

## Determinants of Supply Chain Performance of Indian Manufacturing Organizations

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### Abstract

This paper aims at proposing various determinants of supply chain performance of Indian manufacturing organizations. The determinants are summarized based on extensive literature review of empirical research articles on supply chain management (SCM) and performance measurement approaches. This study is a part of a larger research project exploring SC related practices. A critical analysis is carried out so as to identify research gaps in context of performance measurement of supply chains, as well as to propose directions for future research. A conceptual model is also proposed. Critical investigation of selected articles led to an idea that there can be significant effect of selected variables on SC Performance. It is to be seen that how various parameters, taken from the literature review, affect SC performance and ultimately contributing to its competitiveness. The various parameters like supplier-buyer relations, external supply chain, environmental factors, human metrics, information sharing and performance measurement approaches are taken in a single study in the context of Indian manufacturing organizations. Based on a pilot study with sample size of 100, empirical tests resulted in reduction of items. Based on the obtained results, the organizations can enhance the SCM performance by improving the current practices/strategies through focusing on the determinants that significantly influence SCM performance. Further research can be carried out by using data of various supply chains of other sectors and industries of India to generalize the research.

**Keywords:** SCM, Performance Measurement, Manufacturing Organizations.

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### 1. INTRODUCTION

In today's highly competitive global environment, performance can no longer exclusively be determined by the decisions and actions that occur within a firm as the contribution of all members involved gives overall results of the supply chain (SC). The competition has changed from being between individual organizations to being between supply chains. As organizations form global alliances, it is essential that they understand how supply chain management (SCM) can be successfully implemented (Halldorsson et al. 2008). A supply chain consists of all stages involved which directly or indirectly fulfill a customer request. Its being is to satisfy customer needs and in the process, to generate profits for itself. SC not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and the end users themselves.

The maturity of the supply chain governs a company's performance, affecting its profitability. Indian manufacturing industries are facing competition both from multinational companies and imports in the domestic markets. The new competition parameters include improved quality, products with higher performance, reduced cost, a wider range of products with better services; all delivered at the same time (Dangayach and Deshmukh, 2003). It is a well-known fact that many companies have not succeeded in maximizing their supply chain's prospective because they have failed to develop the performance measures and metrics desired to fully integrate their supply chain, thereby maximizing effectiveness and efficiency (Gunasekaran et al., 2004).

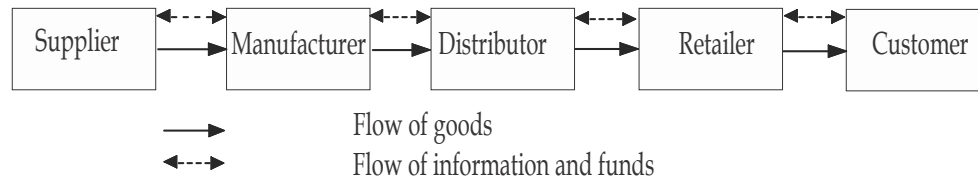
Recently, many firms have realized the potential of SCM in their day to day operations. However, there are many firms which do not have enough insight for development of effective performance measures and metrics needed to achieve a fully integrated SCM. The reason is that they do not have the access to a balanced approach and a clear distribution between the metrics at strategic, tactical, and operational levels (Bhagwat & Sharma, 2007). And, what can't be measured can't be improved. Even though SCM is very pertinent subject today, yet there is no effective tool available to measure supply chain efficiency of any manufacturing organization. Supply chain measurement is more like a qualitative statement unlike productivity or quality measurement, where the parameter can be measured objectively and expressed in a unit or in any ratio. Measuring supply chain performance (SCP) can assist in better understanding of the SC and improving its overall performance (Chen & Paulraj, 2004).

The manufacturing sector is growing rapidly in India and China and has shrunk in most advanced economies. The growth will require several changes, which include significant increase in productivity and quality at the plant levels, pursuit of worldwide competitive manufacturing strategies and operations and successful integration into the global supply chains (Deloitte, 2007). Emerging markets concentrate on mass manufacturing and competing on price. The top three countries in the Global Competitiveness Index are Asian, namely China, India & Korea (CIMA, 2010). In a World Bank Report (2012), India is ranked as 46th on Logistics Performance Indicator (LPI). Thus, the various reports strongly suggest the need of a comprehensive supply chain performance measurement system (SCPMS).

This paper will focus on critically discussing the determinants of supply chain performance (SCP) which may subsequently lead to competitiveness of the firm. In the paper, we will introduce firstly the concept of the supply chain and supply chain management. Secondly, we will discuss briefly about various performance measurement approaches. Then, various determinants of supply chain measurement will be put forward. Finally, we will discuss and reflect on the overall effect of all the determinants on the SCP. In totality, the paper contributes to the design and implementation of conceptual framework involving critical variables measuring supply chain performance in the context of Indian manufacturing organizations.

## **2. SUPPLY CHAIN AND SUPPLY CHAIN MANAGEMENT**

A supply chain (SC) is a network of organizations to perform a variety of processes and activities to generate value in the form of products and services to end consumers (Christopher, 1992). Alternatively, a supply chain is a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the end customer (Christopher, 1998). SC is defined as the "network of facilities and activities that performs the functions of product development, procurement of material from suppliers, the movement of materials between facilities, the manufacturing of products, the distribution of finished goods to customers, and after-market support for sustainment".



**FIGURE 1:** The Basic Supply Chain (Chopra and Meindl, 2001).

Supply chain management (SCM) is an integrated function with full responsibility on linking business functions and process, with and through companies, managing the dynamic of financial, material and information flows, between the different stages of supply chain. SCM is one of business strategy increasingly being used in the business world today and has become the focus of academic as well as corporate attention in recent years (Ballou, Gilbert & Mukherjee, 2000). There are many articles published in various disciplines to try to define the SCM and discuss future directions and the corresponding empirical research methodology (Cooper, et al., 1997; Lambert & Cooper, 2000; Larson & Rogers, 1998). SCM practices as a multi-dimensional construct that encompasses upstream and downstream sides of supply chain (Li et al, 2006). SCM involves an integrated and process-oriented approach to the management, design and control of the supply chain, with the aim of producing value for the end consumer, by both customer service and reduce cost (Bowersox and Class, 1996).

### 3. PERFORMANCE MEASUREMENT APPROACHES

Performance Measurement (PM) is the process of quantifying the effectiveness and efficiency of actions. Supply Chain Performance (SCP) refers to the overall supply chain's activities in meeting end-customer requirements, including product availability, timely delivery, and all the required inventory and capacity in the supply chain to deliver that performance in a responsive manner. SCP crosses company boundaries since it includes basic materials, components, subassemblies and finished products, and distribution through various channels to the end customer. It also crosses traditional functional organization lines such as procurement, manufacturing, distribution, marketing & sales, and research & development. In the Indian context, there have been many attempts to measure the performance at the organizational level, but very few attempts have been made to measure the performance at inter-organizational level (Saad and Patel, 2006).

New organizations have to deal with various kinds of performance pressures and suitable approaches are needed (Gunasekaran et al., 2005). The study is also the direct justification for the need of a new performance measurement. Supporting the idea of new performance measurement system, few other approaches have been proposed. There is an integrated approach for measuring supply chain performance, combining economic value added (EVA), the balanced scorecard (BSC) and activity based costing (ABC), clearly emphasizing the need of overhead handling and a balanced approach (Yao and Liu, 2006). Other approaches focuses on ERP-based supply chain performance and proposes an integrated method, total related cost measurement, to evaluate supply chain performance of a three-echelon, ERP-based supply chain system (Ho, 2007).

Many researchers have proposed new performance measures and metrics considering the changes in markets and enterprise environments. However, there are some confusion surrounding those measures and metrics regarding their importance and specific areas of application in SCM systems. The use of new emerging metrics defined in five categories has been suggested: external, consumer, value-based competition, network performance, and intellectual capital (Basu, 2001). A study based on a survey of 22 firms' SC systems, concluded that SC partners do not share a common vision of or react to the same set of metrics (Spekman et al., 1998). Recently, many research papers that deal with performance measurement in a SC context (Van Hoek, 1998) have appeared in the literature. However, most of them are prescriptive

and not based on historical facts and their analysis and changing market and operations environments or well grounded empirical analysis.

Author(s)	Year	Author(s)	Year
Artz	1999	Li, G. et al	2005
Baiman et al	2001	Li, S. et al	2005
Beamon	1998, 1999	Lockamy and McCormack	2004
Bourne et al	2000, 2002	Lohman et al	2004
Cachon and Lariviere	1999	Lummus et al	2003
Chan	2003	Maloni and Benton	1997
Chan and Qi	2003	Melnyk et al	2004
Chen and Paulraj	2004	Ramdas and Spekman	2000
Dasgupta	2003	Schmitz and Platts	2004
Toni, D. and Tonchia	2001	Stephens	2001
Fynes et al	2005	Talluri and Sarkis	2002
Graham et al	1994	Van der Vorst and Beulens	2001
Gunasekaran et al	2001, 2004, 2005	Van Hoek	2001
Harrison and New	2002	Wang et al	2004, 2005
Holmberg	2000	Webster	2002
Huang et al	2004, 2005	Windischer	2003
Kleijnen and Smits	2003	Windischer and Grote	2003
Lai et al	2002		

**TABLE 1:** Journal article and books of performance measurement systems and metrics for SC  
Source: Craig Shepherd (2006).

A large number of measurement approaches have been developed and used for measuring SCP (Lapide, 1999). Apart from very popular Balanced Scorecard, there are other measurement approaches like Supply Chain Council's SCOR Model, the Logistics Scoreboard, Activity-Based Costing (ABC) and Economic Value Analysis (EVA). Some of the important approaches with their salient features are tabulated below in table 2.

SC Measurement Approaches	Salient Features
The Balance Score Card (BSC)	It advocates the use of Executive Information Systems (EIS) that track a number of balanced metrics that are closely aligned to strategic objectives. The approach would suggest that a small number of balance supply chain measures be tracked on the following four perspectives: Financial perspective, Customer perspective, Internal business perspective, Innovative and learning perspective
Supply Chain Council's SCOR Model	It advocates a set of SCP measures comprising of a combination of Cycle time metrics, Cost metrics, Service/quality metrics & Asset metrics
The Logistics Scoreboard (LSB)	It recommends the use of an integrated set of performance measures: Logistics financial performance, Logistics productivity performance, Logistics Quality performance & Logistics cycle time performance

Supply Chain Scorecard	The SCOR model is a pyramid of four levels that represents the path a company takes on the road to SC improvement. □ Level 1 - it provides a broad definition of the plan, source, make and deliver process. □ Level 2 - it defines the 17 core process categories that are possible components of a supply chain, □ Level 3 - it provides a company with the information it needs to successfully plan and set goals for its supply chain improvements. □ Level 4 - it focuses on implementation, when companies put specific supply chain improvements into play.
Activity Based Costing (ABC)	Activity based costing (ABC) is an accounting methodology that assigns costs to activities rather than products or services. This was developed to overcome some of the shortcomings of traditional accounting methods in tying financial measures to operational performance.
Economic Value Analysis	EVA, developed by Stern, Stewart & Co., attempts to quantify value created by an enterprise, basing it on operating profits in excess of capital employed. These types of metrics can be used to measure an enterprise's value added contributions within a supply chain.

**TABLE 2:** Salient Features of different SC Measurement Approaches.

Different types of performance measures can be divided into four categories ( Toni and Tonchia, 2001) which are shown in table 3 below.

1. Cost and non-cost performance measures	Berliner & Brimson, 1988; Lockamy & Cox,1994; Partovi, 1994; Rangone, 1996
2. Balanced scorecard models, where performance is measured in financial, internal business process, customers, and learning/growth - fields.	Kaplan & Norton, 1993; Kaplan & Norton 1996; Kaplan & Norton, 1992; Kaplan, 1996; Maskell, 1992
3. Internal and external performances	Toni & Tonchia, 2001
4. Value chain models	Toni & Tonchia, 2001

**TABLE 3:** Different Performance measurement Measures.

#### 4. DETERMINANTS OF SUPPLY CHAIN PERFORMANCE

In this paper, the authors propose a conceptual model by linking the relationships with supplier-buyer relations, external supply chain, environmental factors, human metrics, information sharing, performance measurement approaches; and SCM performance in a single study in the context of Indian manufacturing organizations.

Construct	Definitions	Literature
Supply Chain Performance	The overall efficiency and effectiveness of a supply chain	Beamon, 1998; 1999; Harland, 1996; Garwood, 1999; Gunasekaran et al., 2001; Holmberg, 2000; Tompkins and Ang, 1999; van Hoek, 1998; Bechtel and Jayaram, 1997; Kiefer & Novack, 1999; Narasimhan and Jayaram, 1998; Hewitt, 1999; Spekman et al., 1998.

**TABLE 4:** Salient Features of different SC Measurement Approaches.

##### 4.1 Supplier Buyer Relations (SBR)

In supply chain management strategies, supplier relationship activities play an important role (Wisner, 2003). Long-term relationships refer to intention that the arrangement is not going to be temporary (Chen and Paulraj, 2004). A successful strategic alliance and integrated relationship

with suppliers and buyers is very much needed. It should be revolved around trust, loyalty, positive sum game (a win-win relationship), cross-functional teams, achieving common goals and collaboration (Chandra and Kumar, 2000). A firm's success is linked to the strength of its relationship with supply chain partners and it could reduce and increase revenue (Spekman, Kamauff and Myhr, 1998).

Construc	Definitions	Literature
<b>Supplier-Buyer Relations</b>	"The long-term relationship between the organization and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organizations to help them achieve significant ongoing benefits" (Li et al., 2006, p. 109)	Li et al., 2005; Gunasekaran et al., 2001; Balsmeier and Voisin, 1996; Monczka et al., 1998; Noble, 1997; Stuart, 1997; Lamming, 1993; Sheridan, 1998; Tan et al., 2002

**TABLE 5:** Different Performance Measurement Measures.

#### 4.2 External Supply Chain (ESC)

One factor common to all the world class companies in India, whether in the textile/garment field, the automotive field or the pharmacy field, is the established and nurtured supply chain network. The existing supply chains have been strengthened through increased collaboration. Integration with external partners is now very much needed. Strategic partners throughout the global supply chain collaborate to identify joint business objectives and action plans..

Today, thinking has already moved from simple supply chains to complex networks of organizations working together to create competitive advantage and value, i.e. value networks. Consequently, there are developments of networks that criss-cross organisational boundaries shifting from inter- to trans-organisational networks (Bititci et al.,2006). Differences between 'traditional' and 'networked' organisations are well discussed in literatures (Gunasekaran et al., 2005). A successful logistics network can reduce entire supply chain costs, including manufacturing and procurement costs, inventory handling costs, facility costs (fixed costs), labour cost and transportation costs (Simchi-Levi, Kaminisky and Simchi-Levi, 2000).

#### 4.3 Environmental Factors (EF)

The effects of globalization, technology and the growing need for environmental responsibility and sustainability is forcing organizations and individuals to make changes in the way they work. The ministry of corporate affairs and the industry chamber, Confederation of Indian Industry (CII) had reported in their study about the Corporate Social Responsibility (CSR) in which the private sector plays a key role in nurturing inclusive growth. Almost all major Indian organizations have a CSR programme.

Constructs	Definition	Literature
<b>Environmental Factors</b>	The source of events and changing trends and regulations which create opportunities and threats for an individual organization	Lenz, 1980; Turner, 1993; Prahlad, 1998; Chen et al., 1992; Burgess, 1998; Tan et al., 1998; Thomas & Griffin, 1996; Krause et al., 1998; Aldrich, 1979; Paswan et al., 1998; Milliken, 1987; Oswald et al., 1997; Miller & Droge, 1986; Nahm, 2000, Drucker, 2002.

**TABLE 6:** Different Performance Measurement Measures.

However, today one thing we can be certain of is that the rate of change is set to increase even further, both in scope and magnitude. These changes are likely to be more frequent and larger than previously but they also may come from unexpected directions. The primary changes we are likely to face in the future are social rather than economic or technological.

#### 4.4 Human Metrics (HM)

There is a heavy influence of behavioral issues while establishing and implementing the key PMs and metrics. Cultural and political factors also play a significant role in determining the right PMs

and metrics. Organizations share values in terms of tremendous trust, commitment and collaboration. Also, organizational capability and top management supports are essential for an effective SCM (Mello and Stank, 2005). It is suggested that human factor is significantly affecting the SCM effectiveness (Tony and Kelvin, 2007) and is a critical factor in achieving strategic and operational objectives and changes in the supply chain(Hoek, Chatham and Wilding, 2002).

It is found that firms lacking in the appropriate cultural elements such as shared assumptions, values and artifacts are tend to fail when implementing SCM initiatives (Mello and Stank, 2005). Moreover, the need for organizational commitment and governance for supply chain success is also reported (Fawcett, Ogden, Magnan and Cooper, 2006). The findings indicated that the following four types of managerial support are needed to achieve best SC success: top management support, broad-based functional support, channels support and infrastructural/governance support. Few more research works (Robinson and Malhotra, 2005; Wouters, 2009) clearly support the need for a performance measurement system taking the holistic picture, including the human side and organizational issues.

#### 4.5 Information Sharing (IS)

Information sharing is defined as the access to private data between business partners thus enabling them to monitor the progress of products and orders as they pass through various processes or stages in the supply chain (Simatupang and Sridharan, 2002). The elements of information sharing comprises of consistent data acquisition, processing, storage, presentation, retrieval, and broadcasting of demand and forecast data, inventory status and location, order status, cost-related data, and performance status.

Constructs	Definitions	Literature
<b>Information Sharing</b>	"The extent to which critical and proprietary information is communicated to one's supply chain partner" (Li et al., 2006, p. 110)	Li et al., 2005; Monczka et al., 1998; Mentzer et al., 2000b, Stein and Sweat, 1998, Yu et al., 2001; Towill, 1997; Balsmeier and Voisin, 1996; Jones, 1998; Lalonde, 1998; Vokurka and Lummus, 2000; Lancioni et al., 2000; Ballou et al., 2000.

**TABLE 7:** Different Performance Measurement Measures.

Information sharing pertaining to key performance metric and process data improves the supply chain visibility thus enabling effective decision making. Information shared in a supply chain is of use only if it is relevant, accurate, timely, and reliable (Simatupang and Sridharan, 2005;Thatte, 2007). Information sharing with business partners enables organizations in taking better decisions and actions on the basis of greater visibility (Davenport, et al, 2001; Tathee, 2007). In order to make the supply chain competitive, a necessary first step is to acquire a clear understanding of supply chain concepts and be willing to openly share information with supply chain partners(Lummus and Vokurka 1999; cited in Thatte, 2007)

#### 4.6 Supply Performance Measurement Approaches (SPA)

Most of the companies are following financial and non-financial performance measures approaches, however they are not representing them in a balanced framework. The basic question is where the financial and nonfinancial PMs would be suitable to evaluate the performance of a SC system. For example, strategic level PMs are mostly based on financial metrics. PMs at tactical level can be evaluated using both financial and nonfinancial indicators. Operational level performance evaluation is mostly based on nonfinancial indicators. While some companies concentrate on financial performance measures, others are concentrating on operational measures (Kaplan and Norton, 1992

Researchers suggested that an appropriate performance measurement system is a critical requirement for the effective management of a supply chain (Liang, Yang, Cook and Zhu, 2006). There are studies about the PMSs and metrics of supply chains by critically reviewing the contemporary literature those suggest possible areas for future research (Shepherd and Gunter,

2006). SCM needs to be evaluated for its performance in order to bring forward an efficient and effective supply chain (Gunasekaran, Patel and Tirtiroglu, 2001). For effective management in a SC, measurement goals must consider the overall SC goals and the metrics to be used. These should represent a balanced approach and should be classified at strategic, tactical and operational levels, and also as financial and nonfinancial measures (Gunasekaran et al.,2001).

Recently, many research papers that deal with performance measurement in a SC context (Van Hoek, 1998) have appeared in the literature. However, most of them are prescriptive and not based on historical facts and their analysis and changing market and operations environments or well grounded empirical analysis. In addition, they lack a complete coverage of all the performance measures and metrics in new enterprise environments considering different levels of decision-making. An overview of PMSs in SCMs environments highlights the justification for the selection of suitable metrics based on the current and emerging new enterprise environments.

There are not many review articles on performance measures and metrics in logistics and supply chain. An overview and evaluation of the performance measures used in SC models is presented and a framework for the selection of PMSs for manufacturing SCs has also been proposed (Beamon,1999). Three types of PMs are identified as necessary components in any supply chain PMSs, viz., resources, output and flexibility. Another study suggested that traditional models for PM should be separated from more innovative non cost measures such as the time, quality and flexibility (De Toni and Tonchia, 2001).

The authors propose to suggest the suitability of any particular approach in the context of Indian manufacturing organizations.

## 5. PROPOSED MODEL

There is a model to examine relationship between supply chain performance (SCP) and degree of linkage among supplier, internal integration and customer (Lee, Kwon and Severance, 2007). In line with this knowledge, the researchers propose that a model for manufacturing companies can also be developed.

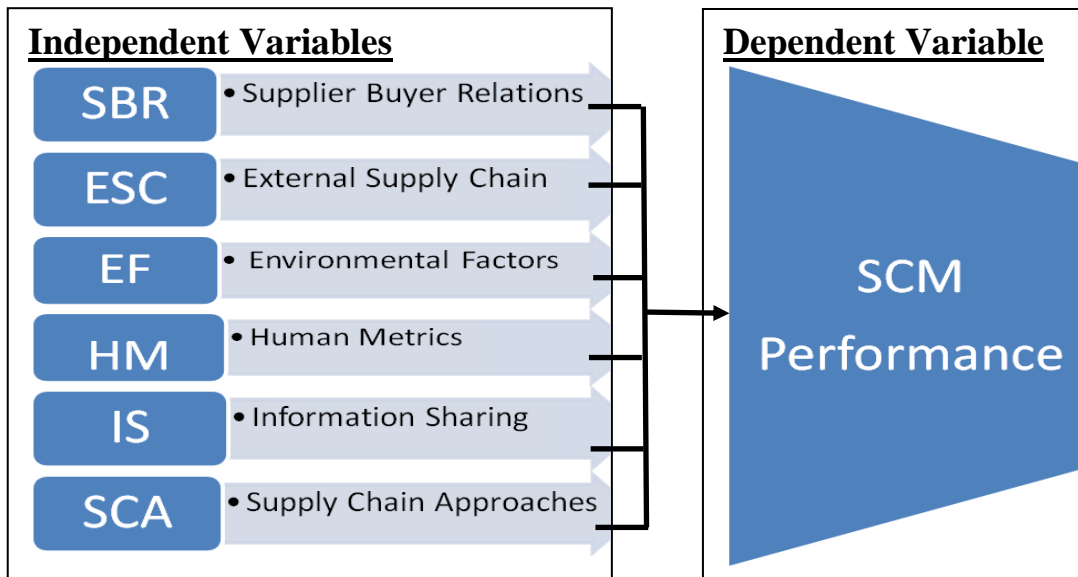


FIGURE 2: Proposed Conceptual Model (Marwah A.K., et al, 2012).



Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.596	.613	33

**TABLE 8:** Reliability Scores.

## 6. METHODOLOGY

This study is part of a larger research project exploring SC related practices, their relevance to managers, and their impact on firm performance and eventually on firm competitiveness.

Methodology used in this study is based on the views of Beamon (1999), that are, PMS should develop a reliable metrics to provide feedback on various performance areas by eliminating the overlapping (duplication) metrics and to include the most important metrics of logistics and supply chain management. Beamon (1999) has focused on the major metrics such as time, resource utilization, output and flexibility to provide a context for developing more detailed performance measures and metrics in new enterprise environments.

The sample of this pilot study focuses on departments of purchasing, production, logistics and distribution in the Indian manufacturing companies. Questionnaire (both online and offline) are the main instruments of this study. Questionnaire items were designed after an extensive literature review. 5–point Likert scale was used. There were total 105 items (excluding 17 demographic items). Questionnaire was emailed to various responded and out of 108 responses which were received, 100 responses were complete in all respects and therefore taken for this pilot study.

## 7. RESULTS

Factor analysis was performed on each construct using SPSS to reduce unnecessary items from the questionnaire and reliability analysis was also done to test how well the items in a set were positively correlated to one another. The factor analysis reduced total number of items from 84 to 33. The summary of items before the factor analysis is shown in table 9. The final questionnaire was tested for reliability. The internal consistency reliability will be higher if the Cronbach’s alpha is closer to 1 (Sekaran, 2003). The final questionnaire shows the value of Cronbach’s alpha as 0.596, which is acceptable for new scale (Table-8).

S. No.	Items	Details
1	SBR1	We consider quality as our number one criterion in selecting suppliers
2	SBR2	We regularly solve problems jointly with our suppliers
3	SBR3	We have helped our suppliers to improve their product quality
4	SBR4	We have continuous improvement programs that include our key suppliers
5	SBR5	We include our key suppliers in our planning and goal- setting activities
6	SBR6	We actively involve our key suppliers in new product development processes
7	ESC1	Our supply chain partner feels like "part of the family" in this supply chain relationship
8	ESC2	Our supply chain partner feels "emotionally attached " to this supply
		chain relationship
9	ESC3	This supply chain relationship has a great deal of personal meaning for our supply chain partner
10	ESC4	Our supply chain partner feels a strong sense of belonging to this supply chain relationship
11	ESC5	Our supply chain partner works towards achieving the common goal
12	ESC6	Our supply chain partner shares risk with you.
13	ESC7	Our supply chain partner is afraid of what might happen if he leaves the supply chain relationship
14	ESC8	Our supply chain partner believes that a firm must always be loyal to its supply chain relationship
15	ESC9	Our supply chain partner thinks that firms these days move from alliance to alliance

		too often			our industry
16	ESC10	Jumping from alliance to alliance seems unethical to our supply chain partner	47	EF17	Technological changes provide opportunities for enhancing competitive advantage in our industry
17	ESC11	Our supply chain partner work towards reputation of the firm rather than profitability	48	EF18	Technological breakthrough results in many new product ideas in our industry
18	ESC12	Our supply chain partner is ready for mutual investments on certain projects	49	EF19	Improving technology generates new products frequently in our industry
19	HM1	The degree of dealings between us and our supply chain partner is very high	50	IS1	We inform trading partners in advance of changing needs
20	HM2	The relationship between us and our supply chain partner is very stable	51	IS2	Our trading partners share proprietary information with us
21	HM3	We are quite involved in the marketing and planning efforts of our supply chain partner	52	IS3	Our trading partners keep us fully informed about issues that affect our business
22	HM4	We and our supply chain partner seek advice for each other when doing marketing analysis	53	IS4	Our trading partners share business knowledge of core business processes with us
23	HM5	We and our supply chain know the strengths and weaknesses of each other very well	54	IS5	We and our trading partners exchange information that helps establishment of business planning
24	HM6	Our firm is powerful enough to ask our supply chain partner to readjust price strategy	55	IS6	We and our trading partners keep each other informed about events or changes that may affect the other partners
25	HM7	Our firm is powerful enough to ask our supply chain partner to readjust their product	56	SPA1	Sales
26	HM8	Our firm can provide training support to our supply chain partner	57	SPA2	Cash flow
27	HM9	Our supply chain partner perceives that our firm is perfectly honest and truthful	58	SPA3	Profit / Sales
28	HM10	Our supply chain partner perceives that our firm is perfectly having high integrity	59	SPA4	Quality of accounting policies
29	HM11	We would like to inform our supply chain partner everything about new developments	60	SPA5	Customer complaints
30	HM12	We willingly share all information that might help your supplier make better decisions	61	SPA6	Percent of missed delay rates
31	EF1	We are affected by mergers and acquisitions	62	SPA7	Customer Surveys
32	EF2	Globalization has helped in our performance	63	SPA8	Percent of products rejected by quality control
33	EF3	We are affected by the infrastructure facilities provided by the government	64	SPA9	Manufacturing cycle time
34	EF4	Customers' needs are unpredictable	65	SPA10	Capacity utilization
35	EF5	Customers' requirements regarding product features are difficult to forecast	66	SPA11	Safety record
36	EF6	Customers' product preferences change over the year	67	SPA12	Absentee rates
37	EF7	The properties of materials from suppliers can vary greatly within the same batch	68	SPA13	Employee training
38	EF8	Suppliers' engineering level is unpredictable	69	SPA14	Customer diversification
39	EF9	Suppliers' product quality is unpredictable	70	SPA15	Percent of sales from proprietary products
40	EF10	Suppliers' delivery time can easily go wrong	71	SPA16	Environmental policies implemented
41	EF11	Competitors' actions are unpredictable	72	SPA17	Community involvement
42	EF12	Competition is intensified in our industry	73	SPA18	Experience/reputation of management
43	EF13	Competitors are from different industries	74	SPA19	Continuity of management
44	EF14	Competitors are from different countries	75	SPA20	Number of new products (last three years)
45	EF15	Competitors often introduce new products unexpectedly	76	SPA21	Percent of sales due to new products
46	EF16	Technology is changing significantly in	77	SCP1	Our supply chain is able to meet special customer specification
			78	SCP2	Our supply chain is able to rapidly adjust capacity so as to accelerate or decelerate production in response to changes in customer demand
			79	SCP3	Our supply chain is able to rapidly introduce large numbers of product improvements/variations
			80	SCP4	There is high level of communication and coordination between all functions in our firm
			81	SCP5	There is a high level of integration of information systems in our firm

82	SCP6	Our firm fills customer orders on time	84	SCP8	Our firm has fast customer response time
83	SCP7	Our firm has short order-to-delivery cycle time			

**TABLE 9:** Initial Questionnaire Items (before factor analysis).

## 8. DISCUSSIONS

The increasingly global nature of competition requires that firms utilize all of their available resources in order to survive and succeed. Consequently, their supply chains need to be very efficient. The present work aimed at narrowing down the different variables leading to SC performance. At this stage, pilot study results indicate the need of an exhaustive model to assess the SC performance. Also, with so many variables and factors, use of structural equation modeling (SEM) is intended.

## 9. IMPLICATIONS AND FUTURE SCOPE

This study is a part of a larger research project exploring SC related practices. The methodology involves literature review of empirical research articles on performance measurement, SCM and competitiveness. The authors' intention is to fill up the gap about the lack of research in supply chain management which investigates the role of critical success factors in manufacturing organizations of India. Furthermore, the study to be carried out resulting from the proposed model is expected to investigate the critical success factors that contribute to the SCM performance in order to increase the competitive advantage of the Indian manufacturing organizations.

The study intends to survey manufacturing organizations of India. The implications of our research work would be to benefit the manufacturing organizations to be surveyed in terms of new and customized SC performance approaches, with due consideration to their geographical location and related SC constraints. However, the scope of this study is limited only to manufacturing organizations. It can be further extended to cover other industries and sectors.

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