A STUDY OF RELATIONSHIP BETWEEN PRODUCT CHARACTERISTICS AND SUPPLYCHAIN MANAGEMENT (SCM) LEVEL OF ACTIVITY AMONG INDIAN TEXTILE INDUSTRIES

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ABSTRACT

This paper on Supply chain management (SCM) in the textile industry was empirically examined through a quantitative research design. The objectives of the study were to identify the level of SCM activities and to examine the relationship of selected company product characteristics for a set of textile industries. Through the literature review, six dimensions of SCM were identified. Those six dimensions are partnership, information technology, operation flexibility, performance measurement, management commitment and leadership, and demand characterization. Each dimension consists of four to six activity items identified through literature analysis. Respondents were assessed for their level of agreement with 26 items that characterize the SCM activities in the six dimensions. The characteristics of product can be broadly classified as seasonal products, basic products and common products. It can be safely interpreted that the product characteristics have no impact or less impact on importance of production system and education training in SCM. For other parameters it like on time delivery, product quality, employee's empowerment, production capacity, run cycles & RM purchasing the product characteristics has does have a significance variation or influence on the level of SCM activity among the textile manufacturing industries. It can be inferred that the level of implementation stages / phases of Supply Chain Management differs based on Textile manufacturer's product characteristics on all the parameters except on the importance in production system and education training.

Keywords: *Product Characteristics, Time Delivery, Textile, Supply Chain Management*

Introduction

Supply chain management encompasses such a wide range of functions that it can seem daunting. It is well known that supply chain management is an integral part of most businesses and is essential to company success and customer satisfaction. One common and very effective model is the Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council to enable managers to address, improve and communicate supply chain management practices effectively. The SCOR model runs through five supply chain stages: Plan, Source, Make, Deliver, Return. The interest in the concept of supply chain management has steadily increased since the 1980s when companies saw the benefits of collaborative relationships within and beyond their own organization (lummus and vokurka 1998).

The supply chain conjures up images of product and services or supply moving from suppliers to executers or manufacturers to distributers to retailers to customers along the chain. There is no commonly accepted definition of supply chain management - it means many different things to many different people and numerous, overlapping definitions exist. As per Cooper & Ellram (1993) the SCM is an integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user … greater coordination of business processes and activities … across the entire channel and not just between a few channel pairs.

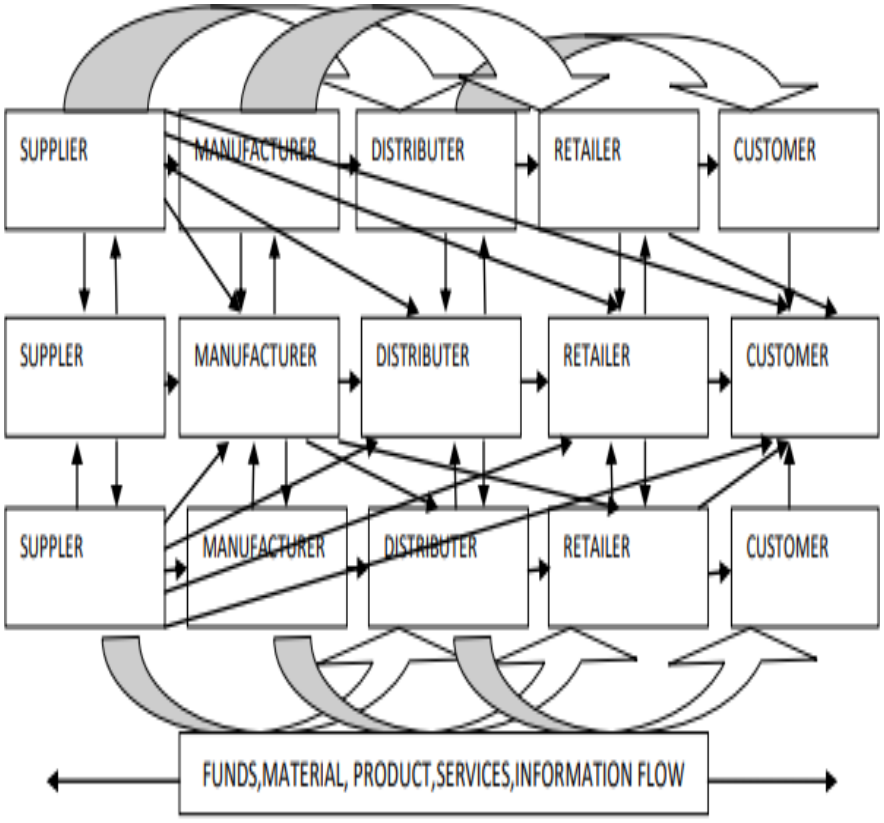

Figure : 1 A Typical supply chain network of a manufacturing industry

Successful supply chain management requires many decisions relating to the flow of information, product and funds. These decisions fall into three categories or phases, depending on the frequency of each decision and the time frame over which a decision phase has an impact.

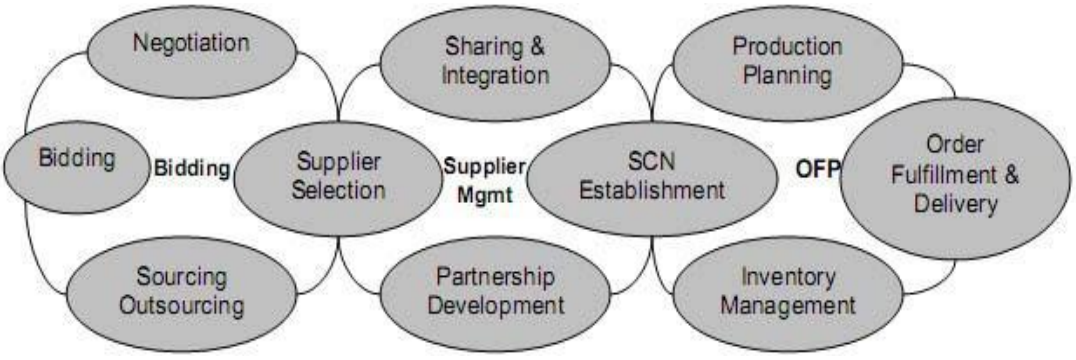

Figure 2: Relationship between SCN processes

The bidding, supplier management and order fulfillment cycles in SCN (Tan, Gek Woo, Shaw, Michael J. and Fulkerson, Bill ,2000)

Materials and Methods/Methodology

According to Subramanian and Nilakanta (1996), the adoption of innovations is related with a company's environmental, organizational, and individual factors. Implementation of QR program, and computer technology usage in purchasing, design, and manufacturing were found to be different among Textile manufacturers. (Sullivan & Kang, 1999). Therefore it suggests that the level of SCM activities be different amongTextile manufacturers.

The objectives of this research are (a) To identify the level of SCM activities of Textile

manufacturers, (b)To examine the differences of Textile manufacturers' characteristics (i.e., product characteristic) according to the level of SCM activities, and (c) To illustrate how the SCM activities and Textile manufacturers' characteristics are relate.

This paper provides dimensions in the Textile industry by providing empirical evidence to understand the Textile industry's current problem. Further, Investigating Textile industry's unique characteristics, such as various product line characteristics in channel relationship between supplier, manufacturer, and retailer

will imply potential impediments to efficient SCM in the Textile industry.

The null hypothesis and alternative hypothesis for the textile manufacturing industry are as follows:

The Null Hypothesis 1: H0: The implementation of Supply Chain Management does not differ based on Textile manufacturers product characteristics.

Alternative Hypothesis 2: H1 The implementation stage of Supply Chain Management differs based on Textile manufacturers product characteristics.

Data were collected with a mailed questionnaire that was developed based on the literature review and previous questionnaires in Textile manufacturing.

Results and Discussion

This section deals with the analysis of relationship between level of SCM activity and product characteristics among textile industry. Those six dimensions are partnership, information technology, operation flexibility, performance measurement, management commitment and leadership, and demand characterization. Each dimension consists of four to six activity items identified through literature analysis. Respondents were assessed for their level of agreement with 26 items that characterize the SCM activities in the six dimensions.

The characteristics of product can be broadly classified as seasonal products, basic products and common products.

Interpretation of data from table No. 1 to table No.3 reveals that from the above oneway ANOVA tables for level of SCM activities, the critical value for oneway ANOVA for df 2 and 66 is 19.48. For the parameter of on time delivery the calculated value of F is 23.534 which is higher than F critical value hence we reject the null hypothesis for the parameter of on time delivery.

On other parameter the calculated F values are as follows product quality F calculated=15.190, importance in production system F calculated= 2.482, educational training F calculated=0.252, employees empowerment F calculated = 5.614, production capacity F calculated=18.575, run cycles F calculated =9.727, RM Purchasing F calculated= 13.198, in all the above cases the calculated F value is less than critical value of 19.48 hence the researcher fails to reject null hypotheses the above parameters.

Table No. 4 gives the analysis for SCM level activities on different parameters. The interpretation from the same are hereby discussed. From the above calculation's analysis through ANOVA test on a sample size of 70 respondents, at a significance level of 0.05. The ANOVA test outcome values on the parameters of Importance in production is 0.091 and for education training the value is 0.778 indicating that there is not a significant difference of product characteristics on parameters of importance in production and education training. Hence it can be safely interpreted that the product characteristics have no impact or less impact on importance of production system and education training in SCM. For other parameters it like on time delivery, product quality, employee's empowerment, production capacity, run cycles & RM purchasing the product characteristics has does have a significance variation or influence on the level of SCM activity among the textile manufacturing industries.

Table No. 1- Product category wise description of Data Mean and SD

		N	Mean	Std. Deviation	Std. Error
Product Quality	Basic Goods	24	4.13	0.537	0.11
	Seasonal	7	3	0	0
	Common	38	4.63	0.675	0.109
	Total	69	4.29	0.769	0.093
Importance In Production System	Basic Goods	24	4.83	0.381	0.078
	Seasonal	7	3.14	0.378	0.143
	Common	38	4.47	0.893	0.145
	Total	69	4.46	0.85	0.102
Education Training	Basic Goods	24	2.71	1.233	0.252
	Seasonal	7	2.86	0.378	0.143
	Common	38	3.16	0.37	0.06
	Total	69	2.97	0.804	0.097
Employee's Empowerment	Basic Goods	24	1.71	1.042	0.213
	Seasonal	7	2	0	0
	Common	38	1.63	1.478	0.24
	Total	69	1.7	1.252	0.151
Production Capacity	Basic Goods	24	2.38	0.495	0.101
	Seasonal	7	3	0	0
	Common	38	2.79	0.622	0.101
	Total	69	2.67	0.586	0.071
Run Cycles	Basic Goods	24	3.04	0.464	0.095
	Seasonal	7	3.86	0.378	0.143
	Common	38	2.84	0.37	0.06
	Total	69	3.01	0.5	0.06
RM Purchasing	Basic Goods	24	3.17	0.482	0.098
	Seasonal	7	2.14	0.378	0.143
	Common	38	2.79	0.622	0.101
	Total	69	2.86	0.625	0.075
	Basic Goods	24	4.29	0.464	0.095
	Seasonal	7	3	0	0
	Common	38	3.47	0.893	0.145
	Total	69	3.71	0.842	0.101

Therefore, it can be inferred that the level of implementation stages / phases of Supply Chain Management differs based on Textile manufacturers product characteristics on all the parameters except on the importance in production system and education training.

Table No. 2. - Product category wise description of Data

		95% Confidence Interval for Mean			
		Lower Bound	Upper Bound	Minimum	Maximum
on time delivery	Basic Goods	3.9	4.35	3	5
	Seasonal Goods	3	3	3	3
	Common Goods	4.41	4.85	3	5
	Total	4.11	4.47	3	5
product quality	Basic Goods	4.67	4.99	4	5
	Seasonal Goods	2.79	3.49	3	4
	Common Goods	4.18	4.77	3	5
	Total	4.26	4.67	3	5
Imp in production system	Basic Goods	2.19	3.23	2	5
	Seasonal Goods	2.51	3.21	2	3
	Common Goods	3.04	3.28	3	4
	Total	2.78	3.16	2	5
education training	Basic Goods	1.27	2.15	1	4
	Seasonal Goods	2	2	2	2
	Common Goods	1.15	2.12	1	5
	Total	1.39	2	1	5
employee's empowerment	Basic Goods	2.17	2.58	2	3
	Seasonal Goods	3	3	3	3
	Common Goods	2.59	2.99	1	3
	Total	2.53	2.81	1	3
production capacity	Basic Goods	2.85	3.24	2	4
	Seasonal Goods	3.51	4.21	3	4
	Common Goods	2.72	2.96	2	3
	Total	2.89	3.13	2	4
run cycles	Basic Goods	2.96	3.37	3	5
	Seasonal Goods	1.79	2.49	2	3
	Common Goods	2.59	2.99	1	3
	Total	2.7	3.01	1	5
RM purchasing	Basic Goods	4.1	4.49	4	5
	Seasonal Goods	3	3	3	3
	Common Goods	3.18	3.77	2	4
	Total	3.51	3.91	2	5

Table: 3: Data Analysis: Oneway ANOVA for SCM level of activity

		Sum of Squares	df	Mean Square	F
on time delivery	Between Groups	16.736	2	8.368	23.534
	Within Groups	23.467	66	0.356	
	Total	40.203	68		
product quality	Between Groups	15.495	2	7.748	15.19
	Within Groups	33.664	66	0.51	
	Total	49.159	68		
Imp in production system	Between Groups	3.074	2	1.537	2.482
	Within Groups	40.868	66	0.619	
	Total	43.942	68		
education training	Between Groups	0.808	2	0.404	0.252
	Within Groups	105.8	66	1.603	
	Total	106.609	68		
employee's empowerment	Between Groups	3.393	2	1.696	5.614
	Within Groups	19.941	66	0.302	
	Total	23.333	68		
production capacity	Between Groups	6.117	2	3.059	18.575
	Within Groups	10.868	66	0.165	
	Total	16.986	68		
run cycles	Between Groups	6.044	2	3.022	9.727
	Within Groups	20.506	66	0.311	
	Total	26.551	68		
RM purchasing	Between Groups	13.771	2	6.885	13.198
	Within Groups	34.432	66	0.522	
	Total	48.203	68		

Table: 4 Data Analysis: Oneway ANOVA for SCM level of activity

		Sig.
On TimeDelivery	Between Groups	0
	Within Groups	
	Total	
Product Quality	Between Groups	0
	Within Groups	
	Total	
Imp In Production System	Between Groups	0.091
	Within Groups	
	Total	
Education Training	Between Groups	0.778
	Within Groups	
	Total	
Employee's Empowerment	Between Groups	0.006
	Within Groups	
	Total	
Production Capacity	Between Groups	0
	Within Groups	
	Total	
Run Cycles	Between Groups	0
	Within Groups	
	Total	
RM Purchasing	Between Groups	0
	Within Groups	
	Total	

TABLE: 5. TUKEY HSD POST HOC TESTS

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Manufacturing Type	(J) Manufacturing Type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
On Time Delivery	Basic Goods	Seasonal Goods	1.125*	0.256	0	0.51	1.74
		Common Goods	-.507*	0.155	0.005	-0.88	-0.13
	Seasonal Goods	Basic Goods	-1.125*	0.256	0	-1.74	-0.51
		Common Goods	-1.632*	0.245	0	-2.22	-1.04
	Common Goods	Basic Goods	.507*	0.155	0.005	0.13	0.88
		Seasonal Goods	1.632*	0.245	0	1.04	2.22
Product Quality	Basic Goods	Seasonal Goods	1.690*	0.307	0	0.95	2.43
		Common Goods	0.36	0.186	0.138	-0.09	0.81
	Seasonal Goods	Basic Goods	-1.690*	0.307	0	-2.43	-0.95
		Common Goods	-1.331*	0.294	0	-2.04	-0.63
	Common Goods	Basic Goods	-0.36	0.186	0.138	-0.81	0.09
		Seasonal Goods	1.331*	0.294	0	0.63	2.04
Imp In Production System	Basic Goods	Seasonal Goods	-0.149	0.338	0.899	-0.96	0.66
		Common Goods	-0.45	0.205	0.08	-0.94	0.04
	Seasonal Goods	Basic Goods	0.149	0.338	0.899	-0.66	0.96
		Common Goods	-0.301	0.324	0.624	-1.08	0.48
	Common Goods	Basic Goods	0.45	0.205	0.08	-0.04	0.94
		Seasonal Goods	0.301	0.324	0.624	-0.48	1.08
Education Training	Basic Goods	Seasonal Goods	-0.292	0.544	0.854	-1.6	1.01
		Common Goods	0.077	0.33	0.971	-0.71	0.87
	Seasonal Goods	Basic Goods	0.292	0.544	0.854	-1.01	1.6
		Common Goods	0.368	0.521	0.76	-0.88	1.62
	Common Goods	Basic Goods	-0.077	0.33	0.971	-0.87	0.71
		Seasonal Goods	-0.368	0.521	0.76	-1.62	0.88
Employee's Empowerment	Basic Goods	Seasonal Goods	-.625*	0.236	0.027	-1.19	-0.06
		Common Goods	-.414*	0.143	0.014	-0.76	-0.07
	Seasonal Goods	Basic Goods	.625*	0.236	0.027	0.06	1.19
		Common Goods	0.211	0.226	0.623	-0.33	0.75
	Common Goods	Basic Goods	.414*	0.143	0.014	0.07	0.76
		Seasonal Goods	-0.211	0.226	0.623	-0.75	0.33
Production Capacity	Basic Goods	Seasonal Goods	-.815*	0.174	0	-1.23	-0.4
		Common Goods	0.2	0.106	0.151	-0.05	0.45

TABLE NO. - 6 HOMOGENEOUS SUBSETS FOR ON TIME DELIVERY

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Seasonal Goods	7	3	
Basic Goods	24		4.13
Common Goods	38		4.63
Sig.		1	0.068

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

TABLE NO. - 7 HOMOGENEOUS SUBSETS FOR PRODUCT QUALITY

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Seasonal Goods	7	3.14	
Common Goods	38		4.47
Basic Goods	24		4.83
Sig.		1	0.377

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. - 8 Homogeneous Subsets for improvement in production system

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05
		1
Basic Goods	24	2.71
Seasonal Goods	7	2.86
Common Goods	38	3.16
Sig.		0.286

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. - 9 Homogeneous Subsets for education training

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05
		1
Common Goods	38	1.63
Basic Goods	24	1.71
Seasonal Goods	7	2
Sig.		0.719

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. – 10 Homogeneous Subsets for employees empowerment

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Basic Goods	24	2.38	
Common Goods	38	2.79	2.79
Seasonal Goods	7		3
Sig.		0.117	0.566

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. - 11 Homogeneous Subsets for production capacity

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Common Goods	38	2.84	
Basic Goods	24	3.04	
Seasonal Goods	7		3.86
Sig.		0.394	1

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. - 12 Homogeneous Subsets for run cycles

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Seasonal Goods	7	2.14	
Common Goods	38		2.79
Basic Goods	24		3.17
Sig.		1	0.176

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table No. - 13 Homogeneous Subsets for RM purchasing

Tukey HSDa,b

Manufacturing Type	N	Subset for alpha = 0.05	
		1	2
Seasonal Goods	7	3	
Common Goods	38	3.47	
Basic Goods	24		4.29
Sig.		0.195	1

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 14.229.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

The statistical test carried on the data to understand the relationship between various parameters and type of product through Tukey HSD analysis, which are represented from Table No. 5 to Table No.13 the interpretations are being discussed hence forth.

The calculated significance value of 0.000 and 0.005 for seasonal, basic goods and common goods versus on time delivery indicate that there is no significance difference on this parameter.

On the product quality parameter, the calculated value of 0.138 indicates that there is a significance difference between basics goods and common goods on the product quality.

The calculated significance value of 0.899, 0.080 and .624 between basics goods and seasonal goods, between basic goods and common goods and between seasonal goods and common goods indicate that there is a significant difference among these factors when analysed in relation to importance in production system.

The calculated value of significance for education system for comparison between the basic and seasonal goods is 0.854, indicating significance difference between the groups, similarly the value between goods basic goods and common goods is 0.971 indicating significance difference between the groups and further the value is 0.761 for the comparison between the seasonal and common goods indicating that there is a significance difference. All the groups comparison value in more than then the critical value of 0.05 indicating that all the three groups are significantly different among each other on the parameter of educational training.

The comparison of product groups on the parameter of employee's empowerment through Tukey HSD test between basic product group and seasonal product group is 0.027 indicating there is no difference among the group on the parameter of employee's empowerment, similarly the value of 0.014 between basic goods and common goods groups indicate there is not much significance difference among the groups. A calculated value of 0.623 between the seasonal and common product groups indicate that there is a significant difference between the group on when compared on the parameter of employee's empowerment.

The comparison among product category group with respect to production capacity have exhibited the values of

0.151 for comparison between the basic goods and common goods. This calculated value is higher than the significance value of 0.05 for Tukey HSD test, indicating that a significant difference between product category of basic goods and common goods groups exists when compared on the parameter of production capacity.

When comparing the groups on the parameter on run cycle the values of Tukey HSD test are 0.000, 0.031, 0.017 between the basic and seasonal groups, between the basic and common goods groups, and between the seasonal and common group is less than the significant value of 0.005 indicating that there is no significance difference among the group on the parameter of run cycle.

Tukey HSD test has revealed the value of 0.000 for the group comparison between the group's categories on the basis of product characteristics, basic and seasonal groups, between the basic and common goods groups, and between the seasonal and common group indicating that no significance difference among the groups exists when compared on the parameter of Raw material purchasing.

Conclusion

The textile industry has practiced the philosophy of SCM in the name of Quick Response (QR). In the conceptual framework of this study, the level of SCM activities was assumed to be different among Textile manufacturers, and it was assumed to have a relationship with the company characteristics. SCM allows Textile manufacturers to better serve their customers through improved operational activities (i.e., reduced cycle times, lower inventory levels), while reducing costs; therefore, implementing SCM activities would be related to production of Textile. The research hypotheses were built based on these assumptions. The survey results supported the research hypotheses. the group comparison between the group's categories indicating that no significance difference among the groups

exists. Therefore, cost-oriented retailers are more likely to handle basic goods and the manufacturers who supply basic goods to the cost-oriented retailers would have shorter lead-time in procuring and delivering. Respondents are rating their relationship with fabric suppliers higher than average, and textile manufacturers' performance seems to be dependent on fabric suppliers' performance. Developing the relationship with fabric suppliers toward closer partnership is being realized in this industry for more desirable performance for both fashion goods and basic goods.

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