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Confirmatory Factor Analysis of Performance in Supply Chains

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ABSTRACT

Organizations are usually ever more under time limits coming from stakeholders to add in this triple-bottom distinct interpersonal, environment in addition to financial duty factors in businesses and provide string supervision strategies. These studies makes use of written content evaluation program this completed centering resonance evaluation to look at commercial connection to help stakeholders via commercial interpersonal duty (CSR) reports. A intention is always to figure out how offer string practices issue on the triple-bottom distinct 100 culturally in addition to eco accountable world companies. These studies analyzes in addition to differences this powerful thoughts within the CSR stories with businesses coming from a variety of sectors, shapes in addition to physical regions. The material evaluation uncovered 10 subjects this give you a photo of methods prime world businesses include in addition to increase the triple-bottom collection with inside businesses in addition to outside offer chains. Information established that whilst institutional stress will be the key motivator at the rear of tactic advancement regarding the many sectors analyzed, businesses emphasize unique tasks of interpersonal, environment in addition to financial duty upstream in addition to downstream with offer tire chains dependant on field, dimensions in addition to regional location. A evaluation uncovered exceptional ideas relating to commercial marketing communications this some other methodologies will not find.

KEYWORDS:-CSR , SUPPLY CHAIN MANAGEMENT

I.INTRODUCTION

SCM is described as systemic and strategic coordination of organizations involved in supply chain business for the purpose of improving the long-term performance of individual organization and its supply chain. An appropriate supply chain performance (SCP) management system is necessary for firms to successfully implement SCM (Lee and Billington, 1992; Gattorna and Walters, 1996; Marien, 2000). Given that there are different perspectives on the measurement of SCP, many firms find it difficult to effectively evaluate the performance of their activities on a supply chain-wide basis (Cooper et al., 1997).

There are different viewpoints as to what constitutes SCP. “Cost” is traditionally the primary performance criterion (Cohen and Lee, 1988, 1989; Lockamy III and Smith, 2000). In the past, costs of inventory,

transportation, and production received greater than other performance criteria. However, these cost-related performance criteria are "non-integrated' and therefore fail to consider chain-wide opportunities to improve performance. As market competition intensifies, cost considerations are no longer the only concern in modern business operations. For instance, Bechtel and Jayaram (1997) advocate the use of integrated measures, is the cash-to-cash cycle that spans functional and organizational boundaries to show all members firms how the chain performs and fosters incentives for firms work with other in chain. By contrast, the non-integrated measures only provide insights into potential problem within individual firm in a supply chain. In additional, Beamon (1999) suggests a framework for combining cost and other criteria, such as customer service and responsiveness to the environment for SCP measurement. The emerging stream of literature SCM suggests that SCP is composed of multiple dimensions, including time and speed (Towill, 1996), agility and flexibility (van Hoek et al., 2001), and quality and productivity (Stainer, 1997). Spekman et al. (1998) discuss the principles on which successful implementation of supply chain management is based. Gunasekaran et al. (2004) present a framework for measuring the strategic, tactical and operational level performance in a supply chain. In this framework, emphasis is on performance measure dealing with suppliers, delivery performance, customer service, and inventory and logistics costs in a SCM. Beamon (1999) presents a framework for the selection of performance measurement systems for manufacturing supply chains and an overview and evaluation of the performance measure used in supply chain models. Neely et al. (1995) suggest quality, time, flexibility and cost as few categories of performance measures but they further point out the need for a generally applicable systematic approach to performance measurement. Performance measurement can provide important feedback information to enable managers to monitor performance, reveal progress, enhance motivation and communication, and diagnose problems (Waggoner et al., 1999); Jharkharia and Shankar, 2001). Holmberg (2000) proposes that adopting criteria for evaluation SCP should be considered from a systems' perspective. Maximizing lead-time, agility for quality in a single firm seems inadequate to measure SCP without due consideration to the performance requirement of its trading partners. Holmberg (2000) further adds that fragmental measures provide little information and might even be harmful to decisions because the context is missing. To overcome SCP measurement problems, Li and O'Brien (1999) suggest a model for analyzing SCP at two levels, namely the chain level and the operational level. At the chain level, objectives associated with the criteria are set for each stage of the supply chain so that the SCP can meet the customer service targets and the best supply chain strategy is selected. At the operational level, manufacturing and logistics activities are optimized under the given targets (Rabinovich et al., 1999). McCarthy and Golicic (2002) reveal unique approaches to collaborative forecasting that circumvent the inhibitors of collaborative planning, forecasting and replenishment adoption and yield substantial improvement in responsiveness, assurance of product availability, optimized inventory and associated costs, and increased revenues and earnings.

1. QUESTIONNAIRE ADMINISTRATION, DESCRIPTIVE STATISICS,

1.1. Questionnaire Development

To address the issues related to agility and trust in Indian industry, a questionnaire-based survey was undertaken. The questionnaire was designed keeping in view the available literature and the previous surveys.

The practicing managers and academicians in the area of SCM were also consulted during the development of the questionnaire.

The questionnaire was tested for two main types of validity, which are content validity, and construct validity. Content validity represents the adequacy with which a specified domain of content is sampled (Nunally, 1978) and that the instrument item has items that cover all aspects of the variables being measured. Content validity cannot be determined numerically. Its determination is subjective and judgmental. It primarily depends on an appeal to the propriety of content and the way it is presented (Nunally, 1978). The instrument developed in this study demonstrates the content validity as the selection of measurement items was based on both, an exhaustive review of the literature md evaluation by academicians and practicing managers during its pre-testing. The content validity was further tested during pilot survey as per the guidelines provide by Forza (2002), After a careful review of respondents' answers to the questionnaire during pilot survey, some questions were modified to convey their intended meaning, and few questions were deleted from the questionnaire as per the suggestions received from the respondents. The construct validity was conducted through an exploratory factor analysis. Factor analysis was conducted to test the uni-dimensionality of the multi-items perceptual measures. As per the suggestion of Kim and Muller (1978) only those items, which had a factor loading of more than 0.40 were used in the questionnaire.

1.2. Questionnaire Administration

1.2.1. Target Industries for Questionnaire Administration

Three sectors from the Indian industry were selected for the administration of the questionnaire. These are:

i. Auto,
ii. Electrical and electronics goods, and
iii. Fast moving consumer goods (FMCG).

1.2.2. Improvement in Survey Instruments

Before sending the questionnaire to the companies, a pilot study was carried out in few industries. The idea behind carrying out the pilot study was to:

i. have a fruitful feedback from the executives working in the area of supply chain management,
ii. add missing questions,
iii. delete any irrelevant question, and
iv. refine/rephrase the language of the existing questions to bring in more clarity in the questionnaire.

A total of fifteen executives in the area of supply chain management were personally contacted. Accordingly the questionnaire was modified and a final questionnaire was evolved. It was then mailed to different companies.

1.2.3. Questionnaire Administration

A total of 760questionnaires were mailed to different companies of the selected sectors throughout the country. These companies were carefully selected from the directory of public sector, private sector, and government

companies which also includes OEMs and suppliers in auto, fast moving consumers goods, and electrical and electronics business.

2. SURVEY RESPONSES AND RESPONDENTS PROFILE

Out of the 760 questionnaires, mailed to the Chief Executives/ Managing Directors, 317 responses were received. Out of this 35 responses were found incomplete and 103 responses were received with regret in filling up the questionnaire. Therefore, only 179 questionnaires were found usable. This gives an effective response rate of 23.55% (Table 1).

This survey is designed with two main objectives, which are (i) to examine the current practices and the issues related to agility and trust among partners of supply chains, and (ii) to test the validity ofsome hypotheses, whichhave been formulated in theearlier section of this chapter.

Table 1: Description of Respondents

		Auto-Sector		FMCG		Electrical & Electronics	
		Manufactures	Supplier	Manufactures	Supplier	Manufactures	Supplier
Sample Size	760	170	217	73	78	81	141
Responded	214	40	55	29	33	21	36
Rejected due to incomplete	35	05	07	09	08	03	03
Qualified respondents	179	35	48	20	25	18	33
Percentage (%)	23.55	20.58	22.12	27.4	32.05	22.22	23.4

3.1 Non-response Bias

A test of non-response bias is to compare the answers of early and late respondents (Lambert and Harrington, 1990). The logic behind this is that the late respondents are more likely to answer the questionnaire like non-respondents than the early respondents (Armstrong and Overton, 1977). Therefore non-response bias was assessed by comparing the responses, which were received late after sending two or more reminders (total 60 respondents in this case) with the early respondents, which were received either without a reminder or with a single reminder (119 in present case). The results from the t-test on some key variables of this study suggest that the early respondent do not significantly differ from the late responses. Therefore, non-response bias in this study is ruled out.

3. OBSERVATIONS FROM THE SURVEY

Figures 1 to 4 show the characteristics of the responding companies.

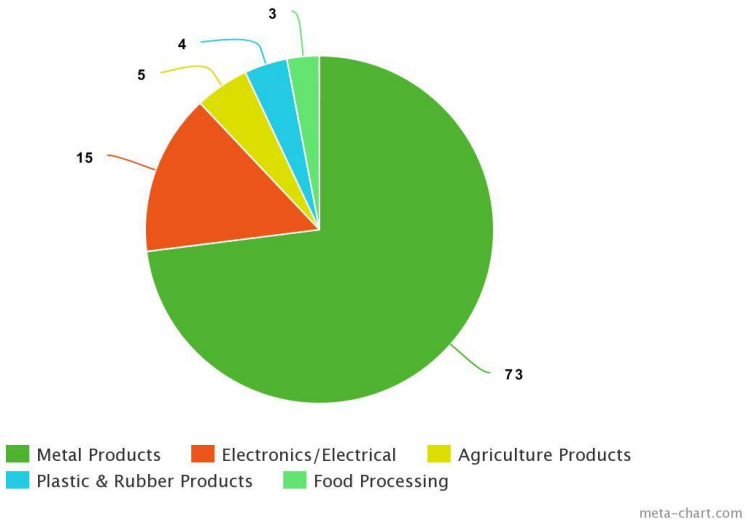

Figure 1: Percent of respondents of the survey across different sectors

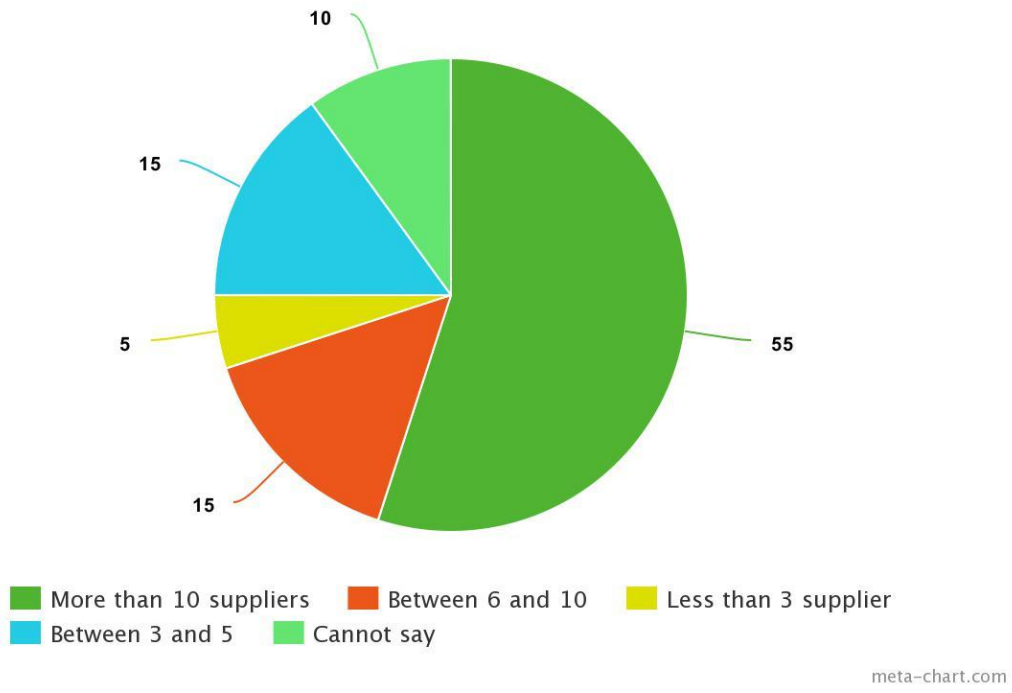

Figure 2: Percent of respondent firms employing different number of suppliers

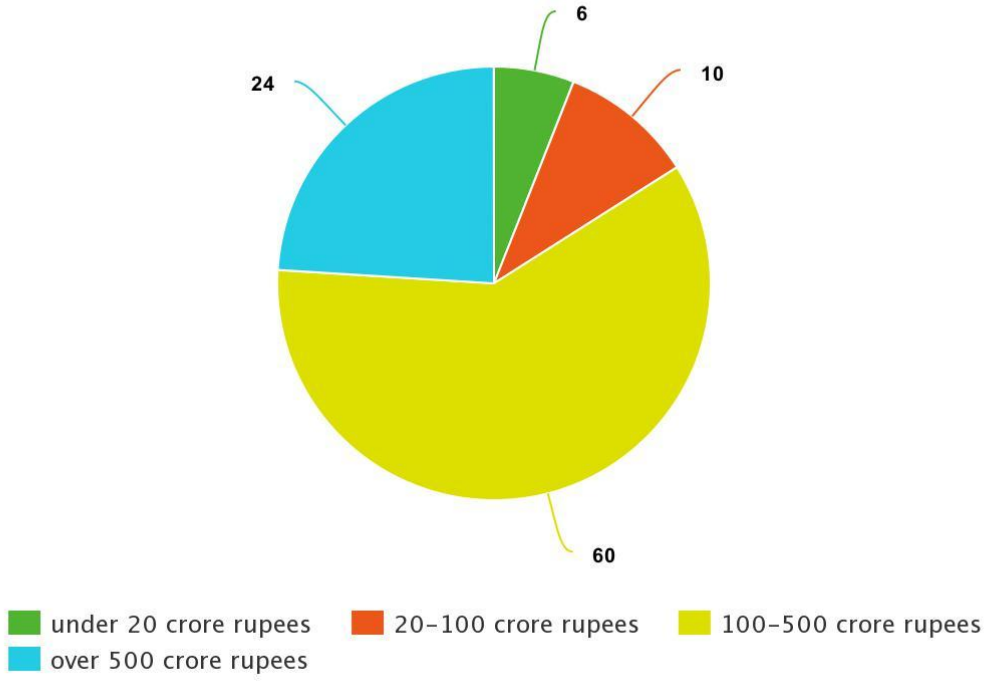

Figure 3: Breakup of respondent companies on the basis of annual turn-over

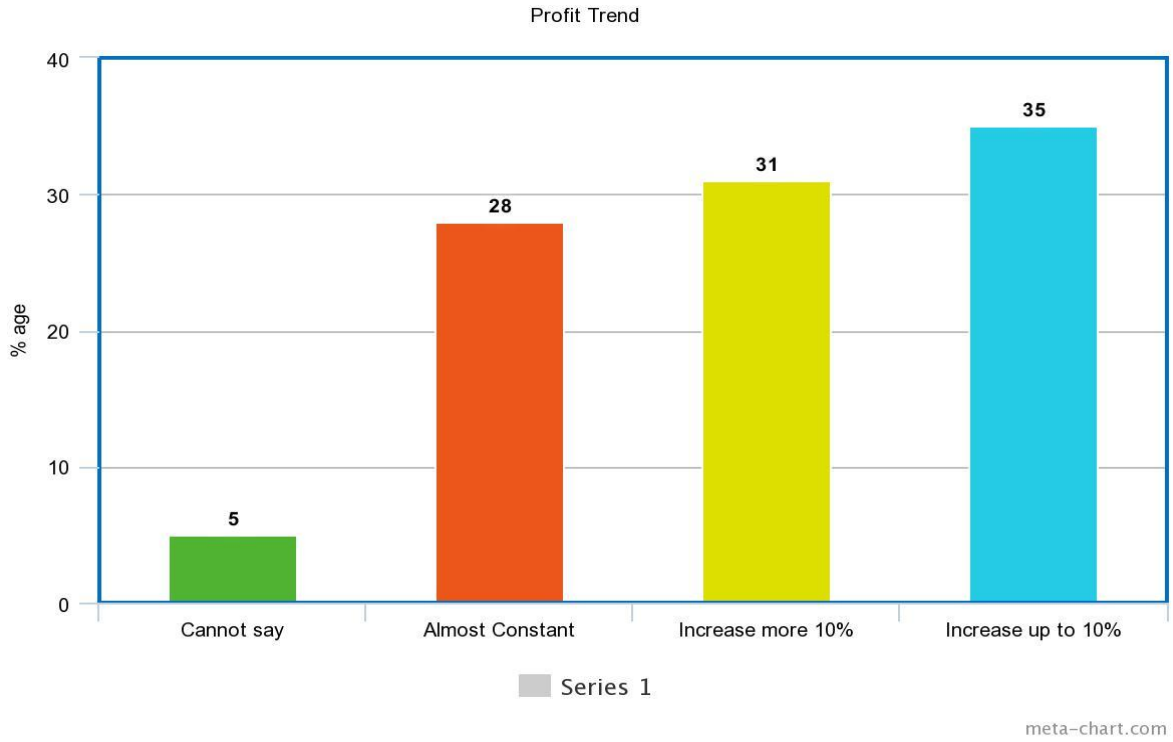

Figure 4: Profit trend of respondent companies during last three ye

4. EXPLORATORY FACTOR ANALYSIS FOR SUPPLY CHAIN PERFORMANCE

The section shows the EFA applied for supply chain performance.

5.1 Reliability

Table 2 shows the items/questions used to measure reliability

Table 2: Items/questions used to measure reliability

S.N.	Item code	Items/statements
1	SCP1	Delivery date is met easily and oftenly.
2	SCP2	Delivery at right location has also been met.
3	SCP3	Delivery of correct products mostly met shortly.
4	SCP4	Deliver products with correct packaging and condition at most occasion.

5.2 Agility and responsiveness

The present study has taken the following six questions to measure it, as mentioned in Table 3.

Table 3: Items/questions used to measure agility and responsiveness

S.N.	Item code	Items/statements
1	SCP6	Time gap is minimum between orders receiving to goods arriving at customer's dock.
2	SCP7	Minimum time is taken to respond to any customer's request every time.
3	SCP8	Agility in terms of delivering different products.
5	SCP10	Customer pull in or push out is early informed.
6	SCP11	Cost related to operating the supply chain (return processing, logistic and administrative cost).

5.3 Cost and quality

Table 4 shows the items/questions used to measure cost and quality

Table 4: Items/questions used to measure cost and quality

S.N.	Item code	Items/statements
1	SCP5	Delivery is always with zero defects.
2	SCP12	Inventory days of supply by this supplier.
3	SCP13	Product's price charged by this supplier.

4	SCP14	Cash to cash cycle time.
5	SCP15	Overall cost over revenue.

Table 5 shows the exploratory factor analysis of supply chain performance

Table 5: Exploratory factor analysis of supply chain performance

S.N.	Item code	Factor loading		
		Reliability	Agility	Cost and quality
1	SCP1	0.840		
2	SCP2	0.815		
3	SCP3	0.936		
4	SCP4	0.912		
5	SCP8		0.748	
6	SCP9		0.800	
7	SCP10		0.781	
8	SCP11		0.740	
9	SCP7			0.643
10	SCP12			0.801
11	SCP13			0.714
12	SCP14			0.796

5. RELIABILITY OF THE QUESTIONNAIRE SURVEY

Cronbach's coefficient (alpha, α) has been used to evaluate construct reliability (Flynn et al., 1990). Value of alpha was calculated to test the reliability and internal consistency of the responses for the present study. Alpha with value equal or greater than 0.50 has been recommended for reliability by Nunnally (1978). Since cronbach's alpha values for all the factors have been found in ranges from 0.704 to 0.911 as mentioned in Table 7. All values have been accepted and established the reliability of the measurement scale for all the variables considered.

Table 6: Exploratory factor analysis of organizational performance

S.N.	Item code	Factor loading
1	SCPOP3	0.860

2	SCPOP4	0.829
3	SCPOP7	0.834
4	SCPOP8	0.608
5	SCPOP9	0.834

Table 7: Reliability analysis of all constructs before and after EFA

S.N.	Construct	Cronbach's alpha value after EFA
1	Agility in Sourcing	0.804
2	Agility in Operations	0.817
3	Agility in Delivery	0.812
8	Institutional Trust	0.936
9	Rational Trust	0.881
10	SCP	0.942
11	SCPOP	0.911

6.1 Establishing the construct for supply chain performance

Table 8 showed the each construct on supply chain performance along with the cronbach's alpha.

Table 8: Summary of EFA for SCP

S.N.	Construct	Number of items before EFA	Number of items after EFA	Cronbach's alpha
1	Reliability and quality	5	5	0.879
2	Agility and responsiveness	5	4	0.698
3	Cost	5	4	0.805

6.2 Measurement model for reliability and quality

Figure 5 shows the reliability and quality for supply chain performance. Table 9 shows that all statements bear significant relationship with the reliability and quality.

Table 10 showed the summary statistics and loadings of items. It showed the standardized coefficient and standard error for each item/question. Table 11 highlighted the model fit indices for reliability and quality. All the indices values have been found above the cut-off level, giving supply chain performance as good fit model.

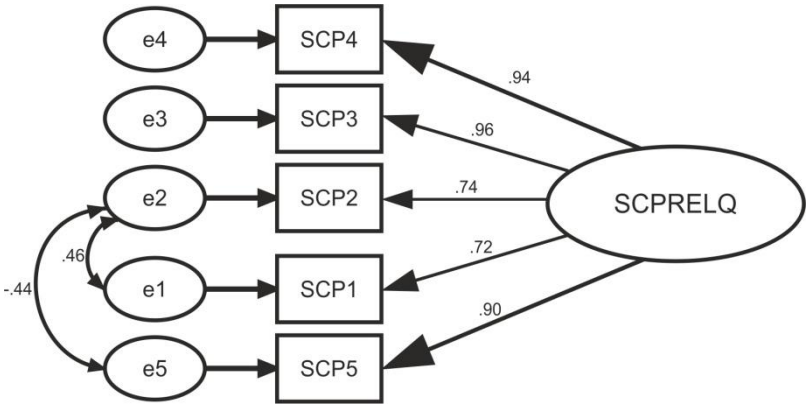

Figure 5: Standardized measurement model for reliability and quality

Table 9: Regression weights for reliability and quality

S.N.	Relationship			Estimate	S.E.	C.R.	P
1	SCP1	<---	SPQ	1.000			
2	SCP2	<---	SPQ	1.343	0.127	10.815	***
3	SCP3	<---	SPQ	0.802	0.078	10.368	***
4	SCP4	<---	SPQ	1.409	0.178	10.197	***
5	SCP5	<---	SPQ	1.369	0.153	9.686	***

*****p<0.001**

Table 10: Summary statistics and loadings of items for reliability and quality

S.N.	Scale items	Standardized coefficient	Standard error
1	SCP1: How many times have your company met delivery date.	0.738	0.000
2	SCP2: How many times have your organization met delivery to the right location.	0.774	0.127
3	SCP3: How many times have your organization delivered the correct product.	0.969	0.088
4	SCP4: How many times have you delivered products	0.983	0.158

	with correct packaging and condition.		
5	SCP5: How many times have you delivered zero defects products.	0.878	0.163

Table 11: Model fit indices for measurement model of reliability and quality

S.N.	Indices	Model indices: reliability and quality
1	(χ2)/df/=CMin/df	1.785
2	GFI	0.986
3	CFI	0.992
4	RMR	0.005
5	RMSEA	0.069

The average value of standard regression weights for reliability and quality for supply chain performance has been found to be 0.852 (Table 10). This provided strong evidence of convergent validity for reliability and quality for supply chain performance.

6.3 Measurement model for agility and responsiveness

Figure 6 shows the agility and responsiveness for supply chain performance. Table 12 shows that all statements bear significant relationship with the agility and responsiveness shown under P-value column.

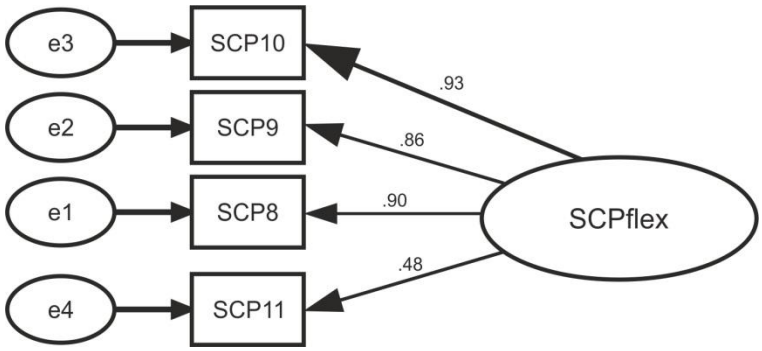

Figure 6: Standardized measurement model for agility and responsiveness

Table 13 shows the summary statistics and loadings of items for agility and responsiveness.

Table 12: Regression weights for agility and responsiveness

S.N.	Relationship	Estimate	S.E.	C.R.	P
1	SCP8 <--- SCPF	1.000			

S.N.	Relationship			Estimate	S.E.	C.R.	P
2	SCP9	<---	SCPF	0.747	0.056	13.257	***
3	SCP10	<---	SCPF	0.971	0.063	15.343	***
4	SCP11	<---	SCPF	0.439	0.080	5.442	***

*****p<0.001**

Table 14 highlights the model fit indices for agility and responsiveness.

Table 13: Summary statistics and loadings of items for agility and responsiveness

S.N.	Scale items	Standardized coefficient	Standard error
1	SCP8: Agility in terms of delivering different products.	0.917	0.000
2	SCP9: Volume agility to fulfill demand upside or downside.	0.849	0.046
3	SCP10: Scheduling agility to cater for customer pull in or push out.	0.937	0.069
4	SCP11: Scheduling agility to cater for customer pull in or push out.	0.87	.079

Table 14: Model fit indices for measurement model for agility and responsiveness

S.N.	Indices	Model indices: agility and responsiveness
1	(χ2)/df/=CMin/df	0.011
2	GFI	1.00
3	CFI	1.00
4	RMR	0.005
5	RMSEA	0.013

6.4 Measurement model for cost

Figure 7 shows the cost for supply chain performance. Table 15 shows that all statements bear significant relationship with the cost shown under P-value column. Apart from this Table 15 shows the estimate, standard error and critical ratio.

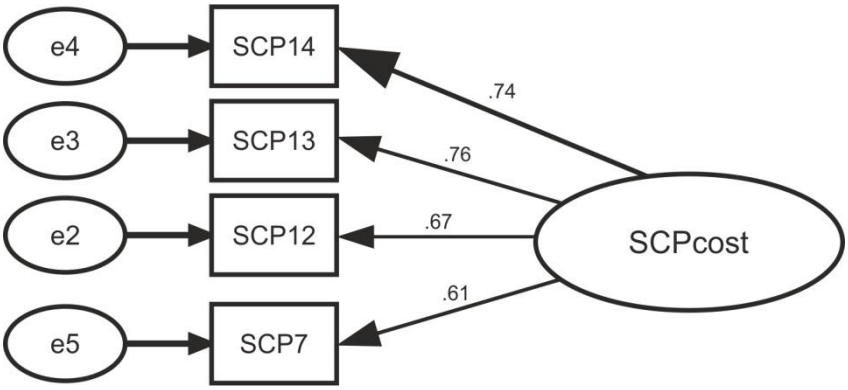

Figure 7: Standardized measurement model for cost

Table 16 shows the summary statistics and loadings of items for cost. Table 17 highlights the model fit indices for cost.

Table 15: Regression weights for cost

S.N.	Relationship			Estimate	S.E.	C.R.	P
1	SCP12	<---	SCPcost	1.000			
2	SCP13	<---	SCPcost	0.564	0.090	6.284	***
3	SCP14	<---	SCPcost	0.857	0.148	6.213	***
4	SCP7	<---	SCPcost	0.959	0.166	5.447	***

*****p<0.001**

Table 16: Summary statistics and loadings of items for cost

S.N.	Scale items	Standardized coefficient	Standard error
1	SCP12: Inventory days of supply by this supplier.	0.664	0.000
2	SCP13: Product's price charged by this supplier.	0.747	0.096
3	SCP14: Cash to cash cycle time.	0.757	0.157
4	SCP7: Cash to cash cycle time.	0.617	0.149

Table 17: Model fit indices for measurement model for cost

S.N.	Indices	Model indices: Cost
1	(χ2)/df/=CMin/df	0.011
2	GFI	1.00
3	CFI	1.00
4	RMR	0.005
5	RMSEA	0.054

6. CONCLUSION

The paper has made all attempts to apply confirmatory factor analysis on supply chain performance. Paper shows the complete results of CFA applied on SCP.

REFERENCES

[1]. Ahire, S. L., Golhar, D. Y., and Waller, M.A., (1996), "Development and Validation of TQM Implementation Constructs", Decision Sciences, Vol. 27, No. 1, pp. 23-56.

[1]. Aitken, J.M. (1999), "Supplier Associations: A methodological opportunity in supply chain research", 8th International Annual IPSERA Conference, Belfast and Buldin, 13-22.

[2]. Anderson, JC and Gerbing, DW. (1988), "Structural Equation Modelling in practice: a review and recommended two-step approach", Psychological Bulletin, Vol. 103, No. 3, pp. 411-23.

[3]. Armstrong, J. S., and Overton, T.S. (1977), "Estimating bias in mail surveys", Journal of Marketing Research, Vol. 14, No. 3, pp. 396-402.

[4]. Avittathur, B., and Swamnidass, P. (2007), "Matching plant flexibility and supplier flexibility: Lessons from small suppliers of U.S. manufacturing plants in India", Journal of operations Management, Vol. 25, pp.717-735.

[5]. Ayers, J.B. (2001), "Handbook of Supply Chain Management", APICS, St. Lucie Press, Virginia.

[6]. Bachmann, R. (2001), ''Trust, power and control in trans-organizational relations'', Organization Studies, Vol. 22 No. 2, pp. 337-65.

[7]. Bagozzi, R.P., and Phillips, L.W. (1982), "Representing and Testing Organizational Theories: A Holistic Construal", Administrative Science Quarterly, Vol. 27, No. 3, pp. 459-489.

[8]. Bakos, J.Y., and Brynjyoolfsson, E., (1993), "From vendors to partners: Information technology and incomplete contracts in buyer-supplier relationships" J. Org. Comput., Vol. 3,No. 3, pp. 301-329.

[9]. Ballou, R. H., Gilbert, S.M. and Mukherjee, A. (2000), "New Managerial Challenges from Supply Chain Opportunities", Industrial Marketing Management, Vol. 29, No. 1, pp. 7-18.