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Supply chain practices : An implementation status in Indian manufacturing organisations

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An implementation status in Indian manufacturing organisations

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Abstract

Purpose – The purpose of this paper is to investigate the current level of supply chain practices (SCPs) in Indian manufacturing organizations.

Design/methodology/approach – The 15 SCPs are identified based on the literature support and opinion of industry experts and academia, and data were collected from 292 organizations. Data were analyzed using the statistical package for the social science software to see the current level/penetration of SCPs in Indian manufacturing organizations.

Findings – The practices, namely, organizational culture, customer relationship, information and communication technology, benchmarking and performance measurement, lean manufacturing, agile manufacturing, supplier relationship are highly penetrated practices in Indian manufacturing organizations. The practices, namely, outsourcing, information sharing, just in time manufacturing, green supply chain management are moderately penetrated practices, while the practices, namely, reverse logistics, postponement, vendor managed inventory, radio frequency are least penetrated practices in Indian manufacturing organizations.

Research limitations/implications – Further study can be extended to see the of penetration practices applicable to service and agriculture sectors.

Practical implications – The result of this paper will enable the organizations to identify and direct their focus on the areas that requires improvement. Also, the organizations will become more aware of the SCPs that will help in boosting up their performance and competitiveness and indirectly boost the growth and contribute to India's economic development.

Originality/value – This is the first kind of study which checked the level of selected SCPs in Indian manufacturing organizations.

Keywords India, Supply chain management (SCM), Performance measures,
Supply chain practices (SCPs)

Paper type Research paper

1. Introduction

Industries have been the backbone of economic growth in driving national development (Normah, 2006). Facing increased competitive pressure due to globalization and increased quality requirements from their customers, manufacturers must increase their productivity and competitiveness in order to survive and prosper (St-Pierre and Raymond, 2004). Organizations can gain competitiveness by increasing the productivity of manufacturing operations and fulfilling the changing needs of customers and employees. Now days, organizations began to realize that it is not enough to improve efficiencies within an organization, but their whole supply chain (SC) has to be made competitive. It has been recognized that understanding and practicing supply chain management (SCM) has become an essential pre-requisite to staying in the competitive market. SCM can be defined as the management technique which integrates suppliers, manufacturers, logistics and customers for improving the long-term performance of the individual organization and the SC as a whole. The SCM implementation results in customer satisfaction by

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providing customers with the right product (Dale *et al.*, 1994) of right quality (Bhagwat and sharma, 2007) and quantity (Chan *et al.*, 2001) from a right source (Carr and Smeltzer, 1999) at the right price (Chin *et al.*, 2004), and finally utilizing the right technology (Vinodh *et al.*, 2009).

The success of the SCM lies in effective implementation of supply chain practices (SCPs) (Metilda and Vivekanandan, 2011). SCPs are a multi-dimensional concept and defined as the set of activities undertaken in an organization to promote effective downstream and upstream linkages of the SC (Li *et al.*, 2006). The SCPs leads to a reduction in the inventory, better information sharing and mutual trust among the SC partners (Sujatha, 2011). Yet, despite these significant benefits, many organizations continue to struggle to understand the complex issues (Cook *et al.*, 2011). The implementation of SCPs seems to be difficult due to the lack of top management support, resistance to share critical information, lack of resources, lack of information technology (IT) infrastructure, unclear organizational objectives, etc. (Pagell and Krause, 2004).

The objective of this work is to obtain the different SCPs from literature and see the penetration of each SCP on the basis of data collected from the Indian manufacturing organizations. In India, the manufacturing organizations are under increasing pressure to improve their performance. Globalization, shortening product life cycle, increasingly sophisticated consumers, increasing labor cost and volatility in input prices has created an environment where manufacturers must be flexible, adaptive, responsive and innovative (Sohal *et al.*, 1999). Organizations used to compete based on price and quality, but now they have to compete across all competitive aspects including flexibility, responsiveness, green manufacturing, etc. in the current economic environment. Thus, it is necessary to see the penetration of different SCPs in Indian manufacturing organizations. This will enable the organizations to identify and direct their focus on the areas that require improvement. Also, the organizations will become more aware of the SCPs that will help to increase their performance and competitiveness. With best SCPs, organizations will be able to improve their business performance and expand their assets, providing work opportunities and indirectly boosting the growth and contribute to India's economic development.

From the literature review, opinion of industry experts and academia, the 15 practices were identified and data were collected from 292 industries. The data were analyzed using statistical package for the social science (SPSS) software. Descriptive statistical analysis has been done to analyze the data to see the penetration of each selected SCP in the Indian manufacturing organizations. There is no study available that focusses on all these SCPs collectively and evaluated the penetration of these SCPs in Indian manufacturing organizations.

The remainder of the paper is organized as follows. The Section 2 represents the previous research on SCPs while methodology of research is explained in Section 3. Profiles of the respondents participated in the survey research is given in Section 4. Section 5 gives the discussion and results of survey research while Section 6 carries conclusion implications and scope of future work.

2. Previous research on SCPs

SCPs can be defined as a set of activities undertaken in an organization to promote effective management of its SC. Any activities within the SC that improves the overall performance of the organization can be treated as SCPs. Most of the authors have

empirically investigated limited numbers SCPs. The research conducted by Donlon (1996) included SCPs, namely, supplier partnership, outsourcing, cycle time compression, continuous process flow and IT. Tan *et al.* (1998) empirically tested the SCPs, namely, purchasing, quality and customer relationship. Tan (2001) included SCPs, namely, flow of materials, information sharing, postponement strategy and mass customization. Similarly Tan (2002) studied the SC and supplier evaluation practices, namely, supplier and customer management, geographical proximity, just in time (JIT), information sharing, product and delivery assessment. Sahay and Mohan (2003) focussed on four SCPs, namely, SC strategy, SC integration, inventory management and IT. Sahay *et al.* (2003) conducted the research on SCPs in India and described the SC initiative to meet the competitive challenges Chin *et al.* (2004) conducted survey in Hong Kong manufacturing organizations to examine the extent to which Hong Kong manufacturers are using the SCPs, namely, building customer-supplier relationships, implementing information and communications technologies (ICT), re-engineering material flows, creating corporate culture and identifying performance measurements. Li *et al.* (2006) conceptualizes five dimensions of SCPs, namely, strategic supplier partnership, customer relationship, the level of information sharing, quality of information sharing and postponement. Saad and Patel (2006) proposed that the concept of SCPs is not fully incorporated by the Indian automobile sector and highlights the difficulties associated with SCPs implementation. Srivastava (2006) comprehensively examine and present the state of logistics and SCPs in India, namely, SC collaboration and partnerships, SC structure, facilities network design, transportation and logistics and the role of ICT. Koh *et al.* (2007) grouped the SCPs in two factors, namely, outsourcing and multi-suppliers (outsourcing, e-procurement, third party logistics (3PL), subcontracting, many suppliers) and strategic collaboration and lean practices (close partnership with suppliers, close partnership with customers, JIT supply, SC benchmarking, strategic planning, holding safety stock, few suppliers). Sundram *et al.* (2011) studied SCPs, namely, supplier partnership, information sharing, risk and reward sharing, information quality, postponement, customer relationship and agreed vision and goals. Chong *et al.* (2011) evaluated SCPs, namely, supplier partnership, customer relationship, information sharing, IT and training. Anuar and Yusuff (2011) focussed on best SCPs and their effect on SC performance. Ou *et al.* (2010) concluded that a successful SCPs implementation leads to better customer satisfaction and finally customer satisfaction leads to better financial performance. Definitions of SCPs and literature support are presented in Table I.

3. Methodology

This study is part of a larger research project entitle "study of selected supply chain practices in Indian manufacturing organizations." This arm of the study checked the penetration of selected SCPs in Indian manufacturing organizations. In the first step of research, the extensive literature review was carried. For literature review, we considered the representative journals which were considered by Melnyk *et al.* (2012) for assessing the state of research in SCM. The selected journals were *Decision Sciences Journal (DS)*, *Journal of Business Logistics (JBL)*, *Journal of Operations Management (JOM)*, *Journal of Purchasing and Supply Management (JPSM)*, *Journal of supply chain management (JSCM)*, *International Journal of Manufacturing Technology and Management (IJMTM)*, *International Journal of Production Economics (IJPE)*. According to Melnyk *et al.* (2012) these journals are appropriate and representative

SCPs	Definitions	Literature support
Agility	The ability of a production system is to achieve its operational goals in the presence of supplier, internal and customer disturbances	Zhang *et al.* (2006) and Slack (2005)
Benchmarking and performance measurement	Performance measurement defined as the feedback or information on activities with respect to meeting customer expectations and strategic objectives Benchmarking is nothing but to compare a firm's business practices and performance with those of a group of comparable firms, or with those of firms that are recognized for their excellence	Neely *et al.* (1995), Kaplan and Norton (1992) and Gosselin (2005)
Customer relationship	The customer relationship is a strategy for understanding customers and their needs in order to optimize interactions A management philosophy which an organization's goals can be best achieved through identification and satisfaction of the customers	Denkena *et al.* (2006) and Ou *et al.* (2010)
Green SCM	The process of using environment friendly inputs, transforming these inputs into outputs that can be reclaimed and re-used at the end of their life cycle, thus, creating a sustainable SC	Zhu and Sarkis (2007) and Al Khidir and Zailani (2009)
Information and communication technology (ICT)	Information technologies is a SC tool to enhance the information and communication system with supplier, customer, within the firm, distribution center, retailer, whole seller, etc.	Power and Simon (2004) and Motwani *et al.* (2000)
Information sharing	The extent to which critical and proprietary information is communicated to one's SC partner Share of complete, accurate, quality, relevant, ease to access information and data with minimum distortion	Marsh and Flanagan (2000) and Curry and Moore (2003)
Just in time manufacturing (JIT)	The JIT production system is used to produce necessary quantities of necessary items at a necessary point in time	Singh and Garg (2011) and Garg *et al.* (2001)
Lean manufacturing	Elimination of everything that does not add value to the product service (set up time, material flow, inventory, etc.) Close integration from raw material to customer through partnership	Ghosh (2012) and Doolen and Hacker (2005)
Organizational culture	The organizational culture consists of some combination of artifacts, ethics and attitude, and basic assumptions that organizational members share about appropriate behavior	Eskildsen *et al.* (2010) and Pearson and Chatterjee (2001)
Outsourcing	Another firm's employee carrying out tasks previously performed by one's own employees Sourcing activities that an organization has the internal capability to perform	Khong (2005) and McIvor (2000)
Postponement	Delaying final manufacturing/assembly until the customer order received	Yang *et al.* (2004) and Bowersox and Closs (1996)

(*continued*)

Table I. Definitions of SCPs and literature support

SCPs	Definitions	Literature support
Reverse logistics (RL)	The process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of recapturing value or proper disposal	Guide *et al.* (2000, 2003)
Supplier relationship	Supplier relationship is the discipline of working collaboratively with suppliers in order to maximize the value creation	Ballou *et al.* (2000) and Claro *et al.* (2003)
RFID	RFID is an auto-ID technology to identify an object by the use of radio wave	Attaran (2007) and Park *et al.* (2010)
Vendor managed inventory (VMI)	VMI is essentially an integrated approach whereby the inventory at the manufacturer/ distributor/retailer is monitored and managed by the suppliers/vendor	Kumar and Kumar (2003) and Danese (2006)

Table I.

of research in the field of SCM and thus they should be representative of the best practices. Second, we included the journals which having more focus on SCM, namely, *Benchmarking: An International Journal (BIJ)*, *Business Process Management Journal (BPMJ)*, *Industrial Management and Data Systems (IMDS)*, *International Journal of Operations and Production Management (IJOPM)*, *International Journal of Physical Distribution and Logistics Management (IJPDLM)*, *International Journal of Productivity and Performance Management/Work Study (IJPPM)*, *Journal of Manufacturing Technology Management (JMTM)*, *Supply Chain Management: An International Journal (SCMIJ)*, *International Journal of Logistics Management (IJLM)*. Overall the 16 journals were selected for literature analysis.

The word "SCPs" was searched in each journal. Around 850 articles related to SCPs are found. These articles are more or less discussed the various SCPs, namely, JIT, lean manufacturing, postponement, agile manufacturing, mass customization, strategic planning, TQM, Six Sigma, continuous improvement, benchmarking and performance measurement, supplier evaluation and rating, supplier and customer relationship, information sharing, agreed vision and goals, top management commitment and support, employee motivation, employee training, employee involvement, environmental management system, green manufacturing, green purchasing, reverse logistics, IT, radio frequency identification (RFID), technology for agile manufacturing, vendor managed inventory (VMI), outsourcing, 3PL, 4PL, transportation and distribution management, geographical proximity, e-procurement, JIT purchasing, etc.

Based on the content analysis (frequency of occurrence of each SCP from the selected 850 articles) and opinion of academia and industry experts, 15 SCPs were selected, namely, supplier relationship, customer relationship, information sharing, ICT, RFID, organizational culture, benchmarking and performance measurement, lean manufacturing, agile manufacturing, JIT manufacturing, postponement, outsourcing, VMI, green supply chain management (GSCM) and reverse logistics. The selection of 15 practices may not appeal to all readers and that argument could be made for including other practices. However, these practices are appropriate and they should be representative of most of the concerns faced by the organizations (as discussed in Section 1).

From the same literature, an initial list of measurement items of each component of the constructs (SCP) was developed. As suggested by Churchill (1979), existing scales were adopted in framing some of the measurement items (Li *et al.*, 2005, 2006; Koh *et al.*, 2007; Anuar and Yusuff, 2011; Cook *et al.*, 2011; Zu, 2009; Talib *et al.*, 2011; Manuj and Sahin, 2011; Sahay and Mohan, 2003, 2006; Chong *et al.*, 2011; Saad and Patel, 2006; Ou *et al.*, 2010; Bhagwat and Sharma, 2007; Chin *et al.*, 2004; Zhou and Benton, 2007; Sahay *et al.*, 2003; Srivastava, 2006). After framing the measurement items, it was checked for content validity. Content validity was assessed from five industry experts (director, operations; director, R&D; retired general manager, operations; senior manager, SC and purchase manager) and three academia (professor in statistics and two assistant professor from engineering education institute). After framing the questionnaire it was pretested from the same industry experts and academia. A pilot study was conducted with 35 manufacturing organizations. Data collected from 35 organizations were tested for mean, standard deviation, missing data, kurtosis and skewness and found within the range. Hence all the measurement items were kept as it is for large scale data collection. The research methodology adopted in this study is shown in Figure 1.

Data collection took six months and was collected from May 2013 to October 2013. Data were collected using web base mode and paper base mode. Single response was collected from each organization and all respondents were from the management level (senior, middle and lower management people), implying a high reliability of the responses received, as these managers have a wider domain (job responsibility) and administrative knowledge. Since this study has an SCM focus, the target respondents were the operations/manufacturing/purchasing/sales and distribution/materials – corporate executive and managers as these personnel were deemed to have the best knowledge in the SC area. The target industries primarily selected, namely, automobile, engineering industries, electrical and electronics, pharmaceutical, chemical and plastic industry, etc. The survey was confined to India only. Through rigorous follow-up, data were collected from 292 manufacturing organizations.

One of the concerns of the survey research is that the information collected from respondents might have a non-response bias. Test for non-response bias were undertaker to check for any significant difference between the early and late respondent (between those subjects who responded before and after the three months) considering the late respondent as non-respondents (Armstrong and Overton, 1977). The results of independent sample *t*-test showed no significant difference between two response waves ($p > 0.05$). Thus, it can be concluded that the non-response bias is not a cause for concern. Similarly, the results of independent sample *t*-test showed no significant difference between the data collected using web base and paper base mode. The one way ANOVA test was carried out to check for any significant difference as per ownership of the organization (Indian, foreign, multinational and public sector), type of organization (automobile, engineering, electrical and electronics, plastic and chemical, pharmaceutical and other), job position of respondents (senior management level, middle management level and lower management level) and found no significant difference at $p > 0.05$. In addition, a Harman's one-factor test was conducted because the data were collected from a single type of respondent at a single point in time. Provided that no one general factor accounts for the majority of covariance, no concerns arise regarding common method variance; the first factor accounted for 19.93 percent of total variance, implying no concerns.

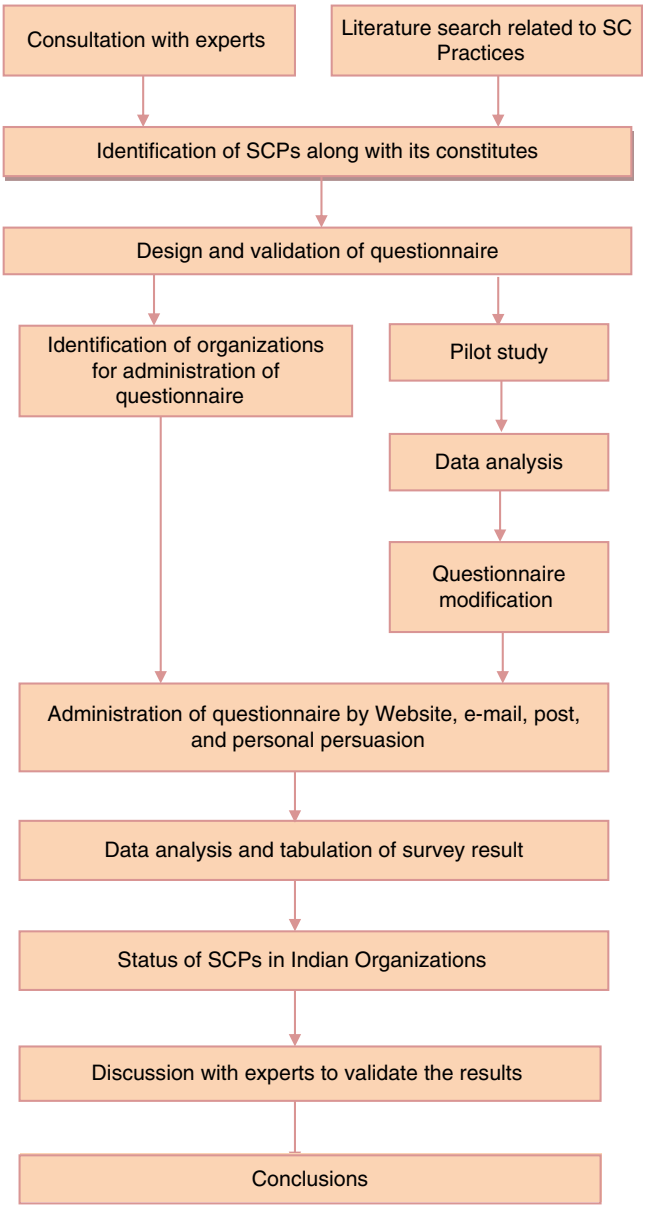

Figure 1.
Research methodology

The eight partially complete surveys that were deemed usable represent 2.74 percent of all surveys used for the final data analysis. All of the partially completed surveys contained 20 or fewer missing questions. The total missing data points accounted for less than 1 percent (0.062 percent) of all responses. Thus, missing data were not deemed a threat to the integrity of the main dataset. Missing data points were estimated and replaced by using the expectation maximization method in SPSS.

The reliabilities of data collected for all SCPs were assessed with construct reliability (CR). The factor analysis was used to calculate the path estimate for each measure of construct (SCPs). Further the value of path estimate was used to calculate the CR. The rule of thumb for a CR estimate is that 0.7 or higher suggests good reliability. Reliability between 0.6 and 0.7 may be acceptable provided that other indicators of a model's CR are good. (Hair *et al.*, 2010). The reliability values for all practices were found greater than 0.7, which are considered acceptable. The reliability of constructs was again evaluated by Cronbach's α. Values of Cronbach's α for each practices were found above 0.75 and overall Cronbach's α value found out to be 0.956 indicate adequate reliability of the measurement scales.

The data were analyzed using SPSS software. Descriptive statistical analysis has been done to analyze the data. The descriptive analysis displays univariate summary statistics for several variables in a single table and calculates standardized values and can be ordered by the size of their means (in ascending or descending order). By sorting the means in ascending order, the level of SCPs and vital practices implemented in the organizations were identified. The implementation statuses of each practice base on mean score were again validated from the panel of industry experts and academia.

4. Profiles of the respondents

The 292 valid responses were collected from the Indian manufacturing organizations. From the 292 responses, 23 percent respondents were from senior management level, 48 percent respondents were from middle management level. The rest of the respondents (29 percent) were from lower management level. Thus 71 percent of the respondents are from senior and middle level management level, implying a high reliability of the responses received, as these managers have a wider domain (job responsibility) and administrative knowledge. Similarly, 61 percent of the respondent organizations were Indian while 4 percent foreign, 31 percent multinational and 4 percent public sector organizations participated in the survey.

The type of organizations selected and their contribution in this study (percentage of respondent) is in line with higher contribution of these industries in the Indian economy and these organizations registered higher index of industrial production in the year 2013. Out of total responses, most respondents (36 percent) indicate their organizations are "automobile industry"; 15 percent of respondents were from "electronics and electrical industry"; 13 percent were from "Engineering industry" 12 percent of the respondents belong to "chemical and plastic," while 4 percent were from "pharmaceutical" sector. All these selected sectors are contributing large in the Indian economy (gross domestic product), so these sectors are selected for the present research. The rest (20 percent) respondents belong to the "other" category (namely, textile, capital goods, fast moving consumable goods, food processing, etc.). The trend in profit is the indication of the performance of organization in operations and finance. The 126 organizations registered 10 percent rise in profit over last three years while 90 organizations has registered a profit rise up to 10 percent. For the 63 organizations the profit over the last three years is almost same while 13 organizations registered a loss. The profile of the respondents is shown in Table II.

5. Results and discussion

There is significant disagreement among statisticians and others about interpretation of results of Likert scale. Some prefer treating the Likert scale as nominal-level

Demographic characteristics	Frequency (%)
Manufacturing sector	
Automotive	36
Electrical and electronics	15
Engineering (excluding automobile)	13
Chemical and plastics	12
Pharmaceutical	04
Other	20
Ownership	
Indian	61
Foreign	04
Multinational	31
Public sector	04
Position	
Assistant manager	09
Deputy manager	14
Manager	22
Senior manager	26
General manager	18
Director	08
CEO	03

Table II. Profile of respondents

measurement (reporting mode and percentage of responses). While some statisticians treat it as an ordinal or continuous measure (reporting mean and standard deviation). As per nature of this study and normality of data for each item, the mean score and standard deviation for each item is calculated. Since a score from 1 to 5 have been used to rate each performance measure, the weighted mean average score and mean standard deviation for each practice was evaluated. The mean score for each practice is calculated by averaging the score of each measurement item of individual practice. Considering 3.0 (average or neutral value) as the moderate value on the five-point Likert scale, the practices having the mean core below 3.0 are considered moderately less or least implemented practices. The practices having the mean score more than 3.0 are considered as moderately more implemented practices. As considering the mean score of 5.0 is completely arbitrary value, the mean score nearer to 5.0 (between 4.0 and 5.0) is considered as the highly implemented practices while the mean score nearer to 3.0 (between 3.0 and 4.0) are considered moderately implemented practices. The results of data analysis were again validated from validation panel comprises of five industry experts and three academia. The panel was asked to comment on each measure (based on mean score and standard deviation) in the context of the Indian manufacturing organization. The mean score for each measure of all the selected SCPs and corresponding standard deviation is shown in Table AI.

5.1 Highly implemented practices

The practices, namely, organizational culture, customer relationship, ICT, benchmarking and performance measurement, lean manufacturing, agile manufacturing, supplier relationship having the mean score above 4.0 and can say that these are highly penetrated practices in Indian manufacturing organizations.

5.1.1 Organizational culture. Research on organizational culture has been at the center of debates since the 1980s. Barney (1986) defines culture as "a complex set of values, beliefs, assumptions, and symbols that define the way in which a firm conducts its business." Barney (1986) maintains that culture can be a source of competitive advantage, and develop an increased performance. There are two dimensions of organizational culture. The first dimension is the organizational interest, and allows organizations that focus on the internal side (the well-being and the development of people in the organization). The second dimension is related to the collaborative relationship among the SC partners (Quinn and Rohrbaugh, 1983).

The "Organizational Culture" (Mean = 4.49, SD = 0.74) is very well penetrated in the Indian manufacturing organization. All the measures are well penetrated in Indian organizations (all mean score is found above 4.0). Sinha and Sinha (1990) and Sinha (1997) identified five social values that affect organizational effectiveness in India, namely, preference for personalized relationship, group embeddedness, duty and obligation over hedonism, hierarchical perspective, etc. Pearson and Chatterjee (2001) concluded that within the context of organizations, Indian employee can embrace global work values while retaining a deep connection to their societal culture. The dependence proneness of Indians is high. The dependency is based on a parent relationship wherein a junior member of a group is related to a senior member who in turn is related to his/her senior. So a vertical symbiotic relationship is created which is highly hierarchical with hardly any horizontal integration (Sinha, 1997). Personalized relationships and nurturance of subordinates is a typical in Indian culture. In India, a good leader is like a good father who accepts responsibility for the development and well-being of employees. In return, these leaders expect obedience and personal loyalty.

The strong organizational culture results in to higher job satisfaction among Indian organizations. Eskildsen *et al.* (2010) conducted survey to analyze job satisfaction within 22 countries, namely, Denmark, India, Norway, Brazil, Finland, the Netherlands, USA, Sweden, Germany, Russia, Estonia, China, Spain, Italy, Japan, Poland, Czech Republic, Great Britain, France, Ireland, Mexico and Hungary. Job satisfaction levels for all 22 countries are measured on a 0-100 scale where 0 indicates the lowest possible score and 100 the highest possible score. From the study it was found that Denmark (71) having the highest score and Japan has the lowest score (41). The Indian job satisfaction index was found 66 and ranks fourth among 22 countries. The Indian organizations share similar scores with the USA and the Netherlands.

Results of all the measures of "organizational culture" are discussed among the "validation panel" and consensus cannot be made on the same. There may be the possibility of a different penetration score if the same is recorded from management people, supervisory-level people and workers.

5.1.2 Customer relationship. Customer relationship comprises the entire range of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers and improving customer satisfaction (Li *et al.*, 2006). Tan *et al.* consider customer relationship management as an important component of SCPs. Good relationships with SC members, including customers, are needed for successful implementation of SCM programs. Close customer relationship allows an organization to differentiate its product from competitors, sustain customer loyalty and considerably widen the value it provides to its customers (Denkena *et al.*, 2006).

Customer loyalty is top most priority of every organization. In the market conditions of rising levels of product variety and customization, the ability to respond to customer orders in a timely manner can provide a competitive advantage over other organization (Zhang *et al.*, 2006).

Handling customer complaint effectively strengthens the relationship with the customer. The speed and effectiveness of a complaint handling is a part of responsiveness. If customer complaints are handled and managed properly, an organization can retain goodwill and gradually develop long-term relationships. Generally, achieving customer satisfaction indicates good reputation and image, and subsequently results in an increased market share (Ou *et al.* 2010). The cost of losing a customer is usually far exceeds the expenses of retaining the same customer. Most of the organizations are having a system to handle customer complaints. Any complaints arise at the customer end flows to production, quality and maintenance department of the manufacturer through the customer handling system.

The penetration of "customer relationship" (Mean = 4.48, SD = 0.83) is high in the Indian manufacturing organization. Fulfilling customer's needs and requirements has become essential for globalized organizations to ensure competitiveness. One of the most key practices for any organization is a customer relationship (Denkena *et al.*, 2006). Table AI shows that all the measures of customer relationship having a mean score above 4.0 except for customers jointly work with the suppliers to overcome difficulties (inventory management, delivery delay and logistics management) (Mean = 3.91). Managing the customer complaints and consistent efforts for the customer satisfaction has the highest mean (Mean = 4.70).

Everything organizations manufacture is for customer satisfaction (Denkena *et al.*, 2006). Though the manufacturer produces quality products, some chance of quality problems are always there. If organizations manage customer complaints and take regular feedback from the customer, subsequently customer satisfaction improves (Vos *et al.*, 2008). From the results of descriptive analysis, it is observed that Indian organizations are much focussed on solving the customer's problems and organizations having a strong organizational structure to evaluate customer satisfaction (Mean = 4.65) through regular evaluation of feedback received from the customers (Mean = 4.63). Indian organizations are enough flexible to respond to a variety of demands from customers (product mix, volume and delivery) (Mean = 4.45) through predicting future customer expectations (Mean = 4.53) and commitment to improve everything that customers suggest (Mean = 4.48). The results indicate that even though some measures were highly implemented (Mean > 4.00), but working with customers jointly with suppliers to overcome difficulties (inventory management, delivery delay and logistics management) having the mean below 4.0 (Mean = 3.91). The mean is just below the 4.0 but it may be due to lack of trust among SC members and these results are in line with the results obtained for the measure 5 and 6 of supplier relationship.

5.1.3 ICT. ICT is defined as a technology or a system that is used in coordinating and integrating information flows electronically throughout the SC network of trading partners and customers in both directions. ICT generates effective and efficient business transactions, quick access to information, allow better customer service, reduce paperwork, allow better communication, increase productivity and save time. Technology plays an important role in the success of SCM. Previously with no internet application, organizations having difficulty in obtaining information because they were

not able to receive or to send updates, feedback or other important information in a timely manner (Power and Simon, 2004). Now, due to advancement in ICT, organizations within SC routinely communicate with each other. The development of SCM requires that members of the SC should co-ordinate their production and logistics activities. This type of coordination can be facilitated by ICT, particularly when these technologies are used to span the traditional boundaries of SC organizations (Sanchez and Parez, 2001).

The "ICT" (Mean = 4.14, SD = 1.35) is well penetrated in the Indian manufacturing organizations. Though mean for this practice is high, but higher value of standard deviation shows the large opinion difference between the respondents. Most of the medium and large scale organizations in India are utilizing the advanced ICT software, namely, CRM, SCM and enterprise resource planning (ERP) software, electronic data interchange (EDI) to provide high-quality data and information among the SC partner (Mean = 4.45 and 4.36). Along with this, India is taking the advantage of ICT and employed it extensively in all areas of the economy in order to upgrade manufacturing, as well as services, to compete effectively in the world economy.

The ICT is extensively used for e-procurement (electronic procurement). E-procurement is the business-to-business or business-to-consumer or business-to-supplier purchase and sale of raw material, semi finish and finished products through the information and networking systems, such as EDI and ERP. The use of ICT for purchasing activity (Mean = 4.25) and fund transfer (Mean = 4.14) in association with the purchasing activity is having the mean well above 4.0 and can be concluded that these measures having higher penetration in Indian manufacturing organizations.

The "validation panel" concludes that the financial constraints are a key barrier to use the advanced information systems to track and/or expedite shipments (Mean = 3.91, SD = 1.53) and direct computer-to-computer links with key suppliers for day to day information sharing (Mean = 3.74, SD = 1.63). Cost considerations are the prime challenges to support the requirements of ICT. Large amount of financial resources is needed for redesigning internal organizational and technical processes and training of staff to achieve efficient tracking system and extension of ICT to most of the suppliers (Motwani *et al.*, 2000). Cragg *et al.* (2002) reported that lack of resources inhibits organizations to adopt these systems.

5.1.4 Benchmarking and performance measurement. Performance measurement is the key issue in every organization. Measuring the organizational performance stimulates to continuous improvement, improves and enhances the process of SC, provides necessary information for management feedback, diagnose and solve the organizational problems.

Neely *et al.* (1995) define performance measurement as the process of quantifying the effectiveness and efficiency of action. Effectiveness is the extent to which a customer's requirements are met and efficiency measures how economically an organization's resources are utilized when providing a pre-specified level of customer satisfaction. Neely *et al.* (1995) identified a number of approaches to performance measurement, including: the balanced scorecard (Kaplan and Norton, 1992); the performance measurement matrix (Keegan *et al.*, 1989); performance measurement questionnaires (Dixon *et al.*, 1990); criteria for measurement system design (Globerson, 1985).

The "Benchmarking and Performance Measurement" (Mean = 4.14, SD = 1.06) is very well penetrated in the Indian manufacturing organization. The mean for the performance measurement (first five measures) is 4.15 and can be concluded that the

organizations are measuring the internal performance, supplier performance and customer performance effectively.

Over the last few years the benchmarking concept is becoming more popular, benchmarking is nothing but to compare an organization's business practices and performance with those of a group of comparable firms, or with those of firms that are recognized for their excellence. Benchmarking is a popular tool which is used universally to improve organizations' performance and competitiveness in business (Gosselin, 2005). The mean for the benchmarking (last two measures) is 3.89 and can be concluded that the Indian manufacturing sector is still in the early stage, but there is a positive attitude toward adoption of benchmarking concepts.

The major problems (as per discussion with experts) are identification of suitable benchmarking partner, lack of resources and confidentiality problems were judged to be serious problems. The essence of benchmarking rests on learning from others (benchmarking partners). Despite sharing information as benchmarking, there seems to be the confidentiality fear among Indian manufacturers. This has discouraged the prospective organizations to initiate a benchmarking project. It appears that there is a lack of awareness of means to overcome confidentiality fear. There was a belief among Indian managers that their products and processes are unique and therefore, it was not possible to benchmark with competitors.

5.1.5 Lean manufacturing. Lean means manufacturing without waste. Waste is anything other than the minimum amount of equipment, materials, parts and working time that are absolutely essential to production while delivering quality products to the manufacturer and the consumer at the lowest cost. The lean approach is focussed on systematically reducing waste in the value stream. The waste concept includes all possible defective work/activities, not only defective products. Waste can be classified in eight categories, namely, motion, waiting, correction, over-processing, over-production, transportation, inventory, knowledge. Lean strategy produces higher levels of quality and productivity and better customer responsiveness (Krafcik, 1998; Nicholas, 1998). The empirical evidence revealed that impact of lean strategy improves the organization's competitiveness (Oliver *et al.*, 1996; Doolen and Hacker, 2005). It is worth mentioning that the impact of lean thinking is an important strategy not only in manufacturing but also for the entire SC.

The "Lean Manufacturing" (Mean = 4.13, SD = 1.19) practice is very well penetrated in the Indian manufacturing organization. Ghosh (2012) concluded that approximately 80 percent of the Indian manufacturing organizations have implemented many dimensions of lean, namely, focus on customer needs, set-up time reduction, total productive maintenance, supplier performance, statistical process control and cross-departmental problem solving.

The expert panel constructed for the validation of survey results emphasizes that the high volatility in the market and shortened product life cycle makes difficulty in operating pull environment in Indian manufacturing organizations. The same fact is reflected in the present study. The mean score for measure "organization uses a pull production system" having the least score (Mean = 3.36) and rank lowest among the all measures of "lean manufacturing."

5.1.6 Agile manufacturing. Now a day, the customer wants a variety of products in very short span of time (Maskell, 2001). The customer can be satisfied by adopting agile manufacturing. Agility is a business concept lie in flexible manufacturing systems (FMS). Flexibility is ability to rapid change as per customer demand that leads to

product or volume mix (Christopher and Towill, 2000). The ability to rapid changeover on a manufacturing line, from one product to another, is a key pre-requisite for increased flexibility, lead time reduction and responsive manufacturing (Mileham *et al.*, 1999). More flexibility in manufacturing operations means more ability to move with customer needs, respond to competitive pressures and be closer to the market (Slack, 2005). Flexibility increases the range of products available, improving a firm's ability to respond quickly and achieving good performance through providing a wide range of products (Zhang *et al.*, 2006). Various typologies of flexibility have been proposed by different researchers. Slack (2005) described five types of flexibility (new product, product mix, quality, volume and delivery). Vokurka and O'Leary-Kelly (2000) presented 15 (machine, material handling, operations, automation, labor, process, routing, product, new design, delivery, volume, expansion, program, production and market). Lummus *et al.* (2003) developed a conceptual model of SC flexibility, namely, operational systems, logistics processes, supply network, organizational design and information system manpower flexibility.

The "Agile Manufacturing" (Mean = 4.10, SD = 1.07) practice is very well penetrated in the Indian manufacturing organization. Due to shorten product life cycle and customer demand, the Indian organizations are operationally responsive by adopting the latest technologies, namely, CAD, CAM, FMS, rapid prototyping, FEM, etc. Second, the supply side of Indian organization is strong and having higher supply network flexibility. Last measure "organization's operations system rapidly reallocates people to address demand changes" having the mean score less than 4.0. Most of the time it is very difficult to develop multi skill labor in an organization and it is difficult to reallocate the people to achieve the flexibility.

5.1.7 Supplier relationship. The literature is strongly suggestive that firms should seek to develop long-term stable relationships with key suppliers (Stuart, 1997; Vollmann and Cordon, 1998). This practice takes several forms. First, when firms develop their product, they can involve their strategic suppliers in these processes (Dyer and Singh, 1998). Second, it is a fair expectation that key suppliers should maintain high-quality standards of products and services (Verma and Pullman, 1998). Third, to complement the high degree of interaction between trading partners, the communication system would need to be able to ensure transparency in the information that is exchanged between the organizations and their key suppliers (Garcıa-Dastugue and Lambert, 2003). This would require that organizations should provide suppliers with information so that they can improve their quality and responsiveness. Fourth, it would be expected that suppliers become involved in the development of new products and that in order to ensure that the relationship remains fair and benefits resulting from cooperation with suppliers be shared with them (Ballou *et al.*, 2000). Lastly, joint problem solving and planning have been found to be positively associated with levels of trust and with organizational performance (Claro *et al.*, 2003). It has been shown in recent studies that organizational performance is linked positively to practices consistent with involvement of suppliers in organizations' operations (Scannell *et al.*, 2000).

Related to all measures discussed above, the results of survey research were analyzed to see the penetration of "supplier relationship" in Indian manufacturing organizations. The mean for this practice is 4.01 and standard deviation of 1.09. The Indian organizations frequently interact with suppliers to set quality, responsiveness and other standards (Mean = 4.31). Before globalization, cost was the important criteria

for selecting the suppliers. Throughout the 1990s the globalization has totally changed the working of all organizations (Christopher and Towill, 2002). In this era only, the organizations come to know that the service to customer with high quality, variety of product with reduces cost and quicker services are not possible without the efforts of suppliers. The Indian organizations are considered quality as the number one criterion in selecting suppliers (Mean = 4.28) and help their suppliers to improve product quality (Mean = 4.07). Similarly, organizations regularly solved problems jointly with their suppliers (Mean = 4.19), namely, training to workers for quality enhancement, collaborative planning and participation of suppliers in early product design. The discussions with panel of experts disclose that most of the Indian organizations having conflict resolution system which includes key persons from quality, development and finance department to resolve day to day problems with supplies.

The mean score of measures, namely, the active involvement of key suppliers in new product development/value engineering processes (Mean = 3.76) and inclusion of key suppliers in planning and goal-setting activities (Mean = 3.74) are found below the mean score of 4.0. As per the discussion with panel members, lack of trust among the SC members is the key barrier related to very close SC integration. The large scale organizations are having close link with suppliers, but till unwilling to participate the suppliers in the key business activities, namely, new product development and planning and goal-setting activities. The mean score for organizations having a separate vendor development department to audit and evaluate the day to day activities of the supplier having the lowest mean among all seven measures of supplier relationship practice (Mean = 3.74). In most of the organizations, instead of the separate vendor development department, the people from purchase, quality, development and finance department are looking the activities of vendor development. Any issues arising with suppliers are looking after by these people.

5.2 Moderately implemented practices

The practices, namely, outsourcing, information sharing, JIT manufacturing, GSCM is having the mean score above 3.0 but less than 4.0 and can say that these are moderately penetrated practices in Indian manufacturing organizations.

5.2.1 Outsourcing. Outsourcing is the use of resources outside the organization to perform tasks that are usually handled internally by the organization itself. Successful outsourcing is a powerful tool for organizations to gain competitive edge over other and the organization can focus on their core competencies (Khong, 2005). The outsourcing includes activities such as design, manufacturing, marketing, distribution and information systems, cleaning, catering and security, etc. (McIvor, 2000). Outsourcing can free up assets and reduce costs in the immediate financial period. The outsourcing reports significant savings on operational and capital costs and improves operational flexibility (Rimmer, 1991; Hendry, 1995; Uttley, 1993).

The "Outsourcing" (Mean = 3.88, SD = 1.67) is moderately penetrated in Indian manufacturing organizations. The larger value of SD shows large opinion differences among the selected measures. There are many other motivations for outsourcing activities by the manufacturing organizations in India. Like a strong supplier relationship (as discussed in Section 5.1) Indian organizations having reliable outsourcing partners. Beyond short-term cost savings, the outsourcing enables organizations to focus on core activities (Prahalad and Hamel, 1990). Due to outsourcing, organizations can concentrate

on operations of a small and manageable number of tasks at which the operation becomes excellent. As per discussion with validation panel, it is observed that Indian outsourcing partners are significantly more advanced or developed by parent organizations which allows organizations to exploit their more advanced technologies. Outsourcing also improves flexibility to meet changing business conditions, demand for products, services and technologies (Greaver, 1999), by creating smaller and more flexible workforces (Patterson and Pinch, 1995).

Another main reason for outsourcing in India is threat of labor unions. In the 1960s, 1970s and 1980s, frequent strikes and lockouts slowed India's industrialization, costing companies millions and causing the industry to abandon some states, namely, Kerala and West Bengal altogether. Now days, situations have improved, but organizations still hesitate to appoint the worker on a permanent basis, instead they are appointing diploma engineers, contract workers or outsource most of the activities to avoid the dominance of labor unions.

According to the validation panel members, the outsourcing has a significant advantage, but most of the organizations hesitate to outsource the key activities (mainly concern with unique design) to restrict the knowledge flow outside the organizations. Second, losing the proficiency to perform such business processes internal in the future because of lacking knowledge of the business processes, poor organizational communication, employee's fear of job lost and change are some of the major barriers for a higher level of outsourcing.

5.2.2 Information sharing. Information sharing is the most essential and common element in any integration and collaborative effort between two organizations (Yigitbasioglu, 2010). To maintain the inter-organizational relationship, the organization must share the complete, accurate, quality, relevant, ease to access information and data with minimum distortion information with the SC partners. Looking at the information flow direction, information sharing is a two-way communication between supplier, customer, distribution center, retailer, wholesaler, etc. In addition, information also shared within the manufacturing firm such as production, quality, panning, inventory data, etc. (Li *et al.*, 2006).

The "information sharing" (Mean = 3.81, SD = 1.24) is moderately penetrated in the Indian manufacturing organization. The Indian organizations frequently contact and communicate with trading partners and informed their trading partners in advance of changing needs and having the highest mean of 4.30 and 4.04.

The measures, namely, "information sharing with trading partners to keep each other informed about the events or changes that may affect business" (Mean = 3.87), "information sharing with trading partners that help the establishment in future planning" (Mean = 3.79) and "trading partners are fully informed about the issues that affect the business" (Mean = 3.73) having the mean below 4.0. In most of the organizations, managers dealing with SC do not realize the real benefits of information sharing and do not have confidence in information sharing system (Marsh and Flanagan, 2000). Lack of leadership and managerial direction for information sharing makes the implementation of information sharing extremely difficult. Curry and Moore (2003) suggested that, in order to achieve an information sharing culture, support of senior management is required. Organizational barriers are also responsible for limited information sharing among SC partners. Organizational barriers are those barriers that are originated from organizational structure and attitudes of the organizational people toward the implementation of information sharing. Normally, the organizations and

individuals resist the changes because of structural conflicts and managerial practices of different organization in SC. In most of small and medium scale Indian organizations, the individual barriers plays vital role in the information sharing. Individuals are more willing to share information when they are happy in their organizations. Unsatisfied individuals always hesitate or refuse to share information. Szulanski (1996) reported that one of the major barriers for sharing information is lack of motivation that can lead to many different obstructions for information sharing. Individuals feel that, power, ownership and privilege of possessing crucial information are lost when they share the information. Some employers regard information as a symbol of power (Kolekofski and Heminger, 2003).

The information sharing related to proprietary information (Mean = 3.53) and business knowledge of core business processes (Mean = 3.43) having the lowest mean among the seven measures of information sharing. The members of the validation panel agreed that they are concerned about the misuse of shared information. The proprietary information shared with SC partners may be either intentionally or unintentionally revealed to competitors. The top management people of Indian organizations are assuming that the Indian bylaws are not enough strong to protect the design and development activities of an individual organization.

5.2.3 JIT manufacturing. The JIT philosophy of production is based on the assumption that inventory levels can be kept to an absolute minimum level, even to one unit, by meeting the customer orders just at the time they arise and by improving quality levels with zero defects (Savsar, 1997). JIT implies pull production instated of push production and uses Kanban cards for the same. Implementation of JIT can produce significant benefits for manufacturing firms; such as, minimizing levels of inventory, responsiveness and improving relationship with suppliers (Salaheldin, 2005).

The "JIT Manufacturing" (Mean = 3.61, SD = 1.39) practice seems to be moderately penetrated in the Indian manufacturing organization. Garg *et al.* (2001) has identified problems in JIT implementation in Indian context. These include poor quality of incoming material, non-receipt of delivery by the buyer of exact quantity on exact time, little workers' motivation, unreliable transportation system, etc. Garg *et al.* (2001) found "work culture" a critical element if an organization wants to implement JIT. According to them, work culture in JIT includes various dimensions as multifunctional workers, long-term employment motivation and trust, top management attitude and commitment, support from union leaders, effective communication, poka yoke inspection method and incentive scheme.

Singh and Garg (2011) compared the Japanese and Indian JIT culture on various dimensions. The concluding remarks of comparisons are as follows.

People. Work culture in JIT includes multifunctional workers, long-term employment motivation and trust, top management attitude and commitment, support from union leaders, effective communication, poka yoke inspection (Matson and Matson, 2007). The Japanese worker is more literate than his Indian counterpart. The Japanese workers are cross-trained and multifunctional, whereas the Indian worker is specialized in one particular task. Japan is having a highly homogeneous society, whereas Indian society is divided in caste, cultural and religious differences.

Plant and equipment. Automation in Japan is very high, whereas Indian industry is labor intensive. Most of the Japanese organizations having a FMS. The Indian organizations use the traditional processes, product or job layout. Most of the

organizations in Japan have their own toolmakers to build their machines, but in India very few organizations have self-manufactured machines.

Process. In Japan, workers and foreman have primary responsibility for quality. In India it is the quality control department that checks the quality. Indian organizations use "Material Requirement Planning" (MRP) for production management, whereas Japanese organizations use Kanban. The MRP is a push system and Kanban is a pull system. The Japanese system uses preventive maintenance, but 100 percent preventive maintenance is absent in India.

Supplier proximity. One important reason is the closer physical and business relationship between Japanese firms and their suppliers. For example, they are physically closer (because Japan is smaller) and this fact expedites delivery. The poor infrastructure facilities in India dominate the JIT manufacturing in Indian organizations (Chandra and Kodali, 1998).

5.2.4 GSCM. GSCM is defined as the process of using environmentally friendly input and transforming these inputs into outputs that can be reclaimed and re-used at the end of their life cycle thus, creating a sustainable SC. Sustainable development means development that meets the needs of the present without compromising the ability of future generations. Sustainability covers three aspects: economic, environmental and social responsibility. Organizations including sustainability in their strategy have measures in place in order to improve the organization with respect to all three aspects. We looked at the environmental aspect of sustainability when studying SC, thus using the term "GSCM."

The "GSCM" practice (Mean = 3.59, SD = 1.73) seems to be moderately penetrated in the Indian manufacturing organization. Though the most of Indian organizations are ISO 14000 certified (Mean = 4.01) but the other measures of GSCM are not deeply penetrated in Indian manufacturing organizations. With panel discussion, it was observed that the export and sales of raw material or finished product to foreign customers is a major driver for improving the environmental performance of enterprises in India. Indian enterprises have started to experience pressures from green barriers when exporting their commodities. Other factors for adoption of GSCM are laws and regulations, to differentiate oneself in a competitive industry by being environmentally friendly and lastly implements GSCM to stay competitive if competitors already have adopted GSCM.

For deep penetration of GSCM practice, the mindset of people has to be changed. Organizations should spontaneously implement GSCM for social cause and not by the external pressure. Following major challenges are observed while discussing with the validation panel members supported by the previous literature.

Resistance to technology advancement adoption. For successful GSCM, organizations have to change their set-up form traditional technology with latest technology (Luthra *et al.*, 2011). During this transition, there is always resistance of organizations to technology advancement adoption. This is especially true when there are changes in the core features of organizations, namely, organizational goals, forms of authority, core technology, operational strategy and market strategy.

Lack of organizational encouragement. Training and education are the prime requirements for achieving the successful implementation of GSCM in any organization (Ravi *et al.*, 2005). For most of the organizations, it is observed that supervisors and workers are getting less training than management people. For successful GSCM, management may encourage employees to learn green information.

Organizations may provide rewards for green employees. Employees may be helped when they face green problems and may be provided support to learn green manufacturing (Hsu and Hu, 2008).

Lack of government support systems. Government strict regulation can encourage the adoption of GSCM (Scupola, 2003; Luthra *et al.*, 2011). In India, the state pollution control board is responsible for monitoring the environmental management in the organizations. Lack of manpower with board, excess work, poor infrastructure, political pressure and corruption hinder the appropriate control over the organizations.

Lack of top management commitment. Top management support and commitment is necessary for any strategic program success (Zhu and Sarkis, 2007; Mudgal *et al.*, 2010). Top management support is especially useful for environmental practices such as GSCM. Top management has significant ability to influence, support actual formation and implementation of green initiatives across the organization (Sarkis, 2009). Top management provides continuous support for GSCM in the strategic plans and action plans for successfully implementing them (Ravi *et al.*, 2005).

Cost implications. Usually, high cost is a big pressure in GSCM as compared to conventional SCM. The initial investment requirement by green methodologies such as green design, green manufacturing, green labeling of packing, etc. is too high. Engaging in environmental management involves two types of costs, direct cost and transaction cost. Both types of costs are likely to constitute a significant barrier to implementing GSCM (Al Khidir and Zailani, 2009). IT enablement, technology advancement, hiring good quality of employees, motivating and training of employees toward GSCM, development of green suppliers will require high-initial investment. Therefore, cost implication is a major barrier to implement efficient GSCM in Indian industry.

Unawareness of customers. A major barrier of GSCM seen in Indian industry is lack of awareness of customers about the benefits of green products. Customer demands become the most crucial type of external pressure. Customer's awareness means if a customer demands green products; the organizations have to be innovative and change the technology. In the Indian market, due to unawareness of customers toward green product benefits, producers are producing non-green products. In USA, 80 percent of people would be willing to pay more for environmentally friendly products (Lamming and Hampson, 1996), while Indian consumers are very cost conscious. As there is always cost differentiation for production of green and non-green product, the non-adopters of GSCM may benefit than the adopters in Indian market.

5.3 Least implemented practices

The practices, namely, reverse logistics, postponement, VMI, RFID is having the mean score less than 3.0 and can say that these are least penetrated practices in Indian manufacturing organizations.

5.3.1 Reverse logistics. Reverse logistics stand for all operations related to the reuse of products and materials. It is the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal (Guide *et al.*, 2000).

The "reverse logistics" (Mean = 2.61, SD = 1.92) is least penetrated practice in the Indian manufacturing organization. The discussion with panel members reveal the following challenges while implementing reverse logistics in Indian manufacturing organizations.

Lack of awareness about reverse logistics. The lack of awareness of benefit of reverse logistics is a major barrier for its implementation. No education and training is provided to the customer either by the organizations or by the government. No collection facilities for end of life products, packaging is provided by the organizations.

Financial constraints. Cost considerations are a prime challenge in commercial recycling. Organizations require allocation of funds and other resources for the implementation of reverse logistics. ICT requires more funds because without these, the returns product tracking and tracing and product recovery is not possible in the present environment. The training of personnel related to the reverse logistics is also very important for efficiently managing and eventually making the reverse logistics profitable. However, all these require financial support.

Problems with product quality. The product quality is not uniform in reverse logistics compared to the forward logistics. Customers usually expect the same level of quality of product from the manufacturer regardless of the nature of the returned product. The returned product quality could be in any range; like that it could be faulty, damaged or simply unwanted by the customer. Organizations cannot compromise on quality to maintain its reputation in the market.

Inadequate ICT systems. An efficient ICT is much necessary for supporting the reverse logistics during various stages of the product life cycle. Efficient information systems are needed for individually tracking and tracing the returns of the product, linking with the previous sales. IT, software and hardware, are essential for end-to-end control and transparency along the reverse chain (Ravi *et al.*, 2005).

Legal issues. Under Indian regulations, excise paid goods once sold by the manufacturer cannot be brought back to the plant without prior documentation and declaration to excise authorities. This is a very cumbersome and time consuming process and non-compliance may mean that the manufacturer will have to face legal actions. Most organizations find this policy as a hurdle in applying the reverse logistics.

Limited forecasting and planning. Accurate return forecasts are hardly available. These include the requirement of a convergent structure of network from many sources to a few demand points, high degree of uncertainty in supply both in terms of quantity and quality of used products returned by customers, and uncertain end markets for recovered products. The uncertain timing and quality of returns, the need to balance returns with demands, and the uncertainty in materials recovered from returned items are also some of the complicating characteristics impacting production planning and control for remanufacturing (Guide *et al.*, 2000, 2003).

Cooperative behavior of chain members. The cooperative behavior of chain members is desired for sharing of information. Important barriers to the reverse logistics are reluctance of the support of the dealers, distributors and retailers toward the reverse logistics activities.

5.3.2 Postponement. Dynamic and intensely competitive markets have forced enterprises to shorten product life cycles and provide product variants. Both quick response and reliable delivery times are increasingly emphasized. These pressures lead to difficulties of effectively matching supply and demand and drive organizations to develop strategies to deal with drastic and unpredictable changes. Mass customization and agility are often proposed as such strategies (Yang *et al.*, 2004). To achieve mass customization and/or agility, many approaches have been proposed and postponement is widely considered as an important way of achieving them (Feitzinger and Lee, 1997; Van Hoek *et al.*, 1999; Yang *et al.*, 2004).

Postponed manufacturing is a specific combination of the three generic types of postponement introduced by Bowersox and Closs (1996): form, time and place postponement. Form postponement refers to the postponement of final manufacturing or processing activities; time postponement refers to the delaying of the forward movement of goods until customer orders have been received; place postponement refers to the positioning of inventories upstream in centralized manufacturing or distribution operations to postpone the forward or downstream movement of goods. Postponed manufacturing opposes push systems in which goods are manufactured entirely in anticipation of future customer orders and stored downstream, even though no customer has formulated any specification. Frequently the combination of three areas of postponement allows for customer service enhancements through customization and operating cost savings through lowered inventory carrying costs. Postponement brings several advantages to enterprises. First, inventory can be held at the generic level so that there will be fewer stock-keeping variants and thus less total inventory. Second, the generic nature of the inventory means it has more flexibility, that is, the same components or modules can be used in various end products. Third, forecasting is easier at the generic level than at the level of the finished item, and this advantage is especially significant in global markets.

The penetration of "postponement" practice (Mean = 2.63, SD = 1.94) seems to be below average and can say that this is least penetrated practice in the Indian manufacturing organizations. Since the postponement often involves a fundamental redesign of decade-old manufacturing processes, its implementation can be challenging. However, this can be accomplished through an incremental implementation strategy (Yang *et al.*, 2004). Ensuring proper alignment across the organization, as well as with suppliers and customers, is one of the most significant challenges organizations face when implementing postponement. External collaboration with suppliers and consumers is critical for the success of postponement. If suppliers cannot respond to the changes as a result of postponement, and if the product design is not tailored to customer requirements, postponement can result in cost overruns and increased lead times. The foundation of every successful postponement implementation is organizational readiness. If management is not willing to take risks, implement significant changes and monitor adjusted metrics, they will be less likely to reap the benefits of postponement (Yang *et al.*, 2004).

The experts validated the survey results related to postponement strategy and concluded that the customization of product is the most significant challenge in the implementation of postponement. For the automobile industry, this strategy is suitable, but for most of product, it is difficult to customize the product and set the postponement strategy. Other challenges discussed for postponement strategy are as follows:

- inability to recognize where postponement is most effective;
- belief that technology does not support implementation;
- lack of organizational alignment;
- postponement consumed too much management time;
- postponement is too complex to implement, since it often involves changing decade-old manufacturing processes; and
- postponement too costly to implement.

5.3.3 VMI. VMI is an approach for a customer-supplier relationship, according to which the supplier/vendor decides appropriate inventory levels of each product (as per previous agreement). The supplier monitors the buyer's inventory level and according to sales forecasts, makes periodic replenishments (Danese, 2006). VMI provides a win-win situation for both buyer and supplier (Kumar and Kumar, 2003).

The "VMI" practice (Mean = 2.56, SD = 1.76) seems to be least penetrated in the Indian manufacturing organizations. VMI concept is well recognized in the retail industry, but its penetration is quite low in manufacturing organizations. As per discussion with panel members it was observed that, the location of suppliers plays vital role in the success of VMI. The location of suppliers in India is widespread and difficult to replenish inventory when required. The second issue is who will take the financial burden of inventory? Most of the suppliers assume that the big organizations dominate the SMEs and transferred the financial liabilities of inventory at the supplier side.

In order for the supplier to be able to manage the inventory, information about inventory levels, expected demand, promotional activities and product-related costs should be made available to the supplier by the buyer (Barratt, 2004). The early availability of such information enables the supplier to be pro-active (Kaipia *et al.*, 2002), which should result in reduced lead times. Accurate and timely demand information need to be shared between the marketing and supply functions of the buyer as well as with the planning function of the supplier. Most of the time, it is observed that organizations are reluctant to share confidential data and information with their suppliers. Resistance to information sharing with suppliers seriously influences the development VMI. As discussed in Section 5.2, Indian organizations are not keen to share vital information with suppliers and results in to failure of VMI.

Another barrier to the success of VMI is ICT infrastructure. For real time information sharing with suppliers, strong ICT linkage between buyer and suppliers are necessary. Financial constraints are a key barrier to develop direct computer-to-computer links with key suppliers for day to day information sharing (as discussed in Section 5.1). Cost considerations are the prime challenges to support the requirements of ICT. The large amount of financial resources is needed for redesigning organizational and technical processes and training of staff to adopt the supplier base ICT.

Threats of information security, resistance to change, fear of SC breakdown, fear of the information sharing breakdown, lack of funds to built supplier base ICT, lack of trust and faith in SC linkages, geographical location of suppliers, disparity in trading partners over managing the inventory were vital barriers to implement and adoption of VMI.

5.3.4 RFID. RFID provides an alternative to bar code identification systems and it is being gradually adopted and deployed in a wide area of applications (Lee and Park, 2008) including manufacturing, transportation, distribution, warehousing inventory, sales, marketing and customer service (Park *et al.*, 2010). RFID is a wireless technology that uses transmitted radio signals. The RFID tag is attached to the product in the initial stages of manufacturing that follows the product down the SC all the way to a retail setting, and finally into the hands of the consumer. There, it can again be scanned while in a box or crate, saving labor. In a retail business, the tag can serve as the price tag. Consumers can count on the tag for warranty information after purchase (Attaran, 2007).

For suppliers, retailers and consumers, RFID technology have numerous advantages over the prevailing bar code technology. Some of these benefits include improved accuracy in managing inventory, improved visibility of orders and inventory, reduced costs for logistical operations, improved customer service, improved security and improved efficiency of business operations (Koh *et al.*, 2007). Other benefits of RFID include automatic non-line-of-sight scanning, labor reduction due to increased automation, enhanced visibility of SC, improved asset tracking and inventory management, item level tracking, traceable warranties and targeted product recalls, improved reliability, quality control and regulation, improved utilization of resources, security against product shrinkage, durability and capacity to hold more information (Michael and McCathie, 2005).

The penetration of "RFID" (Mean = 1.16, SD = 1.81) is very poor in the Indian manufacturing organization. The higher value of standard deviation shows sarong disagreement related to this practice among the survey respondents. All the measures of "RFID" are having the mean score less than 1.5. The validation committee discussed the concern associated with the adoption of this practice and revealed that the implementing RFID in the organization is too costly. Very few organizations have implemented the RFID and very less motivation is coming from these organizations for adopting this technology. Second, people may take a long time to understand and trust the technology because it is relatively new to them. Other concerns discussed are software and equipment costs, lack of standards, resistance to cooperation among different layers in the SC required to maintain information transparency, interferences that thwart signal transmission between tag and reader, and privacy concerns. RFID poses potential security concerns to users when the communication between the tags and the reader is exposed to SC partners. Security concerns may arise regarding the compromise of data during wireless transmission, the storage of data, and the physical security of the storage site (Michael and McCathie, 2005).

6. Conclusion and scope for future work

Industries have been the backbone of economic growth in driving national development. Organizations can gain competitiveness by increasing the productivity of manufacturing operations and fulfilling the changing needs of customers and employees. Thus, the manufacturing organizations must not only become increasingly advanced in their manufacturing process, but also improve their overall SC by strengthening the SCPs. Through literature review, the 15 SCPs were identified. The results of this work will enable the organizations to identify and direct their focus on the areas that requires improvement. Also, the organizations will become more aware of the SCPs that will help increase their performance and competitiveness. With best SCPs, organizations will be able to improve their business performance and expand their assets, providing work opportunities, and indirectly boosting the growth and contribute to India's economic development.

A comprehensive literature review was conducted to form the foundation for developing an initial list of measurement items of each component of the constructs in this study. Data were collected using web-based mode and paper-based mode. Through rigorous follow-up, data was collected from 292 manufacturing organizations. The data were analyzed using SPSS software. Descriptive statistical analysis has been done to analyze the data. By sorting the means in ascending order, the level of SCPs and vital practices implemented in the organizations were identified.

The implementation status of each practice base on mean score is again validated from the panel of industry experts.

The practices, namely, organizational culture, customer relationship, ICT, benchmarking and performance measurement, lean manufacturing, agile manufacturing, supplier relationship having the mean score above 4.0 and can say that these are highly penetrated practices in Indian manufacturing organizations. The mean score and standard deviation of highly implemented practices are shown in Table III.

The practices, namely, outsourcing, information sharing, JIT manufacturing, GSCM is having the mean score above 3.0 but less than 4.0 and can say that these are moderately penetrated practices in Indian manufacturing organizations. The mean score and standard deviation of moderately implemented practices are shown in Table IV.

The practices, namely, reverse logistics, postponement, VMI, RFID is having the mean score less than 3.0 and can say that these are least penetrated practices in Indian manufacturing organizations. The mean score and standard deviation of least implemented practices are shown in Table V.

This study is an effort to investigate the current level of SCPs implemented in Indian manufacturing organizations. The results clearly showed that the Indian organizations also fall short of some practices which may help them to be more competitive. The Indian organizations should harness the benefits of highly implemented practices. Indian organizations are having strong organizational culture which results in to the

Table III. Highly implemented practices in Indian manufacturing organizations

Sr. No.	Supply chain practices	Mean	SD
1.	Organizational culture	4.49	0.74
2.	Customer relationship	4.48	0.83
3.	Information and communication technology	4.14	1.35
4.	Benchmarking and performance measurement	4.14	1.06
5.	Lean manufacturing	4.13	1.19
6.	Agile manufacturing	4.10	1.07
7.	Supplier relationship	4.01	1.09

Table IV. Moderately implemented practices in Indian manufacturing organizations

Sr. No.	Supply chain practices	Mean	SD
1.	Outsourcing	3.88	1.67
2.	Information sharing	3.81	1.24
3.	Just in time manufacturing (JIT)	3.61	1.39
4.	Green SCM	3.59	1.73

Table V. Least implemented practices in Indian manufacturing organizations

Sr. No.	Supply chain practices	Mean	SD
1.	Reverse logistics	2.65	1.92
2.	Postponement	2.63	1.93
3.	Vendor managed inventory (VMI)	2.46	1.76
4.	Radio frequency identification	1.16	1.81

healthy collaborative environment across the SC. The foreign organizations which want to set up the plants in India will be definitely encouraged with status of highly implemented practices.

The moderately implemented practices require very little efforts to strengthen their penetration by eliminating the barriers as discussed in Section 5. The practices, namely, reverse logistics, postponement, VMI, RFID is having the mean score less than 3.0 and can say that these are least penetrated practices in Indian manufacturing organizations. Except postponement strategy, other practices are new practices and can say that these practices are in the implementation phase in Indian organizations.

There is some limitation to the study due to collection of data entirely from manufacturing sector. Further study can be extended to see the of penetration practices applicable to service and agriculture sectors as these sectors plays broader role in the Indian economy than the manufacturing sector.

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Appendix

Sr. No.	Item descriptions	Mean	SD
Organizational culture			
1.	Top management is committed and supportive[a]	4.66	0.70
2.	Substantial autonomy in work execution	4.55	0.66
3.	Employees are open to new ideas and suggestions	4.54	0.72
4.	Mutual confidence and trust among employees	4.5	0.74
5.	Providing training and training resources to employees	4.41	0.81
6.	Seamless communication between top management and employees	4.38	0.81
7.	Managers having power, authority and autonomy	4.38	0.76
		4.49	0.74
Customer relationship			
1.	Management of customer complaints and customer satisfaction	4.70	0.72
2.	Measurement and evaluation of customer satisfaction	4.65	0.68
3.	Collection of feedback	4.63	0.67
4.	Prediction of future customer expectations	4.53	0.72
5.	Committed to improve the management of everything that customers suggest	4.48	0.85
6.	Quickly respond to a variety of demands from customers	4.45	0.9
7.	Jointly working with customers to overcome difficulties	3.91	1.25
		4.48	0.83
Information and communication technology			
1.	Use of information technology for information sharing	4.45	1.00
2.	Use of CRM, SCM and ERP software	4.36	1.30
3.	Use of electronic transfer of purchase orders and invoices	4.25	1.32
4.	Updating information technology with current business	4.16	1.20
5.	Use of information technology-enabled transaction (funds) processing	4.14	1.45
6.	Use of advanced information systems to track and/or expedite shipments	3.91	1.53
7.	Direct computer-to-computer links with key suppliers	3.74	1.63
		4.17	1.35
Benchmarking and performance measurement			
1.	Performance measurement system for organizational performance	4.27	0.99
2.	Procedure to ensure that corrective action after performance measurement	4.21	0.98
3.	Performance measurement system for monitoring customer satisfaction	4.2	1.06
4.	Performance measurement system for monitoring supplier performance	4.08	1.1
5.	Providing training and education to design and use of performance indicators	4.01	1.14
6.	Clear understanding of how to compare organization with competitors	3.92	0.85
7.	Performance measurement system for monitoring competitor performance	3.86	1.29
		4.14	1.06
Lean manufacturing			
1.	Continuous quality improvement program	4.58	0.72
2.	Preventive maintenance activities as per schedule	4.39	0.94
3.	Control of waste and scrap	4.34	1.00
4.	Training to employees to reduce set-up time	4.19	1.32
5.	Pushes suppliers for shorter lead time	4.07	1.14
6.	Use of jigs, fixtures and special tools	4.00	1.68
7.	Use of "Pull" production system	3.36	1.53
		4.13	1.07

(*continued*)

Table AI. Mean score and standard deviations for selected SCPs

Sr. No.	Item descriptions	Mean	SD
Agile manufacturing			
1.	Rapidly responds to changes in product volume	4.23	0.97
2.	Expedition of emergency customer orders	4.16	0.98
3.	Rapidly responds to changes in product mix	4.15	0.97
4.	Rapidly responds to changes manufacturing processes	4.08	1.04
5.	Rapidly responds to reallocate people	3.90	1.25
		4.10	1.07
Supplier relationship			
1.	Frequent interaction with suppliers	4.31	1.06
2.	Quality as the number one criterion in selecting suppliers	4.28	0.86
3.	Solving problems jointly with our suppliers	4.19	0.97
4.	Helping suppliers to improve product quality	4.07	1.02
5.	Active participation of key suppliers in new product development	3.76	1.25
6.	Inclusion of key suppliers in our planning and goal-setting activities	3.74	1.23
7.	Separate vendor development department	3.74	1.26
		4.01	1.09
Outsourcing			
1.	Level of outsourcing activity	4.02	1.64
2.	Outsourcing to focus on core competencies	4.01	1.65
3.	Reliable and committed outsourcing partners	4.00	1.67
4.	Improvement in customer service	3.96	1.64
5.	Grabbing the opportunity of emerging technology through outsourcing	3.92	1.64
6.	Decrease in inventory liabilities	3.90	1.72
7.	Success in diverting capital investment	3.27	1.76
		3.88	1.67
Information sharing			
1.	Frequent contact and communicate with our trading partners	4.30	1.11
2.	Informing trading partners in advance of changing needs	4.04	1.22
3.	Trading partners informed about the events or changes that may affect the business	3.87	1.19
4.	Exchange of information for establishing future planning	3.79	1.21
5.	Informed the trading partners the issues that affect the business	3.73	1.22
6.	Sharing of proprietary information	3.53	1.39
7.	Sharing of business knowledge of core business processes	3.43	1.36
		3.81	1.27
Just in time (JIT) manufacturing			
1.	Completion of daily schedule as planned	4.35	0.89
2.	Frequent deliveries	3.90	1.09
3.	Frequent shipments	3.69	1.31
4.	Changes in production schedule to sudden production stoppages	3.63	1.36
5.	Supply to customers on short notice	3.61	1.28
6.	Small lot sizes	3.48	1.43
7.	JIT deliveries	3.43	1.5
8.	Kanban pull system	2.75	1.73
		3.61	1.39

Table AI. (*continued*)

Sr. No.	Item descriptions	Mean	SD
Green SCM			
1.	ISO 14000 certification	4.01	1.67
2.	Training related to environmental issues	3.83	1.47
3.	Cooperation with customers for cleaner production	3.81	1.58
4.	Environmental guidance from customers	3.59	1.75
5.	Supply of design specification to suppliers	3.42	1.70
6.	Design the products for reduced consumption of material/energy	3.40	1.91
7.	Design the products for reuse and recycle	3.12	2.00
		3.59	1.73
Reverse logistics (RL)			
1.	Knowing life cycles of all products	4.03	1.57
2.	Use of backloads on transports	3.05	1.98
3.	Return of packaging or pallet systems	2.93	1.94
4.	Recovery of products and/or components for overhaul and remanufacture	2.20	2.03
5.	Education to customers to return end of life products	1.95	2.02
6.	Recovery of end of life products	1.48	1.97
		2.65	1.92
Postponement			
1.	Delay of ordering of raw materials till actual order	3.38	1.91
2.	Delay of value-addition till actual order	3.12	1.96
3.	Delay of product assembly activities till actual order	2.10	1.96
4.	Delay of product assembly activities until the last possible position	1.91	1.90
		2.63	1.93
Vendor managed inventory (VMI)			
1.	Information to vendors of demand changes	3.08	1.79
2.	Inventory data available to vendors	2.59	1.77
3.	Linking of vendors through ICT	2.49	1.8
4.	Actual usage/sales data available to vendors	2.45	1.78
5.	Vendor makes periodic replenishments	2.38	1.74
6.	Vendors manage some of the inventory	2.37	1.69
		2.46	1.76
Radio frequency identification (RFID)			
1.	Use of RFID technology to track finish goods	1.26	1.91
2.	Use of RFID technology production activities	1.25	1.86
3.	RFID provides control over raw material and finish goods inventory	1.21	1.83
4.	Use of RFID technology to track raw material	1.19	1.84
5.	Encouraging the suppliers to use RFID technology	1.12	1.78
6.	Availability of RFID data to suppliers/vendors	1.05	1.72
7.	Availability of RFID data to our wholesaler, retailer and customer	1.03	1.71
		1.16	1.81

Notes: [a]Measurement items are developed from the sources – Li *et al.* (2005, 2006), Koh *et al.* (2007), Anuar and Yusuff (2011), Cook *et al.* (2011), Zu (2009), Talib *et al.* (2011), Manuj and Sahin (2011), Sahay and Mohan (2003), Chong *et al.* (2011), Saad and Patel (2006), Ou *et al.* (2010), Bhagwat and Sharma (2007), Chin *et al.* (2004), Zhou and Benton (2007), Sahay *et al.* (2003), Demeter *et al.* (2006), Srivastava (2006)

Table AI.

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