrial/post-industrial perspective.

402. Nandialath, A. M., Mohan, R., & Annavarjula, M. (2014). Endogeneity and dynamics of innovation and firm performance. International Journal of Productivity and Quality Management, *13*(3), 329-348.

403. Narain, R., Yadav, R. C., Sarkis, J., & Cordeiro, J. J. (2000). The strategic implications of flexibility in manufacturing systems. *International Journal of Agile Management Systems*, *2*(3), 202-213.

404. Narasimhan, R., & Das, A. (1999). An empirical investigation of the contribution of strategic sourcing to manufacturing flexibilities and performance*. *Decision sciences*, *30*(3), 683-718.

405. Narasimhan, R., & Jayaram, J. (1998). Causal linkages in supply chain management: an exploratory study of North American manufacturing firms. *Decision Sciences*, *29*(3), 579-605.

406. Narasimhan, R., & Kim, S. W. (2001). Information system utilization strategy for supply chain integration. *Journal of Business Logistics*, *22*(2), 51-75.

407. Narasimhan, R., & Kim, S. W. (2002). Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms. *Journal of Operations Management*, *20*(3), 303-323.

408. Narasimhan, R., Talluri, S., & Das, A. (2004). Exploring flexibility and execution competencies of manufacturing firms. *Journal of Operations Management*, *22*(1), 91-106.

409. National Manufacturing Competitiveness Council (*NMCC*), report (2011).

410. Neely, A., Mills, J., Platts, K., Gregory, M., & Richards, H. (1994). Realizing strategy through measurement. *International Journal of Operations & Production Management*, *14*(3), 140-152.

411. Ngai, E. W. (2005). Customer relationship management research (1992-2002) An academic literature review and classification. *Marketing Intelligence & Planning*, *23*(6), 582-605.

412. Nie, Y., Tan, G. H., Liau, A. K., Lau, S., & Chua, B. L. (2013). The roles of teacher efficacy in instructional innovation: Its predictive relations to constructivist and didactic instruction. *Educational Research for Policy and Practice*, *12*(1), 67-77.

413. Nilsson, C. H., & Nordahl, H. (1995). Making manufacturing flexibility operational-part 1: a framework. *Integrated Manufacturing Systems*, *6*(1), 5-11.

414. Nishat Faisal, M., Banwet, D. K., & Shankar, R. (2006a). Supply chain risk mitigation: modeling the enablers. *Business Process Management Journal*, *12*(4), 535-552.

415. Nishat Faisal, M., Banwet, D. K., & Shankar, R. (2006b). Mapping supply chains on risk and customer sensitivity dimensions. *Industrial Management & Data Systems*, *106*(6), 878-895.

416. Nishat Faisal, M., Banwet, D. K., & Shankar, R. (2007). Information risks management in supply chains: an assessment and mitigation framework. *Journal of Enterprise Information Management*, *20*(6), 677-699.

417. Noble, D. (1997). Purchasing and supplier management as a future competitive edge. *Logistics Focus*, *5(5)*, 23-27.

418. Nord, J. H., & Nord, G. D. (1995). MIS research: journal status assessment and analysis. *Information & Management*, 29(1), 29-42.

419. Novack, R. A., & Simco, S. W. (1991). The industrial procurement process: a supply chain perspective. *Journal of Business Logistics*, *12*(1), 145.

420. Novack, R. A., Langley Jr, C. J., & Rinehart, L. M. (1995). Creating logistics value: themes for the future. Oak Brook, IL: *Council of Logistics Management*.

421. Nunnally, J. (1978). *Psychometric methods*. New York: McGraw-Hill

422. Nunnally, J.C., & Bernstein, I.H. (1994). *Psychometric theory, 3rd ed*. New York: McGraw-Hill.

423. Oke, A. (2005). A framework for analysing manufacturing flexibility. *International Journal of Operations & Production Management*, *25*(10), 973-996.

424. Oke, A. (2013). Linking manufacturing flexibility to innovation performance in manufacturing plants. *International Journal of Production Economics*, *143*(2), 242-247.

425. Oliver, W. (1985). The economic institutions of capitalism. *Journal of Economic*.

426. Osmanagic, N., Prester, J., & Podrug, N. (2005). Manufacturing Strategies and Structures in Croatia. In *Conference Proceedings: International Conference Enterprise in Transition* (pp. 841-853).

427. Oswald, S. L., Mossholder, K. W., & Harris, S. G. (1994). Vision salience and strategic involvement: implications for psychological attachment to organization and job. *Strategic Management Journal*, *15*(6), 477-489.

428. Owens, G., & Richmond, B. (1995). How to reinvent your supply chain: What works, what doesn't. *Chain Store Age*, *71*(11), 96-99.

429. Özekici, S., & Parlar, M. (1999). Inventory models with unreliable suppliersin a random environment. *Annals of Operations Research*, *91*, 123-136.

430. Pandya, K. V., & Anand, H. (2008). Role of innovation in IT in achieving its business objectives: a case study. *International Journal of Business Innovation and Research*, *2*(3), 289-313.

431. Pandya, K. V., Karlsson, A., Sega, S., & Carrie, A. (1997). Towards the manufacturing enterprises of the future. *International Journal of Operations & Production Management*, *17*(5), 502-521.

432. Papke-Shields, K. E., & Malhotra, M. K. (2001). Assessing the impact of the manufacturing executive's role on business performance through strategic alignment. *Journal of Operations Management*, *19*(1), 5-22.

433. Papke-Shields, K. E., Malhotra, M. K., & Grover, V. (2002). Strategic manufacturing planning systems and their linkage to planning system success. *Decision Sciences*, *33*(1), 1-30.

434. Parlar, M., & Perry, D. (1995). Analysis of a (Q, r, T) inventory policy with deterministic and random yields when future supply is uncertain. *European Journal of Operational Research*, *84*(2), 431-443.

435. Parlar, M., Wang, Y., & Gerchak, Y. (1995). A periodic review inventory model with Markovian supply availability. *International Journal of Production Economics*, *42*(2), 131-136.

436. Paswan, A. K., Dant, R. P., & Lumpkin, J. R. (1998). An empirical investigation of the linkages among relationalism, environmental uncertainty, and bureaucratization. *Journal of Business Research*, *43*(3), 125-140.

437. Patel, P. C. (2011). Role of manufacturing flexibility in managing duality of formalization and environmental uncertainty in emerging firms. *Journal of Operations Management*, *29*(1), 143-162.

438. Patton, W. E. (1996). Use of human judgment models in industrial buyers' vendor selection decisions. *Industrial Marketing Management*, *25*(2), 135-149.

439. Paulraj, A., & Chen, I. J. (2007). Environmental uncertainty and strategic supply management: a resource dependence perspective and performance implications. *Journal of Supply Chain Management*, *43*(3), 29-42.

440. Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, *30*(6), 467-480.

441. Peter, J. P. (1981). Construct validity: a review of basic issues and marketing practices. *Journal of Marketing Research*, 133-145.

442. Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, *23*(3), 371-388.

443. Petroni, A., & Braglia, M. (2000). Vendor selection using principal component analysis. *Journal of Supply Chain Management*, *36*(2), 63-69.

444. Pine II, B. J., & Victor, B. (1993). Making mass customization work. *Harvard business review*, *71*(5), 108-117.

445. Platts, K. W., Mills, J. F., Bourne, M. C., Neely, A. D., Richards, A. H., & Gregory, M. J. (1998). Testing manufacturing strategy formulation processes. *International Journal of Production Economics*, 56, 517-523.

446. Podsakoff, P.M., MacKenzie, S.B., Lee, J. and Podsakoff, N.P. (2003). Common method variance in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

447. Popp, D. (2001). Induced innovation and energy prices (No. w8284). *National Bureau of Economic Research.*

448. Porter, M. (1996). America's green strategy. Business and the Environment. *Earthscan, London*, 33-35.

449. Porter, M. E. (1980). Competitive strategy: Techniques for analyzing industries and competition. *New York*, 300.

450. Porter, M. E. (1996). What is strategy?. *Published November*.

451. Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage.

452. Prabhaker, P. (2001). Integrated marketing-manufacturing strategies. *Journal of Business & Industrial Marketing*, *16*(2), 113-128.

453. Prasad, S., & Tata, J. (2000). Information investment in supply chain management. *Logistics Information Management*, *13*(1), 33-38.

454. Punniyamoorty, M., Mathiyalagan, P., & Lakshmi, G. (2012). A combined application of structural equation modeling (SEM) and analytic hierarchy process (AHP) in supplier selection. *Benchmarking: An International Journal*, *19*(1), 70-92.

455. Pyke, D. F., & Cohen, M. A. (1993). Performance characteristics of stochastic integrated production-distribution systems. *European Journal of Operational Research*, *68*(1), 23-48.

456. Pyke, D. F., & Cohen, M. A. (1994). Multiproduct integrated production—distribution systems. *European Journal of Operational Research*, *74*(1), 18-49.

457. Pyke, D. F., & Johnson, M. E. (2004). Sourcing strategy and supplier relationships: alliances versus eProcurement. In *The Practice of Supply Chain Management: Where Theory and Application Converge* (pp. 77-89). Springer US.

458. Qi, L. (2006). The effect of supply uncertainty on supply chain design decisions (Doctoral dissertation, University of Florida).

459. Quinn, F. (2001). Collaboration: more than just technology. *ASCET*, *6*(3), 4-15.

460. Quinn, F. J. (1997). Team up for supply-chain success. *Logistics Management*. 36, 39-41

461. Rahman, S. U. (2001). A comparative study of TQM practice and organisational performance of SMEs with and without ISO 9000 certification. *International Journal of Quality & Reliability Management*, *18*(1), 35-49.

462. Rai, S., & Pedersen, M. K. (2010). Co-creation of IT Innovation, Implications for IT Innovation in India. *Journal of Information Technology Case and Application Research*, *12*(4), 13-36.

463. Rai, S., Chatterjee, S., & Sarker, S. (2011a). ICT Innovation in Contemporary India: Three Emerging Narratives. *ASCI Journal of Management*, *41*(1), 53-64.

464. Rashid, N., Jabar, J., Yahya, S., & Shami, S. (2014). Dynamic Eco Innovation Practices: A Systematic Review of State of the Art and Future Direction for Eco Innovation Study. *Asian Social Science*, *11*(1), 8.

465. Raymond, L., St-Pierre, J., Uwizeyemungu, S., & Le Dinh, T. (2014). Internationalization capabilities of SMEs: A comparative study of the manufacturing and industrial service sectors. *Journal of International Entrepreneurship*, 12(3), 230-253.

466. Roberta Pereira, C., Christopher, M., & Lago Da Silva, A. (2014). Achieving supply chain resilience: the role of procurement. *Supply Chain Management: An International Journal*, *19*(5/6), 626-642.

467. Rebolledo, C., & Jobin, M. H. (2013). Manufacturing and supply alignment: Are different manufacturing strategies linked to different purchasing practices?. *International Journal of Production Economics*, *146*(1), 219-226.

468. Rehfeld, K. M., Rennings, K., & Ziegler, A. (2007). Integrated product policy and environmental product innovations: An empirical analysis. *Ecological Economics*, *61*(1), 91-100.

469. Reitsperger, W. D., & Daniel, S. J. (1990). Dynamic manufacturing: A comparison of attitudes in the USA and Japan. *MIR: Management International Review*, 203-216.

470. Rennings, K. (2000). Redefining innovation—eco-innovation research and the contribution from ecological economics. *Ecological Economics*, *32*(2), 319-332.

471. Rennings, K., & Zwick, T. (2002). Employment impact of cleaner production on the firm level: Empirical evidence from a survey in five European countries. *International Journal of Innovation Management*, *6*(03), 319-342.

472. Rettab, B., Brik, A.B. and Mellahi, K. (2009). A study of management perceptions of the impact of corporate social responsibility on organizational performance in emerging economies: the case of Dubai. *Journal of Business Ethics*, *89*(3), 371-390.

473. Reve, T., & Johansen, E. (1982). Organizational buying in the offshore oil industry. *Industrial Marketing Management*, *11*(4), 275-282.

474. Richardson, P. R., Taylor, A. J., & Gordon, J. R. M. (1985). A strategic approach to evaluating manufacturing performance. *Interfaces*, *15*(6), 15-27.

475. Robert M. (1995). Product Innovation Strategy: Pure and Simple. McGraw Hill Inc.

476. Rogers, P. P., Ojha, D., & White, R. E. (2011). Conceptualising complementarities in manufacturing flexibility: a comprehensive view. *International Journal of Production Research*, *49*(12), 3767-3793.

477. Rondeau, P. J., Vonderembse, M. A., & Ragu-Nathan, T. S. (2000). Exploring work system practices for time-based manufacturers: their impact on competitive capabilities. *Journal of Operations Management*, *18*(5), 509-529.

478. Rosenau M. Jr. (1996). *The PDMA handbook of New Product Development. Choosing a Development process that is right for your company*. NJ: John Wiley and Sons, Inc.

479. Rosenzweig, E. D. (2009). A contingent view of e-collaboration and performance in manufacturing. *Journal of Operations Management*, *27*(6), 462-478.

480. Rosenzweig, E. D., Roth, A. V., & Dean, J. W. (2003). The influence of an integration strategy on competitive capabilities and business performance: an exploratory study of consumer products manufacturers. *Journal of Operations Management*, *21*(4), 437-456.

481. Rudberg, M., & Olhager, J. (2003). Manufacturing networks and supply chains: an operations strategy perspective. *Omega*, *31*(1), 29-39.

482. Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal*, *40*(3), 534-559.

483. Safizadeh, M. H., Ritzman, L. P., Sharma, D., & Wood, C. (1996). An empirical analysis of the product-process matrix. *Management Science*, *42*(11), 1576-1591.

484. Saleh, J. H., Mark, G., & Jordan, N. C. (2009). Flexibility: a multi-disciplinary literature review and a research agenda for designing flexible engineering systems. *Journal of Engineering Design*, *20*(3), 307-323.

485. Salvador, F., Rungtusanatham, M., Forza, C., & Trentin, A. (2007). Mix flexibility and volume flexibility in a build-to-order environment: synergies and trade-offs. *International Journal of Operations & Production Management*, *27*(11), 1173-1191.

486. Sandberg, E., & Abrahamsson, M. (2010). The role of top management in supply chain management practices. *International Journal of Retail & Distribution Management*, *38*(1), 57-69.

487. Santos, F. C. (2000). Integration of human resource management and competitive priorities of manufacturing strategy. *International Journal of Operations & Production Management*, *20*(5), 610-628.

488. Saunders, M. (1994). Strategic purchasing and supply chain management. London: Pitman.

489. Savitskaya, I., & Torkkeli, M. (2011). A framework for comparing regional open innovation systems in Russia. *International Journal of Business Innovation and Research*, *5*(3), 332-346.

490. Saikia, D. (2011). Unorganised Manufacturing Industries in India–A Regional Perspective. *African Journal of Marketing Management , 3*(8): 195-206.

491. Sawhney, R. (2006). Interplay between uncertainty and flexibility across the value-chain: towards a transformation model of manufacturing flexibility. *Journal of Operations Management*, *24*(5), 476-493.

492. Schiederig, T., Tietze, F.,&Herstatt, C. (2012).Green Innovation in Technology and Innovation Management– An Exploratory Literature Review. *R&D Management*, 42(2), 180-192.

493. Schillewaert, N. & Meulemeester, P. (2005). Comparing response distributions of offline and online data collection methods. *International Journal of Market Research, 47*(2), 163-178.

494. Schilling, M. A., & Hill, C. W. (1998). Managing the new product development process: Strategic imperatives. *The Academy of Management Executive*, *12*(3), 67-81.

495. Schrettle, S., Hinz, A., Scherrer-Rathje, M., & Friedli, T. (2014). Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. *International Journal of Production Economics*, *147*, 73-84.

496. Schriesheim, C. A., & Hinkin, T. R. (1990). Influence tactics used by subordinates: A theoretical and empirical analysis and refinement of the Kipnis, Schmidt, and Wilkinson subscales. *Journal of Applied Psychology*, *75*(3), 246.

497. Schroeder, R. G., Anderson, J. C., & Cleveland, G. (1986). The content of manufacturing strategy: an empirical study. *Journal of Operations Management*, *6*(3), 405-415.

498. Schroeder, R. G., Bates, K. A., & Junttila, M. A. (2002). A resource-based view of manufacturing strategy and the relationship to manufacturing performance. *Strategic Management Journal*, *23*(2), 105-117.

499. Schroeder, R. G., Bates, K. A., & Junttila, M. A. (2002). A resource-based view of manufacturing strategy and the relationship to manufacturing performance. *Strategic Management Journal*, *23*(2), 105-117.

500. Schroeder, R. G., Scudder, G. D., & Elm, D. R. (1989). Innovation in manufacturing. *Journal of Operations Management*, *8*(1), 1-15.

501. Schurr, P. H. (2007). Buyer-seller relationship development episodes: theories and methods. *Journal of Business & Industrial Marketing*, *22*(3), 161-170.

502. Schurr, P. H., & Ozanne, J. L. (1985). Influences on exchange processes: Buyers' preconceptions of a seller's trustworthiness and bargaining toughness. *Journal of Consumer Research*, 939-953.

503. Schwab, D. P. (1980). Construct validity in organizational behavior. *Research in Organizational Behavior*, *2*(1), 3-43.

504. Segars, A. H., & Grover, V. (1993). Re-examining perceived ease of use and usefulness: A confirmatory factor analysis. *MIS quarterly*, 517-525.

505. Şener, S., & Sarıdoğan, E. (2011). The effects of science-technology-innovation on competitiveness and economic growth. *Procedia-Social and Behavioral Sciences*, *24*, 815-828.

506. Serel, D. A. (2007). Capacity reservation under supply uncertainty. *Computers & Operations Research*, *34*(4), 1192-1220.

507. Sethi, A. K., & Sethi, S. P. (1990). Flexibility in manufacturing: a survey. *International Journal of Flexible Manufacturing Systems*, *2*(4), 289-328.

508. Sethi, V., & King, W. R. (1994). Development of measures to assess the extent to which an information technology application provides competitive advantage. *Management Science*, *40*(12), 1601-1627.

509. Sethuraman, R., Kerin, S.R & Cron, W.L. (2005). A field study comparing online and offline data collection methods for identifying product attribute preferences using conjoint analysis. *Journal of Business Research, 58*(5), 602-610.

510. Sezen, B., & Çankaya, S. Y. (2013).Effects of Green Manufacturing and Eco-Innovation on Sustainability Performance. *Procedia-Social and Behavioural Sciences*, *99*, 154-163.

511. Shah, R., & Goldstein, S. M. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management*, *24*(2), 148-169.

512. Shah, R., & Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management*, *21*(2), 129-149.

513. Sharma, M., & Kodali, R. (2008). Validity and reliability of applying manufacturing excellence frameworks to Indian industries. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, *222*(6), 723-739.

514. Sharma, R. K., Kumar, D., & Kumar, P. (2005). FLM to select suitable maintenance strategy in process industries using MISO model. *Journal of Quality in Maintenance Engineering*, *11*(4), 359-374.

515. Sharma, R. K., Kumar, D., & Kumar, P. (2006). Manufacturing excellence through TPM implementation: a practical analysis. *Industrial Management & Data Systems*, *106*(2), 256-280.

516. Sharma, R. K., Kumar, D., & Kumar, P. (2008). Predicting uncertain behavior of industrial system using FM—A practical case. *Applied Soft Computing*, *8*(1), 96-109.

517. Shin, H., Collier, D. A., & Wilson, D. D. (2000). Supply management orientation and supplier/buyer performance. *Journal of Operations Management*, *18*(3), 317-333.

518. Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *The International Journal of Logistics Management*, *13*(1), 15-30.

519. Simatupang, T. M., Wright, A. C., & Sridharan, R. (2002). The knowledge of coordination for supply chain integration. *Business Process Management Journal*, *8*(3), 289-308.

520. Simchi-Levi, D., & Zhao, Y. (2003). The value of information sharing in a two-stage supply chain with production capacity constraints. *Naval Research Logistics (NRL)*, *50*(8), 888-916.

521. Singh, R. K., Garg, S. K., & Deshmukh, S. G. (2008). Strategy development by SMEs for competitiveness: a review. *Benchmarking: An International Journal*, *15*(5), 525-547.

522. Skinner, W. (1969). Manufacturing-missing link in corporate strategy. *Harvard Business Review*, *47*(3), 136-145.

523. Skinner, W. (1978). *Manufacturing in the corporate strategy*. John Wiley & Sons.

524. Skinner, W. (1996). Manufacturing strategy on the "S" curve. *Production and Operations Management*, *5*(1), 3-14.

525. Skipper, J. B., & Hanna, J. B. (2009). Minimizing supply chain disruption risk through enhanced flexibility. *International Journal of Physical Distribution & Logistics Management*, *39*(5), 404-427.

526. Slack, N. (1983). Flexibility as a manufacturing objective. *International Journal of Operations & Production Management*, *3*(3), 4-13.

527. Slack, N. (1987). The flexibility of manufacturing systems. *International Journal of Operations & Production Management*, *7*(4), 35-45.

528. Slack, N. (2005). The Flexibility of Manufacturing Systems. *International Journal of Operations & Production Management, 25*(12), 1190–1200.

529. Sodhi, M. S., & Tang, C. S. (2009). Modeling supply-chain planning under demand uncertainty using stochastic programming: A survey motivated by asset–liability management. *International Journal of Production Economics*, *121*(2), 728-738.

530. Soley, M., & Pandya, K. V. (2003). Culture as an issue in knowledge sharing: A means of competitive advantage. *Electronic Journal of Knowledge Management*, *1*(2), 205-212.

531. Sonia, M.S.O. & Francisca, R.A.V. (2005). SMEs internationalization: firms and managerial factors. *International Journal of Entrepreneurial Behaviour and Research*, *11*(4), 258-79.

532. Spector, P. E. (1992). Summated rating scale construction: an introduction (No. 82). *Sage*.

533. Spector, P.E. (1987). Method variance as an artifact in self-reported affect and perceptions at work: myth or significant problem?. *Journal of Applied Psychology*, 72(3), 438-443.

534. Spekman, R. E., Kamauff Jr, J. W., & Myhr, N. (1998). An empirical investigation into supply chain management: a perspective on partnerships. *International Journal of Physical Distribution & Logistics Management*, *28*(8), 630-650.

535. Spekman, R. E., Kamauff Jr, J. W., & Myhr, N. (1998). An empirical investigation into supply chain management: a perspective on partnerships. *International Journal of Physical Distribution & Logistics Management*, *28*(8), 630-650.

536. Spekman, R., Salmond, D., & Kamauff, J. (1994). At last procurement becomes strategic. *Long-Range Planning*, *27*(2), 76-84.

537. Sprow, E.E. (1992). Concurrent Engineering Challenge, Manufacturing Engineering, 35- 7.

538. Stalk Jr, G., & Hout, T. M. (1990). Competing against time. *Research Technology Management*, *33*(2), 19.

539. Stalk, G., Evans, P., & Sgulman, L. E. (1992). Competing on capabilities: the new rules of corporate strategy (Vol. 63). *Harvard Business Review*, 70(2), 54-65.

540. Stein, T., & Sweat, J. (1998). Killer supply chains. *Information Week*, *708*(9), 36-46.

541. Stem, L .W. and El-Ansary, A. I. (1982), *Marketing Channels. Englewood Cliffs.* NJ: Prentice Hall.

542. Stephens, G.K. & Greer, C.R. (1995). Doing business in Mexico: understanding cultural differences. *Organisational Dynamics*, *24*(1), 39-54.

543. Stern, L. W., & Reve, T. (1980). Distribution channels as political economies: A framework for comparative analysis. *The Journal of Marketing*,44, 52-64.

544. Stevens, G. C. (1989). Integrating the supply chain. *International Journal of Physical Distribution & Materials Management*, *19*(8), 3-8.

545. Stevens, G. C. (1990). Successful supply-chain management. *Management Decision*, *28*(8), 25-28.

546. Stock, J. R., & Lambert, D. M. (2001). *Strategic logistics management (Vol. 4)*. Boston, MA: McGraw-Hill/Irwin.

547. Stonebraker, P. W., & Liao, J. (2006). Supply chain integration: exploring product and environmental contingencies. *Supply Chain Management: An International Journal*, *11*(1), 34-43.

548. Stuart, F. I. (1997). Supply-chain strategy: organizational influence through supplier alliances. *British Journal of Management*, *8*(3), 223-236.

549. Suarez, F. F., Cusumano, M. A., & Fine, C. H. (1995). An empirical study of flexibility in manufacturing. *MIT Sloan Management Review*, *37*(1), 25-32.

550. Suárez-Ortega, S. M., & Alamo-Vera, F. R. (2005). SMES'internationalization: firms and managerial factors. *International Journal of Entrepreneurial Behavior & Research*, *11*(4), 258-279.

551. Subramanian, R., Toney, J. H., & Jayachandran, C. (2010). The evolution of research and development in the pharmaceutical industry: toward the open innovation model–can pharma reinvent itself?. *International Journal of Business Innovation and Research*, *5*(1), 63-74.

552. Sun, H., & Hong, C. (2002). The alignment between manufacturing and business strategies: its influence on business performance. *Technovation*, *22*(11), 699-705.

553. Sun, S. Y., Hsu, M. H., & Hwang, W. J. (2009). The impact of alignment between supply chain strategy and environmental uncertainty on SCM performance. *Supply Chain Management: An International Journal*, *14*(3), 201-212.

554. Swamidass, P. M. (1986). Manufacturing strategy: its assessment and practice. *Journal of Operations Management*, *6*(3), 471-484.

555. Swamidass, P. M., & Newell, W. T. (1987). Manufacturing strategy, environmental uncertainty and performance: a path analytic model. *Management science*, *33*(4), 509-524.

556. Sweeney, M. T. (1994). Benchmarking for strategic manufacturing management. *International Journal of Operations & Production Management*, *14*(9), 4-15.

557. Swink, M., & Way, M. H. (1995). Manufacturing strategy: propositions, current research, renewed directions. *International Journal of Operations & Production Management*, *15*(7), 4-26.

558. Swink, M., Narasimhan, R., & Wang, C. (2007). Managing beyond the factory walls: effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management*, *25*(1), 148-164.

559. Tabachnick, B.G. & Fidell, L.S. (2001). *Using Multivariate Statistics, 4th ed., Allyn & Bacon*, New York.

560. Tahriri, F., Osman, M. R., Ali, A., & Yusuff, R. M. (2008). A review of supplier selection methods in manufacturing industries. *Suranaree Journal of Science and Technology*, *15*(3), 201-208.

561. Takala, J., Bhufhai, A., & Phusavat, K. (2006). Proposed verification method for the content suitability of the customer satisfaction survey. *Industrial Management & Data Systems*, *106*(6), 841-854.

562. Takala, J., Hirvelä, J., Liu, Y., & Malindzák, D. (2007). Global manufacturing strategies require "dynamic engineers"? Case study in Finnish industries. *Industrial Management & Data Systems*, *107*(3), 326-344.

563. Talib, F., Rahman, Z., & Qureshi, M. N. (2011). A study of total quality management and supply chain management practices. *International Journal of Productivity and Performance Management*, *60*(3), 268-288.

564. Talwar, B. (2008). Corporate Competitiveness and Sustainable Growth: Exploring Vedic Philosophy as a Guiding Force. *International Journal of Global Business and Competitiveness*, *3*(1), 9-18.

565. Talwar, B. (2011a). Comparative study of framework, criteria and criterion weighting of excellence models. *Measuring Business Excellence*, *15*(1), 49-65.

566. Talwar, B. (2011b). Business excellence models and the path ahead. *The TQM Journal*, *23*(1), 21-35.

567. Tan, B. (2004). Subcontracting with availability guarantees: production control and capacity decisions. *IIE Transactions*, *36*(8), 711-724.

568. Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing & Supply Management*, *7*(1), 39-48.

569. Tan, K. C., Kannan, V. R., & Handfield, R. B. (1998). Supply chain management: supplier performance and firm performance. *Journal of Supply Chain Management*, *34*(3), 2.

570. Tan, K. C., Kannan, V. R., Handfield, R. B., & Ghosh, S. (1999). Supply chain management: an empirical study of its impact on performance. *International Journal of Operations & Production Management*, *19*(10), 1034-1052.

571. Taps, S. B., & Steger-Jensen, K. (2007). Aligning supply chain design with manufacturing strategies in developing regions. *Production Planning and Control*, *18*(6), 475-486.

572. Tattum, L. (1999). Staying at the cutting edge of supply chain practice. *Chemical Week*, *161*(11), 10-12.

573. Tefertiller, K. R., & Ward, R. W. (1995). Revealed comparative production advantage: Implications for competitiveness in Florida's vegetable industry. *Agribusiness*, *11*(2), 105-115.

574. Terziovski, M., & Samson, D. (2000). The effect of company size on the relationship between TQM strategy and organisational performance. *The TQM magazine*, *12*(2), 144-149.

575. Terziovski, M., & Sohal, A. S. (2000). The adoption of continuous improvement and innovation strategies in Australian manufacturing firms. *Technovation*, *20*(10), 539-550.

576. Theodorakopoulos, N., McGowan, C., Bennett, D., Kakabadse, N., & Figueira, C. (2014). Diversifying into technical clothing manufacture as entrepreneurial learning: A situated learning theory perspective. *Journal of manufacturing technology management*, *25*(5), 676-693.

577. Theodorakopoulos, N., Ram, M., & Beckinsale, M. (2013). Developing large procurers and ethnic minority business owners for supplier diversity. *International Journal of Human Resource Management*, *24*(12), 2321-2338.

578. Theodorakopoulos, N., Ram, M., Worthington, I., Shah, M., & Boyal, H. (2005). Supply chain learning: experimenting with supplier diversity. *International Journal of Entrepreneurship and Management*, *1*(4), 461-478.

579. Theodorou, P., & Florou, G. (2008). Manufacturing strategies and financial performance—The effect of advanced information technology: CAD/CAM systems. *Omega*, *36*(1), 107-121.

580. Thomas, D. J., & Griffin, P. M. (1996). Coordinated supply chain management. *European Journal Of Operational Research*, *94*(1), 1-15.

581. Thorgren, S., Wincent, J., & Boter, H. (2012). Small firms in multipartner R&D alliances: Gaining benefits by acquiescing. *Journal of Engineering and Technology Management*, *29*(4), 453-467.

582. Thun, J. H. (2008). Empirical analysis of manufacturing strategy implementation. *International Journal of Production Economics*, *113*(1), 370-382.

583. Timmerman, E. (1986). An approach to supplier performance evaluation. *Journal Supply Chain Management*, 22(4), 2–8.

584. Tompkins, J. A., Knill, B., & Andel, T. (1998). Time to rise above supply chain management. *Transportation and Distribution*, *39*(10).

585. Towill, D. R. (1996). Time compression and supply chain management-a guided tour. *Supply Chain Management: An International Journal*, *1*(1), 15-27.

586. Towill, D. R. (1997). The seamless supply chain-the predator's strategic advantage. *International Journal of Technology Management*, *13*(1), 37-56.

587. Towill, D. R., Childerhouse, P., & Disney, S. M. (2000). Speeding up the progress curve towards effective supply chain management. *Supply Chain Management. An International Journal*, *5*(3), 122-130.

588. Towill, D., & Christopher, M. (2002). The supply chain strategy conundrum: to be lean or agile or to be lean and agile?. *International Journal of Logistics*, *5*(3), 299-309.

589. Tripathi, S. S., Guin, K. K., & De Sadhan, K. (2013). Product and service innovations in large organizations operating in India: A systems approach. *IUP Journal of Business Strategy*, *10*(3), 32.

590. Trivedi, P., Lakshmanan, L., Jain, R. & Gupta Y.K. (2011). Productivity, efficiency and competitiveness of the Indian manufacturing sector, available at: http://www.rbi.org.in/scripts/PublicationsView.aspx?id=13366#EXe (accessed 14 Sept. 2012).

591. Tsireme, A. I., Nikolaou, E. I., Georgantzis, N., & Tsagarakis, K. P. (2012). The influence of environmental policy on the decisions of managers to adopt G-SCM practices. *Clean Technologies and Environmental Policy*, *14*(5), 953-964.

592. Tu, Q., Vonderembse, M. A., Ragu-Nathan, T. S., & Ragu-Nathan, B. (2004). Measuring modularity-based manufacturing practices and their impact on mass customization capability: a customer-driven perspective. *Decision Sciences*, *35*(2), 147-168.

593. Tunälv, C. (1990). Manufacturing strategies and decentralisation. *International Journal of Operations & Production Management*, *10*(2), 107-119.

594. Turner, J. R. (1993). Integrated supply chain management-whats wrong with this picture. *Industrial Engineering*, *25*(12), 52-55.

595. Tzafestas, S. & Kapsiotis, G. (1994). Coordinated control of manufacturing/supply chains using multi-level techniques. *Computer Integrated Manufacturing Systems*, 7 (3), 206-12.

596. Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega*, *3*(6), 639-656.

597. Van der Vaart, J. T., De Vries, J., & Wijngaard, J. (1996). Complexity and uncertainty of materials procurement in assembly situations. *International Journal of Production Economics*, *46*, 137-152.

598. Van Hoek, R. I. (1998). Measuring the unmeasurable-measuring and improving performance in the supply chain. *Supply Chain Management: An International Journal*, *3*(4), 187-192.

599. Van Hoek, R. I. (1999). Postponement and the reconfiguration challenge for food supply chains. *Supply Chain Management: An International Journal*, *4*(1), 18-34.

600. Van Hoek, R. I. (2001). The rediscovery of postponement a literature review and directions for research. *Journal of Operations Management*, *19*(2), 161-184.

601. Van Hop*, N., & Ruengsak, K. (2005). Fuzzy estimation for manufacturing flexibility. *International Journal of Production Research*, *43*(17), 3605-3617.

602. Vastag, G., Kasarda, J. D., & Boone, T. (1994). Logistical support for manufacturing agility in global markets. *International Journal of Operations & Production Management*, *14*(11), 73-85.

603. Verwijmeren, M., van der Vlist, P., & van Donselaar, K. (1996). Networked inventory management information systems: materializing supply chain management. *International Journal of Physical Distribution & Logistics Management*, *26*(6), 16-31.

604. Vickery, S., Dröge, C., & Germain, R. (1999). The relationship between product customization and organizational structure. *Journal of Operations Management*, *17*(4), 377-391.

605. Vokurka, R. J., & Fliedner, G. (1998). The journey toward agility. *Industrial Management & Data Systems*, *98*(4), 165-171.

606. Vokurka, R. J., & Lummus, R. R. (2000). The role of just-in-time in supply chain management. *The International Journal of Logistics Management*, *11*(1), 89-98.

607. Vokurka, R. J., & O'Leary-Kelly, S. W. (2000). A review of empirical research on manufacturing flexibility. *Journal of Operations Management*, *18*(4), 485-501.

608. Von Hippel, E. (2007). Horizontal innovation networks—by and for users. *Industrial and Corporate Change*, *16*(2), 293-315.

609. Vonderembse, M. A., & Tracey, M. (1999). The impact of supplier selection criteria and supplier involvement on manufacturing performance. *Journal of supply chain management*, *35*(3), 33.

610. Wadhwa*, S., Rao, K. S., & Chan, F. T. S. (2005). Flexibility-enabled lead-time reduction in flexible systems. *International Journal of Production Research*, *43*(15), 3131-3162.

611. Waller, M. A., Dabholkar, P. A., & Gentry, J. J. (2000). Postponement, product customization, and market-oriented supply chain management. *Journal of Business Logistics*, *21*(2), 133-160.

612. Walton, L. W. (1996). Partnership satisfaction: using the underlying dimensions of supply chain partnership to measure current and expected levels of satisfaction. *Journal of Business Logistics*, *17*(2), 57.

613. Walton, S. V., & Gupta, J. N. (1999). Electronic data interchange for process change in an integrated supply chain. *International Journal of Operations & Production Management*, *19*(4), 372-388.

614. Ward, P. T., & Duray, R. (2000). Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy. *Journal of Operations Management*, *18*(2), 123-138.

615. Ward, P. T., Leong, G. K., & Boyer, K. K. (1994). Manufacturing Proactiveness and Performance*. *Decision Sciences*, *25*(3), 337-358.

616. Weber, C. A., Current, J. R., & Benton, W. C. (1991). Vendor selection criteria and methods. *European Journal of Operational Research*, *50*(1), 2-18.

617. Wheel Wright, S. C. (1984). Manufacturing strategy: defining the missing link. *Strategic Management Journal*, *5*(1), 77-91.

618. Wheelwright, S. C. (1978). Reflecting corporate strategy in manufacturing decisions. *Business Horizons*, *21*(1), 57-66.

619. White, G. P. (1996). A survey and taxonomy of strategy-related performance measures for manufacturing. *International Journal of Operations & Production Management*, *16*(3), 42-61.

620. Whybark, D. C., & Williams, J. G. (1976). Material requirements planning under uncertainty. *Decision sciences*, *7*(4), 595-606.

621. Williams, F. P., D'Souza, D. E., Rosenfeldt, M. E., & Kassaee, M. (1995). Manufacturing strategy, business strategy and firm performance in a mature industry. *Journal of Operations Management*, *13*(1), 19-33.

622. Williamson, O. (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: The Free Press.

623. Wines, L. (1996). High Order Strategy for Manufacturing. *The Journal of Business Strategy*, *17*(4), 32-33.

624. Wagner, S. M., & Bode, C. (2006). An empirical investigation into supply chain vulnerability. *Journal of Purchasing and Supply Management*, *12*(6), 301-312.

625. Won Lee, C., Kwon, I. W. G., & Severance, D. (2007). Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply Chain Management: An International Journal*, *12*(6), 444-452.

626. Wong, C. Y., Boon-Itt, S., & Wong, C. W. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, *29*(6), 604-615.

627. Wood, A. (1997). Estending the supply chain: strengthening links with it. *Chemical Week*, *159*(25), 25-26.

628. Wood, C. H., Ritzman, L. P., & Sharma, D. (1990). Intended and achieved competitive advantage: measures, frequencies, and financial impact. *Manufacturing Strategy: The Research Agenda for the Next Decade, Kluwer, Boston, MA*.

629. Wook Kim, S. (2006). Effects of supply chain management practices, integration and competition capability on performance. *Supply Chain Management: An International Journal*, *11*(3), 241-248.

630. Xiao, T., & Yang, D. (2008). Price and service competition of supply chains with risk-averse retailers under demand uncertainty. *International Journal of Production Economics*, *114*(1), 187-200.

631. Xu, C., & Xiang-Yang, L. (2007). Multiphase supplier selection model based on supplier development orientation. In *Management Science and Engineering, 2007. ICMSE 2007. International Conference on* (pp. 826-831). IEEE.

632. Yusup, M. Z., Mahmood, W. H. W., Salleh, M. R., & Yusof, A. S. M. (2015). Review the influence of lean tools and its performance against the index of manufacturing sustainability. *International Journal of Agile Systems and Management*, *8*(2), 116-131.

633. Yam, R. C., Lo, W., Tang, E. P., & Lau, A. K. (2011). Analysis of sources of innovation, technological innovation capabilities, and performance: An empirical study of Hong Kong manufacturing industries. *Research Policy*, *40*(3), 391-402.

634. Yang, B., & Burns, N. (2003). Implications of postponement for the supply chain. *International Journal of Production Research*, *41*(9), 2075-2090.

635. Yeung, A. H., Lo, V. H., Yeung, A. C., & Cheng, T. C. (2008). Specific customer knowledge and operational performance in apparel manufacturing. *International Journal of Production Economics*, *114*(2), 520-533.

636. Yew Wong, C., Stentoft Arlbjørn, J., & Johansen, J. (2005). Supply chain management practices in toy supply chains. *Supply Chain Management: An International Journal*, *10*(5), 367-378.

637. Yin, R. (1994). Case study research: Design and methods. *Beverly Hills*.

638. Yu, Z., Yan, H., & Edwin Cheng, T. C. (2001). Benefits of information sharing with supply chain partnerships. *Industrial management & Data systems*, *101*(3), 114-121.

639. Zacharia, Z. G., Nix, N. W., & Lusch, R. F. (2009). An analysis of supply chain collaborations and their effect on performance outcomes. *Journal of Business Logistics*, *30*(2), 101-123.

640. Zeydan, M., Çolpan, C., & Çobanoğlu, C. (2011). A combined methodology for supplier selection and performance evaluation. *Expert Systems with Applications*, *38*(3), 2741-2751.

641. Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2003). Manufacturing flexibility: defining and analyzing relationships among competence, capability, and customer satisfaction. *Journal of Operations Management*, *21*(2), 173-191.

642. Zhang, Q., Vonderembse, M. A., & Lim, J. S. (2006). Spanning flexibility: supply chain information dissemination drives strategy development and customer satisfaction. *Supply Chain Management: An International Journal*, *11*(5), 390-399.

643. Zhao, K., & Yu, X. (2011). A case based reasoning approach on supplier selection in petroleum enterprises. *Expert Systems with Applications*, *38*(6), 6839-6847.

644. Zhou, H., & Benton, W. C. (2007). Supply chain practice and information sharing. *Journal of Operations Management*, *25*(6), 1348-1365.

645. Zielke, A., & Pohl, M. (1996). Virtual vertical integration: the key to success. *The Mckinsey Quarterly*, (3), 160.

646. Zikmund, W. (2000). *Business research methods*, 6th ed. The Dryden Press, Fort Worth.

647. Zouggari, A., & Benyoucef, L. (2012). Simulation based fuzzy TOPSIS approach for group multi-criteria supplier selection problem. *Engineering Applications of Artificial Intelligence*, *25*(3), 507-519.

648. Zhen, L. (2012). An analytical study on service-oriented manufacturing strategies. *International Journal of Production Economics*, *139*(1), 220-228.

649. Zuckerman, G. (2005). Cash-rich firms feel pressure to spend. *Wall Street Journal (Eastern edition) July 11*, 2005, C.1.

650. Zwass, V. (1996). Electronic commerce: structures and issues. *International Journal of Electronic Commerce*, 3-23.

List of Publications

Publications in Journal

1. Dewangan D. K., Agrawal R., & Sharma, V. (2015a). Enablers for Competitiveness of Indian Manufacturing Sector: An ISM-Fuzzy MICMAC Analysis. *Procedia- Social and Behavioral Sciences, Volume 189, Pages 416-432 (15 May 2015),* **Operation Management in Digital Economy, Elsevier.**
2. Dewangan, D. K., Agrawal, R., & Sharma, V. (2015b). Supplier selection for competitive advantage in supply chain: an integrated fuzzy analytic hierarchy process using simulation approach. International Journal of Automation and Logistics, Special Issue on: *Supply Chain Sustainability and Mitigating Risks*,1(4), 370-399.
3. Dewangan D. K., Agrawal R., Sharma V., (2015c). Enablers of Eco-Innovation to Enhance the Competitiveness of Indian Manufacturing Sector: An Integrated ISM-Fuzzy MICMAC Approach. *International Journal of Business Innovation and Research*, **Inderscience** (accepted).
4. Dewangan D. K., Agrawal R., Sharma V., (2014). Enablers for Competitiveness of Indian Manufacturing Sector: Modeling through integrated ISM-fuzzy MICMAC Approach. *Technological Forecasting and Social Change*, **Elsevier** (under review).

Published in Edited Book

5. Dewangan D. K., Agrawal R., Sharma V., (2015d). An approach of Modeling for Humanitarian Supplies. Edited Book on *Managing Humanitarian Logistics, Springer Proceedings in Business and Economics*, to be published by **Springer Publications**. (DOI 10.1007/978-81-322-2416-7_11).

Refereed Conference Proceedings

6. Dewangan D. K., Agrawal R., Sharma V., (2014). Enablers for Competitiveness of Indian Manufacturing Sector: An ISM-Fuzzy MICMAC Analysis. Paper presented at the Proceedings of the *XVIII Annual International Conference of the Society of Operations Management (SOM-2014)*, December 12-14, 2014, at DOMS, **IIT Rookee**, India.
7. Dewangan D. K., Agrawal R., Sharma V., (2014). Evaluation and Selection of Vendor Using an Analytical Hierarchy Process (AHP) in Supply Chain Management. Paper presented at the Proceedings of the *International Conference on Research and Sustainable Business" (ICRSB-2014),* March 8-9, 2014, at DOMS, **IIT Rookee**, India.
8. Dewangan D. K., Agrawal R., Sharma V., (2013). An approach of Modeling for Humanitarian Supplies. Paper presented at the International Conference on *Humanitarian Logistics (ICHL-2013)*, September 22-23, 2013 at **IIM Raipur**, India.

Appendix-1

Department of Management Studies
Indian Institute of Technology Roorkee, Roorkee
Phone: Tel: 01332-285014, 285617 Fax: 01332-285565

Letter from Supervisor,

January 01, 2014

Dear Participants,

I wish to introduce ***Mr. Devendra Kumar Dewangan*** . He is a research scholar in the Department of Management Studies and is enrolled for Ph.D. at the Indian Institute of Technology Roorkee (IITR), Uttarakhand, India. His doctoral thesis is a study on "*Enhancing the Competitiveness of Manufacturing Sector Through Supply Chains in India*". This is a very important topic in the current era to enhance the competitiveness of the manufacturing sector in India. Manufacturing is the main engine of economic growth and wealth creator for a country; it creates a sustainable economy, encourages investments, creates jobs and build the nation. With the changing landscape of manufacturing dominance, shift of markets from the west to the east and the ability of the manufacturer to be located in any part of the world has made the competition among nations to create and maintain their manufacturing sector very competitive. The business environment is continuously changing due to increasing global inter-connectivity, growing demand for innovation, technology, new product development, rapidly dropping cost of key technologies, shifting basis of competition and unemployment. This survey gives a stunning performance of the Indian manufacturing sector to sustain in the global market. The research for the thesis is based primarily on survey data. It is critically important that he obtain your cooperation if he is to get a good result. I am very much aware of how little time that someone with your responsibilities has. Nevertheless, by finding the time to complete this questionnaire you will enable us to gain a much better understanding of the reasons for the success of Indian manufacturing companies. Let me further ensure you that the survey results will remain strictly confidential. We will only be presenting the aggregate results for all the companies participating in the survey. I would like to repeat how grateful I would be if you could assist **Mr. Devendra Kumar Dewangan**.

Thanking you in anticipation,
Yours Sincerely,
Dr. Rajat Agrawal
Assistant Professor

Appendix-2

Department of Management Studies
Indian Institute of Technology Roorkee, Roorkee
Phone: Tel: 01332-285014, 285617 Fax: 01332-285565

First Cover Letter,
January 01, 2014

Subject: Enhancing the Competitiveness of Manufacturing Sector Through Supply Chains in India

Dear [Name and Title]:
[Address]

I am a research scholar in the Department of Management Studies, Indian Institute of Technology, Roorkee (IITR), Uttarakhand, India working on my Ph.D. thesis under the supervision of Dr. Rajat Agrawal, Assistant Professor in the same department. I am writing to ask for your cooperation in participating in my research work. I would appreciate it if you could take some time to complete the attached questionnaire and **return the same within three weeks**.

My research work is on enhancing the competitiveness in select India manufacturing companies. The purpose of this study is to evaluate the impact of supply chain performance on the manufacturing competitiveness in Indian companies. It will evaluate the company manufacturing competitiveness on the basis of the various parameters presented in the attached questionnaire. Finally, a scale will be developed for the measurement of manufacturing competitiveness for the Indian manufacturing companies which could be helpful in the measurement of the company's manufacturing competitiveness.

You have been identified as one of the respondents in your company who will be able to provide the necessary data/information for this study. I would also like to ensure that your response would be kept strictly confidential. Information from this survey will be generalized and participating companies will not be identified. The questionnaire takes 20-30 minutes to complete.

Please, indicate your decision by placing a "tick" or "cross" in the appropriate number/space against each question/item.

If you have any enquiries or questions about this research, please feel free to contact me at +91-7669735848 or at my e-mail ID (deva.iitr@gmail.com). My department fax number is +91-1332-285565, 273560. I hope that you will assist in adding to the body of knowledge regarding the manufacturing competitiveness of the Indian manufacturing companies. Thank you very much for your valuable time.

Yours Faithfully,
Devendra Kumar Dewangan
Research Scholar
Indian Institute of Technology Roorkee (IITR)
Roorkee, District Haridwar, Uttarakhand, India-247667

Department of Management Studies
Indian Institute of Technology Roorkee, Roorkee
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Appendix-3

First Reminder Letter (Follow-up Letter)

Monday, 3 February, 2014

Subject: Enhancing the Competitiveness of Manufacturing Sector Through Supply Chains in India

Dear [Name and Title]:
[Address]

I am a research scholar in the Department of Management Studies, Indian Institute of Technology, Roorkee (IITR), Uttarakhand, India. I am writing to ask you to assist me in my research. Three weeks ago I sent you a questionnaire asking you the questions on manufacturing competitiveness in your company.

I would be very grateful if you could take some time to complete the attached questionnaire and **return it to me within a week. If you have already returned your questionnaire, please ignore this letter.**

Thank you very much for your valuable time and cooperation.

Yours Faithfully,
Devendra Kumar Dewangan
Research Scholar
Indian Institute of Technology Roorkee (IITR)
Roorkee-247667
District Haridwar, Uttarakhand, India

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Appendix-4

Second Reminder Letter (Follow-up Letter)

Friday, 14 March, 2014

Subject: Enhancing the Competitiveness of Manufacturing Sector Through Supply Chains in India

Dear [Name and Title]:
[Address]

I am a research scholar in the Department of Management Studies, Indian Institute of Technology, Roorkee (IITR), Uttarakhand, India. I am writing to ask you to assist me in my research. Last month I sent you a questionnaire asking you the questions on manufacturing competitiveness in your company.

I would be very grateful if you could take some time to complete the attached questionnaire and **return it to me within a week. If you have already returned your questionnaire, please ignore this letter.**

Thank you very much for your valuable time and cooperation.

Yours Faithfully,
Devendra Kumar Dewangan
Research Scholar
Indian Institute of Technology Roorkee (IITR)
Roorkee-247667
District Haridwar, Uttarakhand, India

Appendix-5

Introduction

This questionnaire is a part of a study of supply chain performance and its impact of manufacturing competitiveness in Indian manufacturing companies. The study address factors and items which need to assess for the measurement of manufacturing competitiveness of the company which may be part of your work and many other processes of implementing and improving manufacturing competitiveness, therefore your responses are very important.

Purpose

The main objective of this study of supply chain performance and its impact of manufacturing competitiveness in Indian manufacturing companies. All responses given will be treated with the utmost confidence. The results of the present study will be used for research purposes only and no attempts will be made to identify any individual or company in any publication. Please do not place your name on any part of this questionnaire.

About Questionnaire

The present questionnaire is divided into three (03) sections. Each section is supposed to collect particular information. Section –I consist of questions related to a brief profile of the respondents and the firm he/she is working in. Section –II comprise of questions related to the supply chain performance and manufacturing competitiveness.

Instructions

1. Please read each item carefully before answering them.

2. Indicate your decision by placing a tick ("√") or cross ("×") in the box to the right of the items.

3. Make sure to complete **ALL** items.

4. Please answer the items which suit your company. If you are not sure, please answer to the best of your ability.

5. Please, return the completely filled questionnaire within **three** weeks from the date of receipt of this questionnaire on the following e-mail ID: deva.iitr@gmail.com.

Section-I Demographic Information of the respondent and the company

Please provide the following information:

1. Position or Job title

   i) CEO/President ☐
   ii) Vice President or Director ☐
   iii) Operation Managers ☐
   iv) Supply Chain Managers ☐
   v) Purchasing Managers ☐

2. Gender

   i) Male ☐ ii) Female ☐

3. Job Experience of Respondents

   i) 1-4 Years ☐
   ii) 5-10 Years ☐
   iii) More than 10 Years ☐

4. Category of Company

   i) Automobiles & Auto ancillaries Industry ☐
   ii) Cement Industry ☐
   iii) Food and Beverages Industry ☐
   iv) Metal and Non Metals Industry ☐
   v) Pharmaceuticals Industry ☐
   vi) Power & Energy Industry ☐
   vii) Textiles Industry ☐
   viii) Other Industries (Please Specify) ☐

5. Company Ownership

   i) Public ☐ ii) Private ☐

6. No. of Employees

i) < 499 ☐

ii) 500 to 999 ☐

iii) 1000 to 1999 ☐

iv) 2000 to 4999 ☐

v) >5000 ☐

Section –II is related to Supply chain performance and Manufacturing competitiveness

Please indicate the degree to which you agree to the following statements in five-point Likert Scales, (1= Strongly Disagree. 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree, N/A= Not Applicable)

S. No.	Questionnaires	1	2	3	4	5	N/A
	Environmental Uncertainty						
	Technology Uncertainty						
1.	Our company is characterized by rapidly shifting technology						
2.	If we don't keep up with changes in technology, it will be hard for us to stay competitive						
3.	The rate of process obsolescence is high in our industry						
4.	Our company frequently changes our production technology						
5.	Our company frequently changes our process technology						
	Demand Uncertainty						
6.	Our master production schedule has a high percentage of variation in demand						
7.	Our demands are fluctuating radically from week to week						
8.	Our supply requirements vary drastically from week to week						
9.	We maintain our inventory of critical material to fulfil the changing demand						
10.	The volume and/or composition of demand is difficult to predict						
	Supply Uncertainty						
11.	Stability of quality of critical material						
12.	Delivery frequency of critical material						
13.	Complexity of critical material						
14.	Variance of material supply lead-time						
15.	Delay of critical material delivery						
	Supply Chain Management Practice						
	Customer Relationship						
16.	We regularly assess the formal and informal complaints of our customers						

17.	We often interact with clients to determine reliability and other standards for us						
18.	We often interact with clients to determine responsiveness and other standards for us						
19.	We have regular follow up with our customers for quality /service feedback						
20.	We regularly measure and evaluate customer satisfaction						
21.	We have frequently determined future customer expectations						
22.	Firm's geographical proximity to suppliers						
23.	We have successfully resolved customer complaints						
24.	We believe to form a long term contracts with customers						
25.	Willingness to increase delivery frequencies						
	Information Sharing						
26.	We inform trading partners in advance of changing needs						
27.	Our trading partners share proprietary information with us						
28.	Our trading partners keep us fully informed about issues that affect our business						
29.	Our trading partners share business knowledge of core business processes with us						
30.	We and our trading partners exchange information that helps the establishment of business planning						
31.	We and our trading partners keep each other informed about events or changes that may affect the other partners.						
32.	The level of information exchange with our major supplier through information networks						
	Information Quality						
33.	The exchange of information between our trading partners is timely						
34.	The exchange of information between our trading partners is accurate						
35.	The exchange of information between our trading partners is complete						
36.	The exchange of information between our trading partners is reliable						
	Supply Chain Integration						
37.	There is a high level of communication and coordination between all functions in our company						
38.	Cross-functional teams are frequently used for process design and improvement in our company						
39.	There is a high level of integration of information systems in our company						
40.	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers						

	Eco-Innovation						
41.	Our company made eco-innovation products						
42.	Environmental patent applications position among peers						
43.	After-tax returns among peers						
44.	Reductions of energy compared to peer companies						
45.	Waste reduction ratio compares with peer companies						
	Supply Chain Management Performance						
	Customers Responsiveness						
46.	Our company fills customer orders on time						
47.	Our company has short order-to-delivery cycle time						
48.	Our company has fast customer response time						
49.	Our company have customer satisfaction measurement system						
50.	Our company have been determining key factors for improving customer satisfaction						
	Supply Chain Efficiency						
51.	Our company supply chain is successful in minimizing overall cost						
52.	Our company supply chain is successful in minimizing inventory levels						
53.	Our company supply chain is successful in providing reliable delivery						
54.	Our company supply chain is successful in meeting quality specifications						
	Supplier Selection						
55.	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers						
56.	Our suppliers deliver innovative materials/components/products to us						
57.	Our suppliers provide materials/components/products to us at a reasonable price						
58.	Our suppliers provide high quality, responsive service to us.						
59.	Our suppliers provide materials/components/products to us on demand based to satisfy the customer requirement						
	Manufacturing Competitiveness						
	Price/Cost						
60.	Our company offers, product at competitive price/cost						
61.	Our company able to offer price/cost as low or lower than our competitors						
62.	We try to reduce the production price/cost of the product						
63.	We constantly stress to reduce Research and Development cost						
64.	We always focus to reduce distribution cost of products						

	Continuous Improvement						
65.	Our company always tries to continuous improvement of the quality of a product						
66.	Our company uses empowers employees for continuous improvement						
67.	Our company uses statistical quality control tools for continuous improvement						
68.	Our company follows total quality management for continuous improvement						
69.	Our employees go for regular training and development for continuous improvement						
70.	Our company hires an external counselor for continuous improvement						
	New Product Development						
71.	Our new products are very different to existing products in the market						
72.	Our new products are radical improvements of existing products						
73.	Our new products create platforms for new product lines						
74.	There are a large number of modified products produced each year						
75.	Our existing product lines are repeatedly improved						
76.	Our modified products can be made rapidly						
	Manufacturing Flexibility						
77.	Our company frequently utilizes job rotation for workers						
78.	Our company have a number of operations and which gives higher performance						
79.	In our company changes in machining processes can be handled by existing machines						
80.	In our company machine setup times between operations are relatively quick						

Appendix 6

Questionnaires after pilot study and this item are usable for first order confirmation analysis

S. No.	Questionnaires	1	2	3	4	5	N/A
	Environmental Uncertainty						
	Technology Uncertainty						
1.	Our company is characterized by rapidly shifting technology						
2.	If we don't keep up with changes in technology, it will be hard for us to stay competitive						
3.	The rate of process obsolescence is high in our industry						
4.	Our company frequently changes our production technology						
5.	Our company frequently changes our process technology						
	Demand Uncertainty						
6.	Our master production schedule has a high percentage of variation in demand						
7.	Our demands are fluctuating radically from week to week						
8.	Our supply requirements vary drastically from week to week						
9.	We maintain our inventory of critical material to fulfil the changing demand						
	Supply Uncertainty						
10.	Complexity of critical material						
11.	Delay of critical material delivery						
	Supply Chain Management Practice						
	Customer Relationship						
12.	We regularly assess the formal and informal complaints of our customers						
13.	We often interact with clients to determine reliability and other standards for us						
14.	We often interact with clients to determine responsiveness and other standards for us						
15.	We have regular follow up with our customers for quality /service feedback						
16.	We regularly measure and evaluate customer satisfaction						
	Information Sharing						
17.	We inform trading partners in advance of changing needs						
18.	Our trading partners share proprietary information with us						
	Information Quality						
19.	The exchange of information between our trading partners is complete						

	Supply Chain Integration						
20.	Cross-functional teams are frequently used for process design and improvement in our company						
21.	There is a high level of integration of information systems in our company						
22.	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers						
	Eco-Innovation						
23.	Our company made eco-innovation products						
24.	Environmental patent applications position among peers						
25.	After-tax returns among peers						
26.	Reductions of energy compared to peer companies						
27.	Waste reduction ratio compares with peer companies						
	Supply Chain Management Performance						
	Customers Responsiveness						
28.	Our company have customer satisfaction measurement system						
29.	Our company has short order-to-delivery cycle time						
	Supply Chain Efficiency						
30.	Our company supply chain is successful in minimizing overall cost						
31.	Our company supply chain is successful in minimizing inventory levels						
32.	Our company supply chain is successful in providing reliable delivery						
33.	Our company supply chain is successful in meeting quality specifications						
	Supplier Selection						
34.	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers						
35.	Our suppliers deliver innovative materials/components/products to us						
36.	Our suppliers provide materials/components/products to us at a reasonable price						
37.	Our suppliers provide high quality, responsive service to us.						
38.	Our suppliers provide materials/components/products to us on demand based to satisfy the customer requirement						
	Manufacturing Competitiveness						
	Price/Cost						
39.	Our company offers, product at competitive price/cost						
40.	Our company able to offer price/cost as low or lower than our competitors						

41.	We try to reduce the production price/cost of the product						
42.	We constantly stress to reduce Research and Development cost						
43.	We always focus to reduce distribution cost of products						
	Continuous Improvement						
44.	Our company always tries to continuous improvement of the quality of a product						
45.	Our company uses empowers employees for continuous improvement						
	New Product Development						
46.	Our new products create platforms for new product lines						
47.	Our existing product lines are repeatedly improved						
	Manufacturing Flexibility						
48.	In our company changes in machining processes can be handled by existing machines						
49.	In our company machine setup times between operations are relatively quick						

Appendix 7

Questionnaires after first order confirmation analysis

Dimensions	Items Code	Item Descriptions
Eco-Innovation (ECO)	**ECO1**	Our company made eco-innovation products
	ECO2	Environmental patent applications position among peers
	ECO3	After-tax returns among peers
	ECO4	Reductions of energy compared to peer companies
	ECO5	Waste reduction ratio compares with peer companies
Environmental Uncertainty (EU)	**EU1**	Our company is characterized by rapidly shifting technology.
	EU2	Our company frequently changes our process and production technology. So the rate of process obsolescence is high in our company
	EU3	Our master production schedule has a high percentage of variation in demand
	EU4	Our demands are fluctuating radically from week to week
	EU5	We maintain our inventory of critical material to fulfil the changing demand
	EU6	Stability of quality of critical material
Manufacturing Competitiveness (MC)	**MC1**	Our company offers, product at competitive price/cost, lower than our competitors
	MC2	We try to reduce the R&D and production price/cost of the product
	MC4	Our company uses empowers employees for continuous improvement
SCM Performance (SCMP)	**SCMP3**	Our company supply chain is successful in minimizing inventory levels and overall cost
	SCMP5	Our company supply chain is successful in meeting quality specifications
SCM Practice (SCMPR)	**SCMPR1**	We regularly assess the formal and informal complaints of our customers
	SCMPR2	We often interact with clients to determine reliability, responsiveness other standards for us
	SCMPR4	Our trading partners share proprietary information with us
Supplier Selection (SS)	**SS1**	Our supply chain is characterized by full system visibility from suppliers' suppliers to customers' customers
	SS4	Our suppliers provide high quality, responsive service to us.