A Survey on Factors Affecting Supply Chain Management Effectiveness: A Case of Textile Sector in Sri Lanka

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Abstract— The modern world is streaming towards the simplification of processes, reengineering and reformations of management to increase the effectiveness of manufacturing, thus practices innovative concepts, state of art technologies, best management strategies and approaches. Supply Chain Management is one such critical management approach to manage the flow of goods and services from its origin to destination effectively and efficiently.Supply Chain Management is executed in industries throughout their value chain. The apparel industry is a major industry in the world which practices supply chain management. When it comes to Sri Lanka, the apparel industry is a vital contributor to the economy and effectiveness is the key player of achieving stakeholder expectation and increasing the bottom line of the industry. The purpose of this study is to identify the factors affecting supply chain management effectiveness in the Sri Lankan textile industry. A questionnaire survey was conducted to collect primary data. The sample size was 130 with a response rate of 79%. The questionnaire consisted of nineteen factors identified through an extensive literature review. A likert scale of five options was used to capture the responses. Respondents for the questionnaire were managers, assistant managers, executives and operation analysts. In the analysis KMO and Bartlett Test have used to evaluate the reliability and the significance of the study. SPSS statistical software was used for the analysis. Varimax rotated component matrix was used to determine the coefficient of the equations. Only twelve of them affect to the research model. According to the analysis 11 factors were significant and five factors strongly affect to the effectiveness of Supply Chain Management of textile industry of Sri Lanka. They are planning, quality, sourcing, communication and procurement. Recommendations are provided related to the affecting factors as organizations need to concentrate their effort on developing these factors. Organizations are suggested to use planning tools and communication tools to improve sharing of information among supply chain partners which helps increase the transparency and planning tools such as MRP, MRPII, ERP, VMI, DRP to improve the planning process.

I. INTRODUCTION

A. Background

Simultaneous to globalization, the contemporary business environment is highly competitive and organizations have to face many challenges with the dynamic nature of the environment. Globalization has also led to the necessity of corporation or rather at a higher level, collaboration between different entities involved. Therefore supply chain management has become essential for organizations to move towards a higher level of collaboration and gain competitive advantage over their competitors.

Supply chain management can be defined as"planning, implementing and controlling the flow of information, materials and services from raw material and component suppliers to the manufacturing of the finished product for ultimate distribution to the end customer"(Michigan State University). Further it is stated as "It's a systematic integration of processes for demand planning, customer relationship collaboration, order fulfillment or delivery, product or service providing, manufacturing or operations planning and control, supplier relationship collaboration, life cycle support, and reverse logistics and their associated risks. These processes, which employ a combination of people, systems and technology, can be performed by the firm itself or in collaboration with external supply chain partners" (Michigan State University). This statement depicts the importance of supply chain management as it covers the systematic planning of integration right from the beginning of sourcing to the ultimate consumer. It also takes into account the reverse flow of goods which is from the consumer to the supplier. Proper integration and management of the reverse flow is vital now with the environmental concerns and practices of recycling and reusing. In order to gain the benefits, effective supply chain management must be practiced.

When looking at the apparel industry there are many parties involved in the supply chain as most of the world renowned brands have outsourced their manufacturing to the developing countries. The practice of outsourcing results in a greater need for supply chain integration as there are many intermediateparties involved in the business process. Therefore the greater importance for effective management of the supply chain to maximize the potential benefits.

B. The Sri Lankan Apparel Industry

The apparel industry is growing at a significant pace, which urges the companies to search for better ways to create and deliver superior values to customers(Hasarali, Mayadunne, Weerakoon, Samarasinghe, Weligodapola, & Thelijjagoda, 2012). In 2005 U.S.-Sri Lanka bilateral trade totalled U.S. $2.2 billion, which mostly consisted of Sri Lankan apparel. After liberalization of the economy in 1977, the apparel industry in Sri Lanka started growing rapidly and during 1990s, it grew at 18.5% annually (Hasarali, Mayadunne, Weerakoon, Samarasinghe, Weligodapola, & Thelijjagoda, 2012). This gradually led to the replacement of tea by apparel as the nation's largest foreign exchange earner.It was Sri Lankan rupees 3.8 billion and predicted that it will be about 4.2 billion in 2014 (Sri Lanka Central Bank Annual Report 2013). Therefore this industry has immensely contributed to the wealth of the nation by being the highest industrial employment generator and the highest foreign exchange earner. The Sri Lankan apparel industry caters to manyworld renowned high-end brands which include Victoria's Secret, Liz Claiborne, Pierre Cardin, Nike, Donna Karan, Ralph Lauren, Tommy Hilfiger, Nautica and Gap. Therefore Sri Lanka's apparel industry has to be well ahead of other competitors in order to retain these customers.

As the complexity of the supply chain increases due to increase of suppliers, more manufacturing plants, increased demand, geographically dispersed distribution centers with wide consumer networks, the industry has to adapt successfully to all potential challenges.Therefore the purpose of this study was to identify the factors which affect supply chain management effectiveness with respect to the textile industry of Sri Lanka.

II.   METHODOLOGY AND EXPERIMENTAL DESIGN

Primary data was used for this study.Data collection was done through a questionnaire survey. The questionnaire consisted ofnineteen questions which are related to the evaluation of the nineteen factors which were identified through the literature review.The nineteen independent factors weremarketing plans, market forecasting methods, a good supplier selection, machine upgrading planning, industrial planning, underutilized capacity planning, quality management and quality policy objectives responsibility and quality planning, quality assurance, quality improvements, sourcing practices, strategic, relationship with supplier, the degree of strength of the relationship with the supplier, a formal sourcing approach, responsive time of retailers, relationship with suppliers and their level of trust and commitment, government support, uncertainty aspects from overseas, information sharing risk sharing obtaining mutual benefits and coordinating plans with suppliers and information sharing obtaining mutual benefits and coordinating plans with customers. The Likert scale with five options was used to capture the responses. The sample size of the study was 130 and the response rate was 79%. Respondents of the questionnaire were Managers, Assistance Managers, Executives and other staff officers whose job role was directly related to their supply chain management systems. The population of the study was export oriented apparel manufactures and the technique used in the study was non probability sampling method as used in a similar study in Pakistan by (Nabila, Saeed, & Lodhi, 2013).Judgmental sampling method was used to include the major export oriented apparel manufactures of Sri Lanka.

The conceptual frame work has been developed by referring previous studies and related literature (Figure 1).
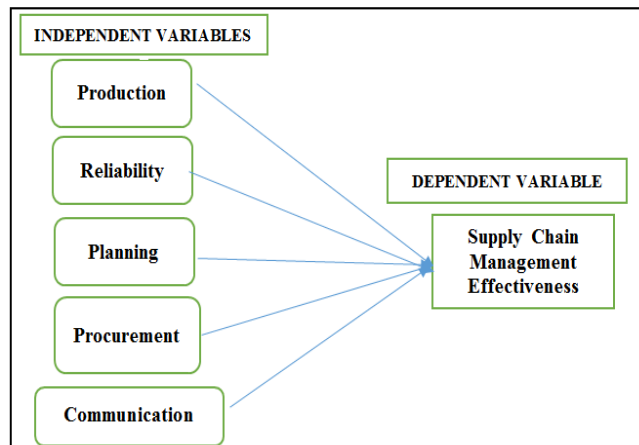

Figure 1: Conceptual framework

Once the conceptual framework was developed the factors which come under each independent factor was identified through literature.
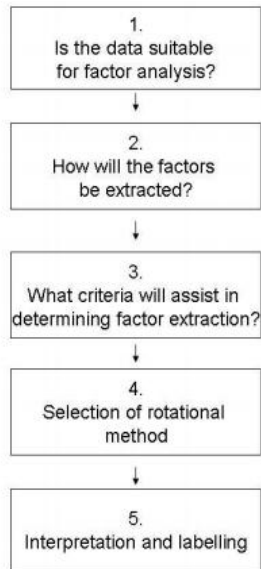
Figure 2: The 5-step Exploratory Factor Analysis Protocol (Williams, Brown, & Onsman, 2012)

Under the analysis, the Kaiser –Meyer-Olkin (KMO) method was used to test the sampling adequacy of the study.The reliability of the study was analysed through Cronbach's Alpha model which evaluates internal uniformity within the variables of the study.Descriptive statistics and factor analysis was used for the main data analysis(Fabrigar, MacCallum, Wegener, & Strahan, 1999; Stewart, 1981).The factor analysis was done according to the steps of Figure 2 which is given by(Williams, Brown, & Onsman, 2012). Statistical Program for Social Sciences (SPSS) was used as the main analysis software.

III.   RESULTS

Table 1: KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.602
Bartlett's Test of Sphericity	Approx. Chi-Square	1984.975
	df	171
	Sig.	.000

As in Table 1 the KMO value is 0.6 which is greater than the acceptable value of 0.5(Field, 2005), therefore ensures the sampling adequacy. The Cronbach's Alpha value is 0.754 which is greater than the acceptable value of 0.7, therefore the study is reliable.

The extraction method used is the Principal Component Analysis.

As per the Eigenvalue rule five factors affect the model and Table 2 depicts the values of Initial Eigenvalues, Extraction Sums of Squared Loadings, and Rotation Sums of Squared Loadings. All factors greater than 1 which generated by SPSS define the research model. There are five factors of which the Initial Eigenvalues is greater than 1 while rest of the other twelve factors are having less than 1 Initial Eigenvalues values.

Varimax method is used to determine the effectiveness and verifications. Results of the rotation method of varimax is shownin Table 3. Factors which are having greater than 0.5 value are considered as significant factors.   Accordingly the factors Marketing Plans, Machine Upgrading Planning, Industrial Planning, Underutilized Capacity Planning, A Formal Sourcing Approach, Responsive Time of Retailers, Relationship with Suppliers and Their Level of Trust and Commitment, Uncertainty Aspects from Overseas, Market Forecasting Methods, A Formal Sourcing Approach, The Degree of Strength of the Relationship with the Supplier, The Degree of Strength of the Relationship with the Supplier, Sourcing Practices, Strategic Relationship With Supplier and Information Sharing, Obtaining Mutual Benefits and Coordinating Plans with Customers lies within the significant region.

With these factors the following functions can be defined:
Factor 1 = f (Marketing Plans, Machine Upgrading Planning, Industrial Planning, Responsive Time of Retailers, Inventory planning, Underutilized Capacity Planning, Planning Tools, Production Plans)
Factor 1 can be named as Planning Factor**.**

Factor 2 = f (Outsourcing, Inventory planning)
Factor 2 can be named as Sourcing Factor

Factor 3 = f (Quality Management and Quality Policy, Objectives, Responsibility and Quality Planning)
Factor 3 can be named as Quality Factor

Factor 4 = f (On time Deliveries, On Time Financial Flow)
Factor 4 can be named as Procurement Factor

Factor 5 = f (Information Sharing, Obtaining Mutual Benefits and Coordinating Plans with Customers)
Factor 5 can be named as Communication Factor

IV. DISCUSSION AND CONCLUSION
A. Discussion
According to the results of the study there are five main factors which influence the effectiveness of supply chain

Table 2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.990	42.054	42.054	7.990	42.054	42.054	6.159	32.416	32.416
2	2.509	13.206	55.260	2.509	13.206	55.260	2.986	15.714	48.130
3	2.139	11.259	66.519	2.139	11.259	66.519	2.378	12.514	60.644
4	1.181	6.215	72.733	1.181	6.215	72.733	1.983	10.438	71.082
5	1.078	5.673	78.407	1.078	5.673	78.407	1.392	7.325	78.407
6	.953	5.017	83.424						
7	.776	4.086	87.510						
8	.632	3.328	90.838						
9	.449	2.363	93.201						
10	.370	1.945	95.146						
11	.297	1.562	96.708						
12	.175	.921	97.629						
13	.126	.661	98.290						
14	.116	.609	98.898						
15	.093	.488	99.386						
16	.059	.313	99.699						
17	.031	.165	99.864						
18	.014	.076	99.940						
19	.011	.060	100.000						

management in the apparel industry in Sri Lanka. The total variance explained by these factors is 70.4%. The factors are planning, sourcing, communication, reliability and quality. This gives a clear insight that the organizations have to focus their efforts more on these factors in order to increase their supply chain effectiveness.

Parameters which affect the factor of planning are marketing plans, machine upgrading planning, industrial planning, underutilized capacity planning, a formal sourcing approach, responsive time of retailers, relationship with suppliers and their level of trust and commitment, uncertainty aspects from overseas.

Parameters which affect the factor of sourcing are market forecasting methods and formal sourcing approach. Parameters of the factor of quality are quality management and quality policy, objectives, responsibility and quality planning. Parameters which affect the factor of procurement are on time financial flow and on time delivery. Parameters which affect the communication factor are information sharing and obtaining mutual benefits and coordinating plans with customers.

Table 3. Rotated Component Matrix

Rotated Component Matrix[a]	Component				
	1	2	3	4	5
Marketing Plans	.891	.200	.019	.005	.203
Outsourcing	.333	.705	-.219	.286	-.145
A Good Supplier Selection	-.041	.159	-.697	.067	.093
Machine Upgrading Planning	.755	.333	-.081	.039	.423
Industrial Planning	.682	.315	.039	.392	-.328
Responsive Time of Retailers	.887	.081	-.332	-.029	.037
The Degree of Strength of the Relationship with the Supplier	-.428	-.585	-.180	.019	.061
Quality Assurance	-.654	-.507	-.156	.177	.131
Quality Improvements	-.136	-.775	.221	.407	.047
On time Deliveries	.076	-.254	-.031	.869	.114
On Time Financial Flaw	.048	.259	-.208	.679	.257
Quality Management and Quality Policy, Objectives, Responsibility and Quality Planning	-.051	.013	.877	-.118	-.025
Inventory planning	.560	.626	.200	.136	.306
Underutilized Capacity Planning	.851	.067	.147	.390	-.031
Planning Tools	.756	.186	.399	.167	.238
Government Support	.349	.551	.661	.127	.143
Production Plans	.814	.302	-.028	.018	.011
Information Sharing, Risk Sharing, Obtaining Mutual Benefits and Coordinating Plans with Suppliers	-.612	-.190	-.376	.084	.001
Information Sharing, Obtaining Mutual Benefits and Coordinating Plans with Customers	.145	-.125	-.075	.303	.871
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 6 iterations.					

B.Conclusion

The factor analysis method has been applied in this research to identify the main factors which affect the supply chain effectiveness of the Sri Lankan apparel industry. Through the study five main factors have been identified as planning, sourcing, quality, procurement and communication. It could be concluded that organizations should focus intensively on the functions of planning, sourcing, quality, procurement and communication in order to improve the effectiveness of their supply chain. Use of proper planning tools and communication tools simplify processes and improve accuracy. Sharing information among supply chain partners using proper communication tools increase the transparency and facilitate quick decision making to face dynamic situations.Therefore it could be recommended that communication tools such as: Electronic Fund Transfer (EFT),Electronic Data Interchange (EDI), Intranet, Extranet, Value Added Network (VAN) and planning tools such as: Material Requirement Planning (MRP), Manufacturing Resources Planning (MRP II), Enterprise Resource Planning (ERP), Data Warehouse (DW), Vendor Managed Inventory (VMI), Distribution Requirement Planning (DRP),Customer Service Management (CRM) must be utilized by organizations. For sourcing proper sourcing procedures should be formulated and supplier

evaluation has to be performed. For the procurement function the reliability of delivery has to be improved and standard procurement procedures must be used. For the quality function, use of appropriate quality tools, quality assurance systems and quality standards have to be practiced.

As further research this study can be expanded to other industries to identify factors which affect the effectiveness of those particular industries. Also as further researchthe identified factors can be used to develop models for the supply chain effectiveness in the apparel industry.

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