CRITICAL SUPPLY CHAIN MANAGEMENT COMPONENTS: UNDERSTANDING THEIR LINKAGES AND IMPACT ON MANUFACTURING FIRM PERFORMANCE

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Abstract

In recent years, numerous approaches have been proposed to improve firm performance. In particular supply chain management has received considerable attention. This study empirically examines the extent to which supply chain management impact on the firm performance by clustering firms based on supply chain performance construct. Based on the review of literature relating to supply chain management components, supply chain performance and organizational performance constructs' items are identified and a conceptual model was framed and the hypotheses were empirically tested using Structural Equation Model (SEM) consisting of Confirmatory Factor Analysis (CFA) and Path Analysis. The findings from the structural equation model results support that there is a significant relationship with the supply chain performance and organizational performance.

Keywords: Supply chain management; Causal research, Supply chain performance clusters

1. INTRODUCTION

In the modern world competition is no longer between organizations, but among supply chains ('SCs'). Effective supply chain management ('SCM') has therefore become a potentially valuable way of improving organizational performance. However, the understanding of the why and how SCM affects firm performance, which areas are especially important and which are the important moderator effects is still incomplete. This paper thus analyses the impact of supply chain management components on the improvement of SC performance and in turn on organizational performance of manufacturing industries. This topic is important since enhancing the effectiveness and efficiency of SCM is a critical component of a firm's ability to achieve its superior performance. SCM have been identified as an important "tool" for firm and optimization techniques have become an integral part of organizational business processes. The structure of the paper is as follows: first, the importance of SCM and its potential influence on the performance is established and the moderating effects of supply chain performance support are discussed. The conceptual model is presented. Then the methodology (including the nature and source of data, sample and questionnaire) and results obtained are presented. The conclusion discusses the main implications of the research.

2. THEORETICAL BACKGROUND AND RESEARCH MODEL

The forthcoming paragraphs present various linkages among supply chain management components, supply chain performance and organizational performance.

Sundram et al (2011) have assessed the effect of supply chain management practices on supply chain performance by means of self-administrated empirical survey were used to collect data among 125 electronics Industries in Malaysia. Finding depicts that supply chain practice has positive relationship with supply chain performance and Thakkar et al (2008) have reviewed existing literature on supply chain practices of SMEs by review of around 77 articles from reputed journals on supply chain management and development of appropriate construct and propositions are proposed for SME enterprises. Finding shows that SCM would be better instrument for SMEs to identify and assess the better supplier and enhance their performance.

Vanichchinchai et al (2010) have explored the effect of total quality management practices on supply chain management practices and firm's supply performance by proposed a conceptual model and tested using SEM by data collected from 211 manufacturing industries located in Thailand. Finding depicts that total quality management practices having direct effect on supply chain performance and supply chain management practices having indirect effect on supply chain performance and Wisner (2003) has developed and empirically test the relationships among supplier and supply chain practices by SEM was applied to test the proposed model by collected data from manufacturing industries. Result reveal that supply chain management strategies have positive impact on organizational performance.

Yusuf et al (2012) have find out the relationship among agile supply chain, competiveness and business performance by data collected from the sample of 158 supply chain mangers has working in oil and gas industry located in UK and analyzed using correlation and one-way ANOVA. Finding revealed that supply chain agility having a significant and positive relationship with competiveness and business performance and Wong et al (2011) have studied the impact of supply chain practice and knowledge management (KM) capabilities on organizational performance by primary data collected using questionnaire were examined through SEM framework. Finding depicts that implementation of supply chain practices will have impact on knowledge management capabilities and in turn it will influence the organizational performance.

Sukati et al (2012) have explored the causality among supply chain strategy, supply chain practices and supply chain performance by means of sample collected via questionnaire from 200 managers working in Malaysia manufacturing industry and analyzed using multiple regression. Finding depicts that supply chain practice has effect on supply chain performance and supply chain strategy have weak effect on supply chain performance.
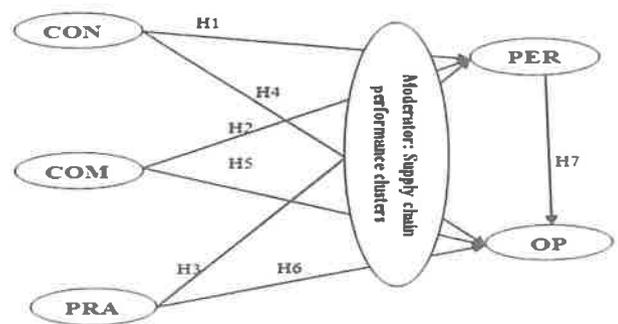
The research model in Fig. 1 was used to analyze the relationships between SCM and the performance and the supply chain performance clusters as moderators of this relationship

3. RESEARCH METHODOLOGY

This present study assumes both a descriptive and exploratory character since it aims to describe and organize information about the influence of SCM on performance of the manufacturing firms. This research builds upon earlier research conducted on these research constructs, the survey included questions about the key SCM components and their level of performance. A literature review, along with discussions and interviews with supply chain experts and practitioners, were used to confirm the questionnaire and the survey participants were asked with the five point item statement for all the five constructs. The data collection instrument used for this research is a well structured questionnaire. The sample population for this study consists of the manufacturing firms located in the Union Territory of Puducherry including Pondicherry, Karaikal, Mahe and Yanam. Sampling technique adopted in this research work is simple random sampling method and the sample size for the study was 255 manufacturing firms. The statistical tools used in this research work are cluster analysis and Structural Equation Model (SEM) modeling includes measurement and structural model.

4. RESULTS AND DISCUSSION

This section describes in length, the methodology applied by the researcher in conducting the proposed research work.

4.1 Segmentation of Manufacturing Undertakings based on Supply Chain Performance

Manufacturing units have been grouped based on their similarities among the two factors of lead time and inventory performance and responsiveness performance oriented supply chain performance. Cluster analysis has been applied to segment the manufacturing units based on the level of supply chain performance they possess on lead time and inventory performance and responsiveness performance. Final cluster centers have been displayed in Table 1.

Supply Chain Performance	Cluster		
	1	2	3
Lead Time and Inventory Performance	2.84(III)	2.95(II)	3.80(I)
Responsiveness Performance	2.12(III)	3.45(II)	4.23(I)
Average	2.48	3.2	4.02

Average2.483.24.02It can be observed from the above table that manufacturing units have been grouped into three clusters. The first cluster is designated as "low performance group" as the mean value regarding the supply chain performance in respect of this group is low when compared to the other two groups. The second group has been labeled as "moderate performance group" as their mean value hover in the middle of the five point scale. The mean value in respect of the third group float around the four mark in the five point scale, and hence this group can be referred to as "high supply chain performance group".

ANOVA values in respect of the three clusters regarding the supply chain performance factors are shown in Table 2.

Table 2: ANOVA

Supply Chain Performance	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Lead Time and Inventory	22.931	2	0.239	252	96.046	0.000
Responsiveness	68.347	2	0.211	252	323.200	0.000

It can be inferred from the above table that all

the three supply chain performance factors are playing strong role to bifurcate the manufacturing units into three groups. A brief description about these three supply chain performance groups is given below.

4.1.1 Low Supply Chain Performance Units

The supply chain performance level of this group is low in respect of all the supply chain performance related factors of lead time and inventory performance and responsiveness performance as the mean values are below the three mark in the five point scale. This cluster ranks the lowest in terms of the lead time and inventory performance and responsiveness performance, as well as the overall average. 18% of the 255 units (46) constitute this group.

4.1.2 Moderate Supply Chain Performance Units

The second cluster of manufacturing units with respect to supply chain performance factors is designated as "Moderate supply chain performance Units". This group has moderate level of supply chain performance on lead time and inventory performance and responsiveness performance factor, as the mean value of this group in respect of supply chain performance hover around the three mark in the five point scale, which is quite moderate. 46% of the 255 manufacturing units surveyed constitute this moderate group.

4.1.3 High Supply Chain Performance Units

The average means score values in respect of the three supply chain performance factors of this segment is 4.02. Since the mean hover around the four mark in the five point scale, this group can be designated as "high supply chain performance group". This group has high level of lead time and inventory performance and responsiveness performance. 36 percent of the manufacturing units surveyed constitute this group.

Number of manufacturing firms constituting each cluster is displayed in Table 3.

Table 3: Number of Cases in each Cluster

	1	46	18%
Cluster	2	117	46%
	3	92	36%
Valid		255	100%

It can be inferred from the above table that "high supply chain performance units" group and "moderate supply chain performance units" group account for more than three-fourth of manufacturing units surveyed (82 percent).

4.2 STRUCTURAL EQUATION MODELING (SEM)

Structural equation modeling (Partial Least Squares-PLS) was used to test the hypothetical model and evaluate the influence of the moderators over the variables. It involved estimating the measurements validity and reliability, structural parameters of the structural equation model, and testing the research hypotheses. Convergent validity indicates the extent to which the measures of a construct that are theoretical related are also related in reality. Convergent validity can be evaluated by inspecting the factor loadings of the measures on their respective constructs (Chin, 1998; Hulland, 1999), and the reliability of the measures can be assessed using composite reliability and average variance extracted (AVE).

Table 4 Factor loading of indicators for low, high and moderate supply chain

performance firms

Constructs	Low performance firms Factor Loadings	High performance firms Factor Loadings	Moderate performance firms Factor Loadings
Supply Chain Concerns	0.42-0.84	0.50-0.81	0.58-0.67
Supply Chain Competence	0.48-0.74	0.52-0.66	0.45-0.73
Supply chain Practices	0.49-0.80	0.55-0.82	0.53-0.71
Supply Chain Performance	0.41-0.71	0.56-0.83	0.46-0.78
Organizational Performance	0.66-0.81	0.63-0.76	0.52-0.69

Table 3 shows the results of the psychometric properties of the measurements. Most of the factor loading are satisfactory with the cutoff value above 0.7, except that the factor loading of two items are below the cutoff value but yet acceptable. Thus, overall measurement items have adequate item reliability. Similarly, for convergent validity (also referred to as composite reliability), the AVE should be at least 0.5 and the CR should be greater than 0.6 (Bagozzi and Yi, 1988). In all cases, the measurement model seems to have adequate convergent validity and reliability. Discriminant validity can be verified with the square root of the AVE for each construct higher than any correlation between this construct and any other construct (Fornell and Bookstein, 1982; Fornell and Larcker, 1981). As shown in Table 4, each construct shares a greater variance with its own measures than with any other construct. This reveals that each construct is more closely related to its own measures than to those of other constructs and thereby confirming the discriminant validity (Fornell and Bookstein, 1982; Fornell and Larcker, 1981). We discuss the current SCM and performance among manufacturing firms in Union Territory of Puducherry, India followed by the empirical results.

Table 5 Reliability and Validity analysis for Low, High and Moderate Supply Chain Performance Firms

Constructs	Low Supply chain Performance firms				High Supply chain Performance firms				Moderate Supply chain Performance firms			
	AVE	Composite reliability	R square	Cronbach's Alpha	AVE	Composite reliability	R square	Cronbach's alpha	AVE	Composite reliability	R square	Cronbach's alpha
Supply Chain competence	0.59	0.81		0.74	0.57	0.84		0.78	0.53	0.80		0.73
Supply Chain concerns	0.50	0.79		0.69	0.52	0.77		0.70	0.59	0.76		0.62
Organizational Performance	0.52	0.89		0.87	0.56	0.87		0.83	0.58	0.78		0.67
Supply Chain Performance	0.51	0.72	0.37	0.61	0.58	0.73	0.41	0.59	0.52	0.68	0.31	0.66
Supply Chain Practices	0.52	0.81	0.29	0.73	0.58	0.87	0.26	0.84	0.57	0.81	0.31	0.72

Table 6 Discriminate Validity for Low, High and Moderate Supply Chain Performance Firms

| Constructs	Low Supply chain Performance firms						High Supply chain Performance firms						Moderate Supply chain Performance firms					
	AVE	1	2	3	4	5	AVE	1	2	3	4	5	AVE	1	2	3	4	5
Supply Chain competence	0.59	**0.77**					0.57	**0.75**					0.53	**0.73**				
Supply Chain concerns	0.50	0.29	**0.70**				0.52	0.06	**0.72**				0.59	0.16	**0.77**			
Organizational Performance	0.52	0.29	0.57	**0.72**			0.56	0.48	0.36	**0.74**			0.58	0.32	0.33	**0.76**		
Supply Chain Performance	0.51	0.35	0.04	0.19	**0.71**		0.58	0.24	0.15	0.33	**0.76**		0.52	0.51	0.24	0.46	**0.72**	
Supply Chain Practices	0.52	0.28	0.12	0.24	0.49	**0.72**	0.54	0.37	0.25	0.45	0.50	**0.73**	0.57	0.49	0.23	0.42	**0.41**	**0.75**

4.2.1 Causal Model for Low supply chain performance manufacturing firms
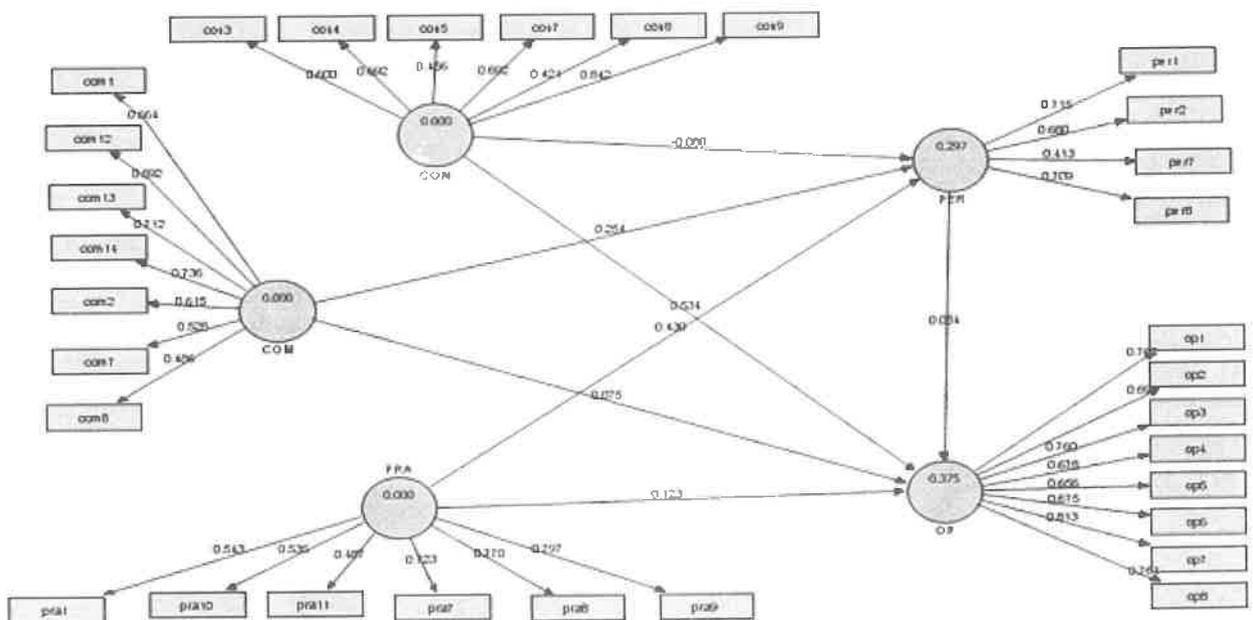
Supply chain competence and practices have significant positive relationship with supply chain performance and Supply chain concerns and practices have significant positive relationship with organizational performance. The R^2 values were 0.29 and 0.37 it indicates that the model explains a good amount of variance in supply chain performance and organizational performance of low supply chain performance based manufacturing industries.
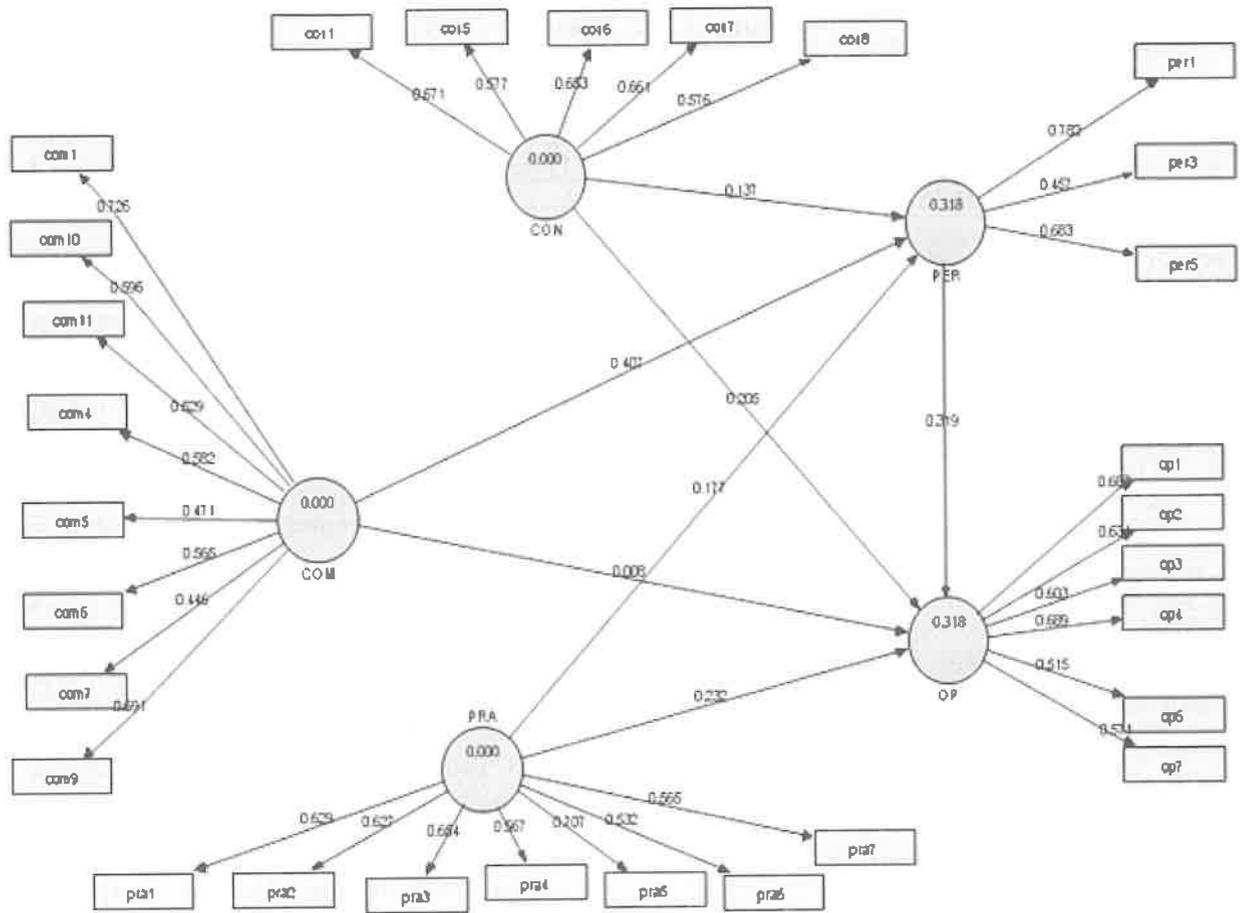
4.2.2 Causal Model for High supply chain performance manufacturing firms
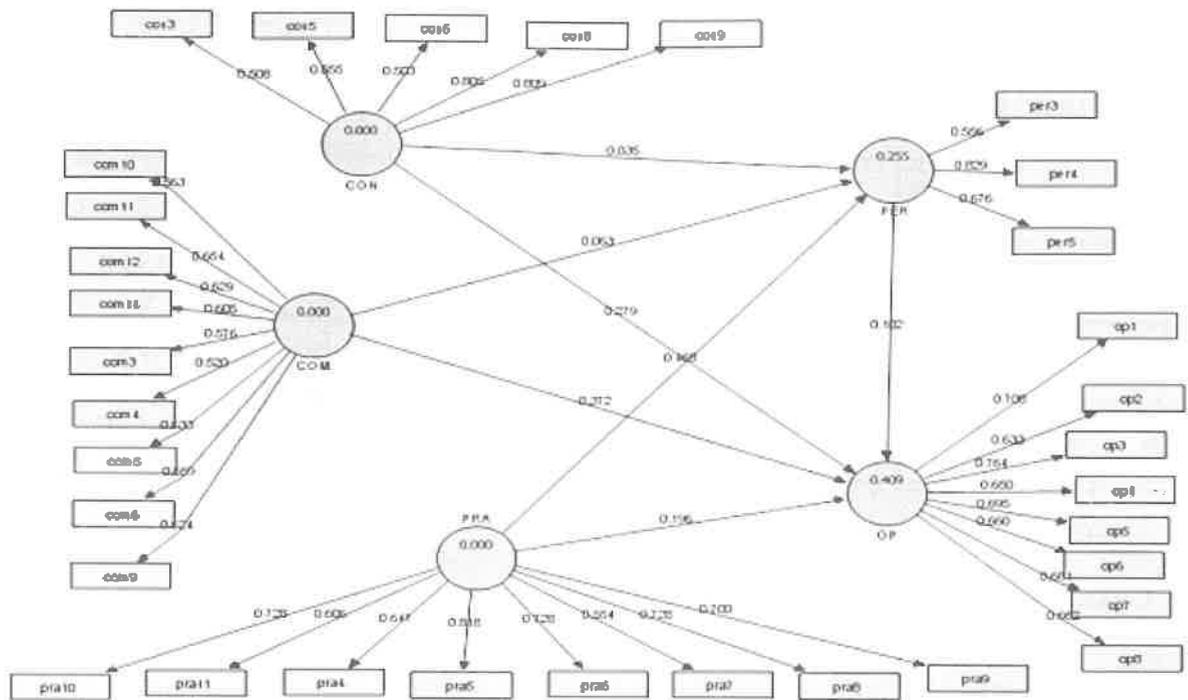
Supply chain practices found to be have significant positive effects on supply chain performance and supply chain concerns have significant positive effects on organizational performance. The R^2 values were 0.26 and 0.40 it indicates that the model explains a good amount of variance in supply chain performance and organizational performance of manufacturing industries. Supply chain practices found to be have significant positive effects on supply chain performance and supply chain concerns, competence and practices have significant positive effects on organizational performance.

4.2.3 Causal Model for Moderate supply chain performance manufacturing firms

The R^2 values were 0.32 and 0.32 it indicates that the model explains a good amount of variance in supply chain performance and organizational performance of manufacturing industries. Supply chain competence found to be having significant positive effects on supply chain performance and supply chain concerns, performance and practices have significant positive effects on organizational performance.

Path	Low performance firm		High performance firm		Moderate performance firm	
	Beta coefficient(?)	t-Value	Beta coefficient(?)	t-Value	Beta coefficient(?)	t-Value
COM -> OP	0.07	0.76	0.37	4.53*	0.008	0.06
COM -> PER	0.25	1.90	0.06	0.65	0.40	4.49*
CON -> OP	0.53	9.53*	0.28	3.24*	0.20	2.09**
CON -> PER	-0.080	0.68	0.03	0.42	0.13	1.51
PER -> OP	0.08	0.83	0.10	0.80	0.31	2.80*
PRA -> OP	0.12	1.48	0.19	2.38**	0.23	1.98**
PRA -> PER	0.4	3.61*	0.46	6.13*	0.17	1.783

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

From the above it infer that supply chain concern have significant and positive relationship with organizational performance in low , high and moderate supply chain performance clusters firms like wise supply chain practices have significant and positive relationship with organizational performance in high and moderate supply chain performance.

5. CONCLUSION AND IMPLICATION OF THE STUDY

This study has provided empirical justification for a framework that identifies five constructs of SCM and describes the relationship among SCM and Performance within the context of manufacturing Industries in India. Previous studies supporting the importance of SCM mostly used case studies and relate SCM to organizational performance and not Supply Chain Performance (SCP). The major contribution of the present study is the test the causal relationship of SCM components on supply chain performance and in turn on organizational performance based on the

clusters of supply chain performance firm. Based on a survey data of 255 manufacturing firms, the research framework was tested using PLS method, which is a variance-based structural equation modeling approach. This study carries more weight especially for generalization purpose due to the limited quantitative approach in the extant literatures. As a whole, effective SCM have important implications for Performance. This study offers a number of managerial implications. First, it provides SCM managers with an impeccable formula for evaluating the effectiveness of the new combination of SCP and organizational performance. Second, the analysis also indicates that SCM might directly influence SCP. Theoretically, this study offers empirical evidence suggesting that even in emerging markets better SCM can yield good performance.

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