THE IMPACT OF IMPORTANT CONTEXTUAL FACTORS ON SUPPLY CHAIN MANAGEMENT PRACTICES IN MANUFACTURING FIRMS IN SRI LANKA

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ABSTRACT

Supply Chain Management (SCM) practices have been defined as a set of activities undertaken in an organization to promote effective management of its supply chain. The objectives of the study are: to analyze the impact of important contextual factors on SCM practices, to recommend the areas to be improved for better SCM practices in manufacturing firms of different industries and different sizes. The contextual factors are: Industry, Organization Size, Length and Structure of the Supply Chain and Level of Uncertainty in the Demand. For evaluating the SC performance, the measurement instrument developed by Suhong Li et al. (2005), was used, and it includes six SCM constructs: Strategic Supplier Partnership [SSP], Customer Relationship [CR], Information Sharing [IS], Information Quality [IQ], Internal Lean Practices [ILP] and Postponement [POS] with a number of dimensions (attributes) for each construct. Identifying the impact of firm's main contextual factors on SCM practices will help to reduce complexity in the implementation process and come across possible means to deal with the impact of the factors. This study was based on data collected through a questionnaire from 86 randomly selected manufacturing firms from apparel, food and printing industries. A formal statistical analysis including analysis of variance (ANOVA), pairwise mean comparison and rank correlation analysis was performed. The research found that: only IS and IQ practices are affected by the contextual factors; apparel manufacturers have relatively higher level of IS practice; industry and the size of the firm have a combined impact on IQ and SC structure has significant effect on both IS and IQ. The nature of these effects was also analyzed in detail. Recommendations were made on specific dimensions of SCM practices which are statistically significant among contextual factors.

Keywords: SCM Practices, Organizational Contextual Factors, Manufacturing Firms

1. INTRODUCTION

The researchers in the area of Supply Chain Management (SCM) have identified that a lot of barriers disturb effective implementation of SCM. Among them, poor managerial and employee support, unclear objectives, lack of strategy and corporate culture are the major ones (Charles et al., 2003). Therefore, understanding the impact of the factors affecting SCM practices would support to overcome the barriers and facilitate effective SCM implementation.

Research Problem

Lack of knowledge on the impact of main contextual factors affecting SCM practices and difficulty to recognize the specific areas to be developed for improving these practices, collectively form the basic dilemma, which should be solved in order to overcome the barriers against effective implementation of SCM, which has been restricted over many decades in Sri Lankan manufacturing firms, keeping most of them far behind in the global competition.

Therefore, this research finds the impact of above contextual factors on SCM practices and recognizes the areas to be developed to improve the practices, especially for manufacturing firms in Sri Lanka. Three industries (Apparel, Food and Printing) in which most of Sri Lankan manufacturers are engaged, have been selected for the study. Identifying the impact of a firm's main contextual factors on SCM practices will provide a start to comprehensive SCM feasibility assessment. The measurement instrument developed by Suhong Li et al. (2005) was used to evaluate the practices. This model consists of six SCM practices: Strategic Supplier Partnership [SSP], Postponement [POS], Information Sharing [IS], Information Quality [IQ], Internal Lean Practices [ILP], and Customer Relationship [CR]. The data were collected through a questionnaire from 86 randomly selected manufacturing firms of three industries: Apparel, Food and Printing. The contextual factors considered were: Industry, Size of the Firm, Length of the SC, Channel Structure and the Level of Uncertainty in the Demand.

1.1 Significance of the Study

This research will identify the impact of a firm's main contextual factors on six key SCM constructs. It will help to reduce the complexity in the implementation process and come across possible means to deal with the impact of these factors. This will provide a start to comprehensive SCM feasibility assessment, especially for the Sri Lankan manufacturing firms. No longer are companies competing against other companies, but rather supply chains are competing against supply chains. Therefore, findings of this study will offer initiatives to start practicing SCM in Sri Lankan manufacturing companies, which are far behind in the global competition. Few firms in Sri Lanka have formally implemented SCM and even they are not based on properly studied compatibility of the practices to the situation of the firm. Perhaps a failure in one of the SCM practices may not indicate a failure of all the aspects of the particular practice. Therefore, it is important to recognize particular aspects of the practices that should be reconsidered, in order to improve overall performance of the practice. Since many Sri Lankan manufacturers in these three industries are engaging in global trade, the findings will be useful for those firms for SCM improvement.

2. LITERATURE REVIEW

Supply Chain Management (SCM) practices have been defined as a set of activities undertaken in an organization to promote effective management of its supply chain (Li et al., 2005). This research has found six constructs for SCM practices, defining different numbers of dimensions (attributes) for each construct. The six practices are: Strategic Supplier Partnership, Customer Relationship, Information Sharing, Information Quality, Internal Lean Practices and Postponement.

Charles et al., 2003 have mentioned that poor managerial and employee support, unclear objectives, lack of strategy, corporate culture are the major barriers against SCM implementation. It implies that studying the impact of the factors affecting SCM practices would support to overcome these barriers.

The realities of today's digital economy are requiring and enabling dramatically improved levels of SC efficiency and effectiveness. The business-to-business (B2B) or extended digital SC, enabled by Internet technologies, is specifically being offered as the next competitive weapon. McCormack and Kasper, (2002) have offered definitions and measures of the extended SC construct and reviewed the results of an ongoing benchmarking research project completed in cooperation with the US and European

Supply Chain Councils. This study found that internet usage in this regard is just beginning in both the USA and Europe but has significant relationships to cross-company (B2B) integrating practices that are key components of the extended SC and SCM performance.

Supply chain practices were classified into five broad types (www.ctl.mit.edu):

1. *Supply Chain Integration (SCI)* includes integration with customers, with suppliers, and across the internal organization. From the functional perspective, integrated collaborative product development is also included.
2. *Complexity Management* refers to coping with supply chain complexity in a cost-effective way.
3. *Aligning Strategy and Supply Chain* implies that SCM is well integrated into the strategic planning of a company and its CEO-level agenda.
4. *Information Technology (IT) with Process Improvement* means adoption of advanced SCM software combined with process improvement.
5. *Operational Innovation* means creating and implementing leading-edge practices and technologies in SCM.

The purpose of the research done by Damien (2005) is to review a sample of the literature relating to the integration and implementation of SCM practices from a strategic viewpoint. The literature is examined from three perspectives. First, SC integration covers issues relating to integration of core processes across organizational boundaries through improved communication, partnerships, alliances and cooperation. Second, strategy and planning examines SCM as a strategic matter for trading partners, along with factors relating to the amount of planning required. Third, implementation issues concern factors critical for successful implementation, as well as issues specific to inter and intra-organizational aspects of supply chain initiatives contained in this sub-group. All three need to inform and underpin each other in order for management of supply chains to be able to deliver on the promise of benefits for all trading partners.

3. METHODOLOGY

The data were collected from a randomly selected sample of manufacturing firms from apparel, food and printing industries. The composition of the sample, according to the industry and the size of the firm is given in Table 3.1.

Table 3.1: Composition of the Sample

Size of the Firm

		Large	Medium	Small	Total
Industry	Apparel	14 (16.3%)	10 (11.6%)	04 (4.7%)	28 (32.6%)
	Food	13 (15.1%)	09 (10.5%)	11 (12.8%)	33 (38.4%)
	Printing	07 (8.1%)	12 (14%)	06 (6.9%)	25 (29%)
	Total	34 (39.5%)	31 (36.1%)	21 (24.4%)	86 (100%)

The supply chain evaluation model defined by Suhong Li et al. (2005) was used in preparation of the questionnaire and it has six constructs: Strategic Supplier Partnership, Customer Relationship, Information Sharing, Information Quality, Internal Lean Practices and Postponement.

The level of each construct of each dimension was measured using five point Likert Scale. In order to analyze the data, General Linear Model (GLM) and Pair-wise Mean Comparison were applied. A formal residual analysis was conducted to check the validity of underlying assumptions of the GLM. According to the descriptive analysis results, the arithmetic mean was selected as the suitable measure of location for the data. Then the effect of the contextual factors was determined using General Linear Model (GLM). Subsequent to identifying significant factors, Tukey's Pair-wise Comparison was performed to find out which levels of the factors are significantly different.

3.1 Organizational Contextual Factors

Size of the Firm, Length of the SC, Channel Structure and Level of Uncertainty in the Demand were assumed to be most important contextual factors when it is preparing to implement SCM at a firm. Some of these factors have been suggested by Suhong Li et al. (2005). For all of these variables, data were collected in categorical form. Definitions for all contextual factors and the justifications to derive the levels of the factors are described below.

- *Industry:*

  The three industries considered are: Apparel, Food and Printing. The reason for this selection was that they represent a larger proportion of Sri Lankan Manufacturing companies and their perceived differences in SC characteristics. Even though 'Printing' industry includes a lot of service characteristics, it was also included considering its manufacturing process involved.

- *Size of the Firm:*

  An exact definition given by any authorization was not found for the size of the firm and a lot of studies have used the turnover of the company as a major indicator for determining it. Therefore, the annual turnover of the company was used as the basis for classifying the companies into Small, Medium and Large. Appropriate Statistical methods were also used for the classification. The answers provided by the responding companies for the 'Size of the Company' were used as the prior data (Small/Medium/Large). The Dot-Plots of annual turnover were sketched to see the clustering of companies according to the Size of the Company as answered. (Only those companies who had answered were taken.)   Then following classification was done analyzing the ranges of clustering seen in the Dot Plots.

Table 3.2: Classification for Size of the Company

Industry	Turnover Range (in Rs. Millions)	Size
Printing	Not more than 10	Small
	10-100	Medium
	Over 100	Large
Food	Not more than 100	Small
	100-750	Medium
	Over 750	Large
Apparel	Not more than 50	Small
	50-500	Medium
	Over 500	Large

The companies who had not given their annual turnover were carefully analyzed from the Dot-plots and determined which should be their actual size category. During this process, responses given by some firms for the 'size of the firm' were edited.

- *Length of the SC:*

The total number of participants (estimated) in the upstream and the downstream of the manufacturer was considered as the length of the supply chain. It is not practical to find the actual length of the entire SC because of its complexity. Therefore, it was approximately obtained by classifying the number of upstream and downstream entities as Small, Medium and Large according to the manufacturer's knowledge.

- *Channel Structure:*

This is the structure of the intermediaries in the supply chain. The upstream and downstream structures were considered in the following manner.

Table 3.2: Coding for Upstream & Downstream structure

Raw Material Flow (Upstream)	Upstream Structure
Raw material manufacturer → Manufacturing company	Up-Str1
… → Retailer → Manufacturing company	Up-Str2
… → Distributor/Wholesaler → Manufacturing company	Up-Str3
Finished Product Flow (Downstream)	**Downstream Structure**
Manufacturing company → End customer	Down-Str1
Manufacturing company → Retailer → End customer	Down-Str2
Manufacturing company → Distributor/Wholesaler → Retailer → End customer	Down-Str3

- *Level of Uncertainty in the Demand*

This is how much uncertain the demand for the manufacturer's main product. Uncertainty in the demand was classified into two: Low and High. The level 'Medium' was excluded in order to reduce the confusion of the respondent in answering.

Organizational

Contextual Factors

SCM Practices

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┌─────────────────────────────┐              ┌───────────────────────────────────────────┐
│  ┌──────────────────┐        │              │  ┌───────────────────────────────────┐    │
│  │    Industry      │        │              │  │  Strategic Supplier Partnership   │    │
│  └──────────────────┘        │              │  └───────────────────────────────────┘    │
│                              │              │                                           │
│  ┌──────────────────┐        │              │  ┌───────────────────────────────────┐    │
│  │  Size of the firm │       │              │  │  Postponement                     │    │
│  └──────────────────┘        │              │  └───────────────────────────────────┘    │
│                              │   ─────────▶ │                                           │
│  ┌──────────────────┐        │              │  ┌───────────────────────────────────┐    │
│  │  Length of the SC │       │              │  │  Information Sharing              │    │
│  └──────────────────┘        │              │  └───────────────────────────────────┘    │
│                              │              │                                           │
│  ┌──────────────────┐        │              │  ┌───────────────────────────────────┐    │
│  │  Channel Structure │      │              │  │  Information Quality              │    │
│  └──────────────────┘        │              │  └───────────────────────────────────┘    │
│                              │              │                                           │
│  ┌──────────────────────────┐│              │  ┌───────────────────────────────────┐    │
│  │ Level of Uncertainty in  ││              │  │  Internal Lean Practices          │    │
│  │ demand                   ││              │  └───────────────────────────────────┘    │
│  └──────────────────────────┘│              │                                           │
│                              │              │  ┌───────────────────────────────────┐    │
│                              │              │  │  Customer Relationship            │    │
│                              │              │  └───────────────────────────────────┘    │
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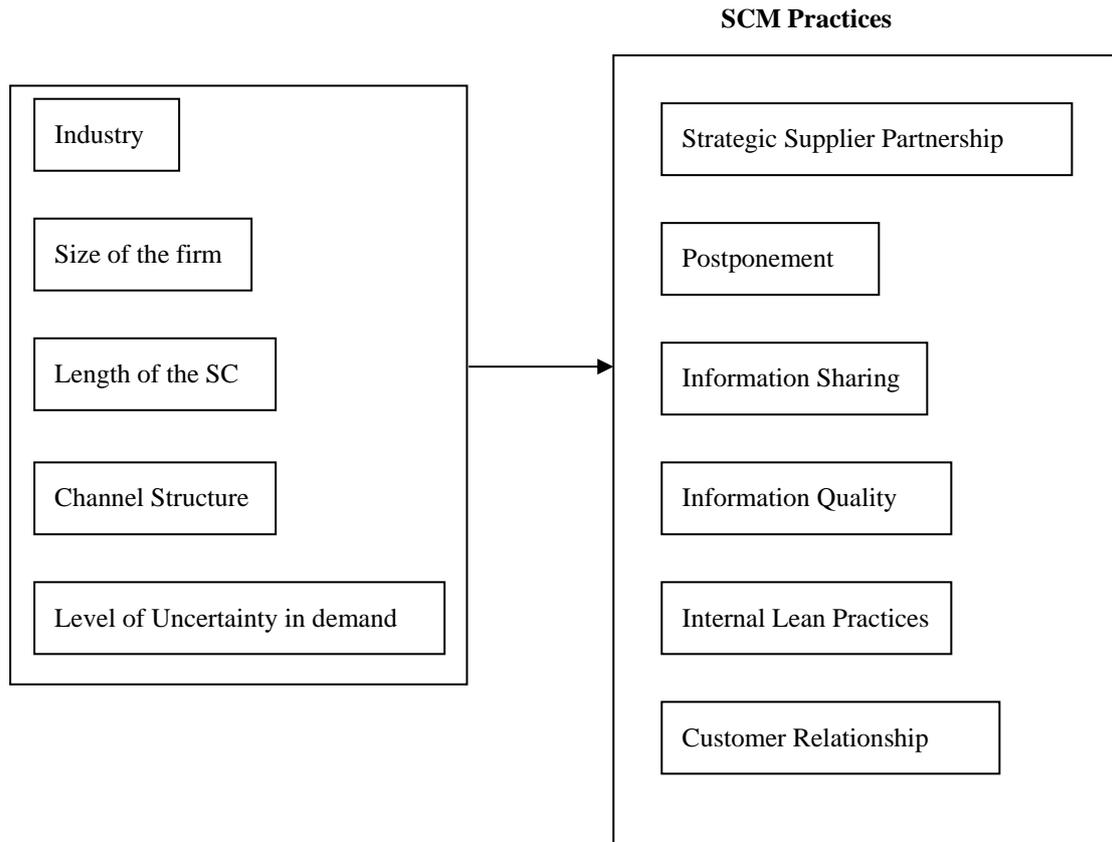
Figure 3.1: The Research Framework

The arithmetic mean was selected as the most appropriate measure of location of each SCM construct according to the descriptive statistical results. The histograms of the averages of construct values indicated approximately symmetric behavior in the distribution. The analysis was basically three types: General Linear Model (GLM), Pairwise Mean Comparison and Rank Correlation analysis. The dependencies of the SCM practices on contextual factors were tested using a specific Analysis of Variance called 'General Linear Model'. General Linear Model (GLM) was used to perform univariate analysis of variance with balanced and unbalanced designs. After identifying significant factors, Tukey's Pairwise Comparison was performed to find out the significantly different levels of the factors. Results of the GLM analysis were validated by a formal residual analysis. Spearman's Rank Correlation analysis was performed in order to make recommendations about the areas to be improved, for achieving better levels of SCM practices which were statistically significant. The rank correlation was used because the Pearson's coefficient of correlation measures only the magnitude of linear relationship between two variables. Since the relationship between SC constructs and their attributes is not obvious to be linear, the rank correlation was applied.

4. DATA ANALYSIS

An analysis of Variance model named General Linear Model (GLM) was used to analyze the impact of the contextual factors on SCM practices. The level of significance (alpha, α) used throughout analysis is 0.05. After identifying significant SCM constructs, in order to identify the areas or attributes of SCM practices to be improved, Spearman's Rank Correlation analysis was used.

4.1 The Impact of Contextual Factors on SCM Practices

To analyze the impact of contextual factors on SCM practices, General Linear Model (GLM) was applied so as to be useful for checking interaction effects of the factors as well. The p-values correspond to the GLM analysis are given in Table 4.1. (These results were validated and corresponding residual analysis is provided in Appendix)

Table 4.1: P-Values of General Linear Models *(alpha = 0.05)*

Model	Factor	SSP	CR	IQ	IS	ILP	POS
GLM1: Industry+Size+ Industry*Size	Industry	0.699	0.893	**0.016**	**0.006**	0.103	0.917
	Size	0.102	0.210	0.756	**0.022**	0.315	0.960
	Industry*Size	0.427	0.366	**0.006**	0.526	0.119	0.612
GLM 2: Industry+SC Length+ Industry*SC Length	Industry	0.584	0.396	0.332	**0.007**	0.190	0.946
	SC Length	0.851	0.342	0.712	0.361	0.109	0.785
	Industry*SC Length	0.248	0.458	1.000	0.892	0.949	0.659
GLM 3: Industry+Demand Uncertainty+ Industry*Demand Uncertainty	Industry	0.396	0.335	**0.033**	**0.004**	0.108	0.715
	Uncertainty	0.779	0.181	**0.007**	0.287	0.193	0.686
	Industry*Uncertainty	0.612	0.401	0.181	0.575	0.476	0.326
GLM 4: Upstream SC Structure+Downstream SC Structure+Upstream*Downstream SC Structure	Upstream SC Structure	0.434	0.459	0.846	**0.000**	0.749	0.405
	Downstream SC Structure	0.245	0.291	**0.018**	0.251	0.068	0.854
	Upstream * Downstream SC Structure	0.458	0.736	0.147	**0.018**	0.206	0.717

The p-values indicate that all of the SCM practices except IS and IQ, are not significantly affected by the contextual factors. The p-values less than the level of significance (0.05) imply that both Industry and Size of the firm influence IS practice of an organization. In order to identify between which levels of the above factors this difference exists, Tukey's pairwise mean comparison was applied. The results are shown in Table 4.2.

Table 4.2: Tukey's Pairwise Comparison for IS
(Factors: Industry & Size of the Firm)

Factor	Levels	Statistical Significance of the Mean Difference
Industry	Apparel/Food	Significant
	Apparel/Printing	Significant
	Food/Printing	Not significant
Size of the Organization	Large/Medium	Not significant
	Large/Small	Significant
	Medium/Small	Not significant

IS of Food and Printing Firms is significantly different while Medium and Small firms practice significantly different levels of IS.

The combined factor of upstream and downstream SC structures is also significant. The mean profile of the combinations of these SC structures illustrates that the combination of Upstream Structure 2 and Downstream Structure 1 has relatively lower level of IS. Tukey's pairwise result implied the same.
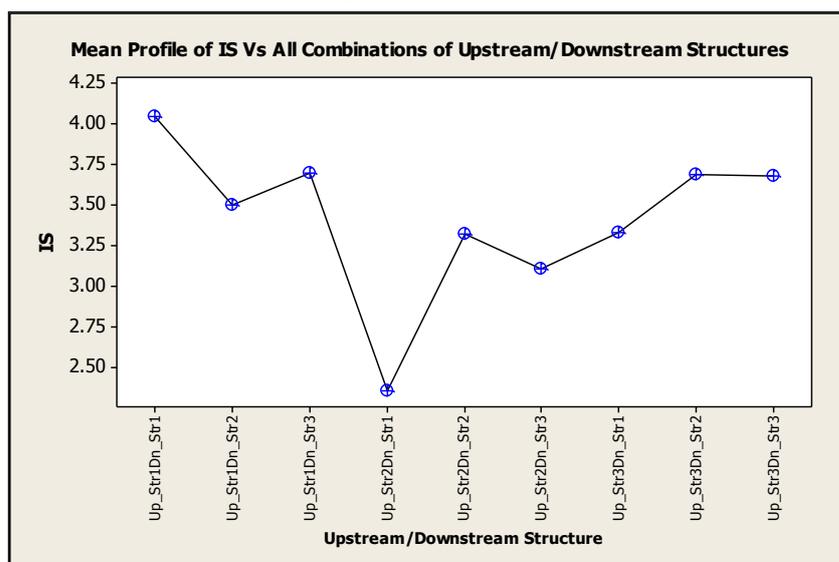

Figure 4.1: Mean Profile of IS for All Combinations of Upstream & Downstream SC Structures

In case of Information Quality (IQ), the p-value 0.006 implies that Industry and Size of the Firm have a combined effect on IQ. Demand uncertainty and Downstream SC structure also have significant effects on IQ. For further analyzing these, Tukey's pairwise comparison was applied.
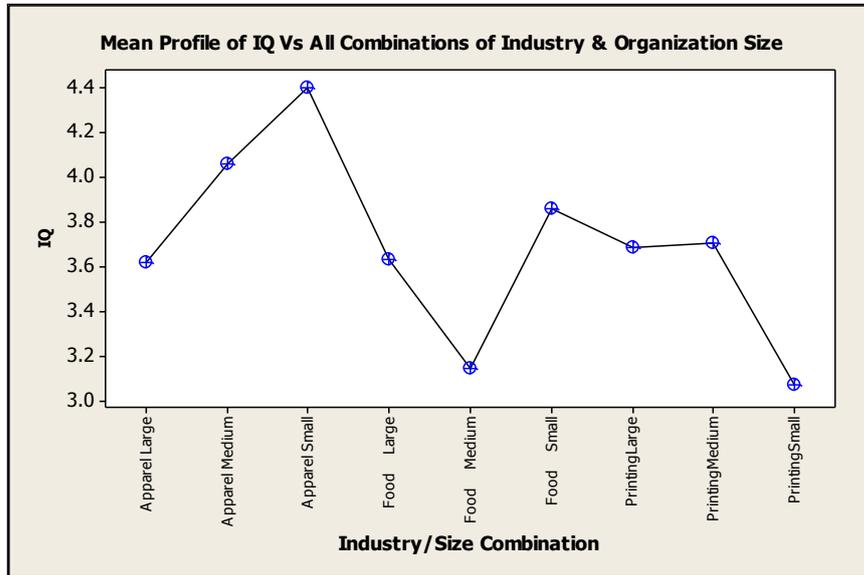

Figure 4.2: Mean Profile of IQ for All Combinations of Industry and Size

Medium sized food manufacturers small printers have relatively lower levels of IQ. Main effect plot of Downstream SC structure in Figure 4.3 illustrates that Downstream SC structure 2 has relatively lower level of IQ. For further analyzing these, Tukey's pairwise comparison was applied.
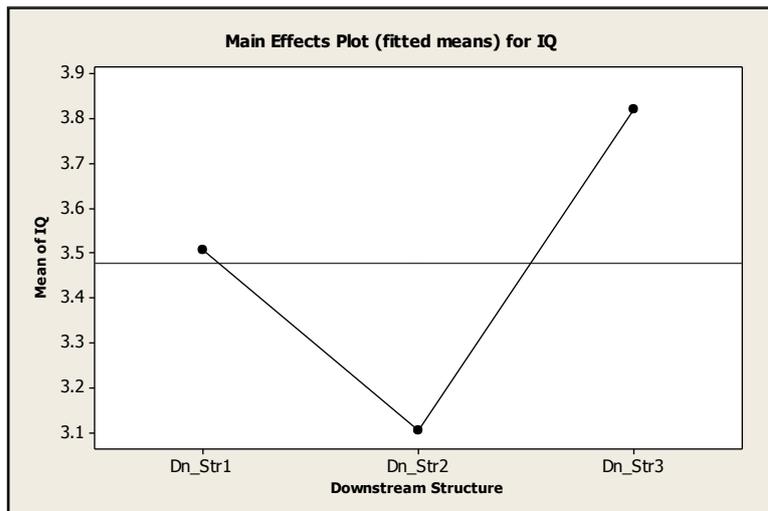
Figure 4.3: Main Effect Plot for Downstream SC Structure

4.2 Correlation Analysis

Spearman's Rank Correlation Analysis was the method used to identify the areas to be improved for better levels of SCM practices in manufacturing firms of different industries and different sizes. The SCM practices which are not significantly different (SSP, POS, CR and ILP) among different industries and organization sizes are not included in this correlation analysis. The objective of this analysis was only to identify areas of the SCM practices to be improved, in the companies which are lagging behind the others. The Rank Correlation Coefficients were calculated between score of a particular SCM construct and all of its attributes. Then required attributes were selected through a careful manual analysis of correlation values.

Information Sharing in Three Industries

The GLM has shown that a statistically significant difference in IS among manufacturers of three industries. Tukey's Pairwise Comparison results indicate that this difference mainly exists between Apparel and the other two industries. Table 4.3 provides relevant rank correlation values.

Table 4.3: Rank Correlation Coefficients with IS for Industry

Attribute of IS*	Apparel	Food	Printing
IS1	0.58634	**0.48070**	**0.40627**
IS2	0.35327	0.63248	0.37795
IS3	0.51692	0.58966	0.58423
IS4	0.70808	0.76103	0.81138
IS5	0.54697	0.67912	0.61831
IS6	0.37562	0.60482	0.78140
IS7	0.40003	0.66309	0.56544

(* see the Appendix for the attributes of IS)

For attribute IS1, correlation coefficients of Food and Printing industries are less than that of the Apparel industry. Therefore, IS1 (Sharing business unit proprietary information with trading partners) has been identified as the main attribute which caused for relatively less IS level in these two industries.

Information Sharing of the Firms of Three Scales

According to the GLM, level of IS in three scales of manufacturing firms are significantly different, regardless of the industry. Tukey's Pairwise Comparison results indicate that this difference mainly exists between Large and Small-scale manufacturers. Therefore, Medium-scale was not included in the correlation analysis

Table 4.4: Rank Correlation Coefficients with IS for Size of the Firm

Attribute of IS[*]	Large	Small
IS1	0.53448	0.53604
IS2	0.45543	**0.39887**
IS3	0.54070	0.58868
IS4	0.48759	0.88487
IS5	0.63912	0.79022
IS6	0.48759	0.70019
IS7	0.61791	0.73556

([*]see the Appendix for the attributes of IS)

According to the values in Table 4.4, IS2 (Making informed trading partners in advance of changing needs) is the attribute which has caused lesser level of IS practice in Small firms compared to Large firms.

Information Quality in Three Industries and Three Scales

According to the measurement instrument selected in the study, Information Quality (IQ) has five attributes. The GLM indicate that there is a significant difference in level of IQ between different combinations of Industry and the Size of the firm. The combinations selected for the correlation analysis are the combinations which were selected as significant by Tukey's Pairwise Comparison. Table 4.5 provides the results.

Table 4.5: Rank Correlation Coefficients with IQ for Combinations of Industry and Size of the Firm

Attribute of IQ*	Apparel/Medium	Apparel/ Small	Food/ Medium	Printing/ Small
IQ1	0.69293	0.86603	**0.80296**	**0.67893**
IQ2	0.51795	0.86603	0.89912	0.92582
IQ3	0.66144	1.00000	**	0.92582
IQ4	0.84248	0.86603	**0.70244**	0.95618
IQ5	0.92962	0.86603	**0.58835**	**0.77152**
Attribute of IQ[1]	**Food/Small**	**Printing/ Medium**		
IQ1	0.93850	0.93877		
IQ2	0.87939	0.83412		
IQ3	0.88636	0.62271		
IQ4	0.92129	0.65007		
IQ5	0.90915	0.34340		

(*see the Appendix for the attributes of IQ,

**not defined due to equal observation)

Tukey's Comparison result implies that medium-scale food manufacturers and small scale-printers have significantly lower levels of IQ compared to, medium scale-printers medium/small-scale apparel and small-scale food manufacturers. Mean profiles also revealed this. The correlation analysis result shows that both categories of manufacturers should focus on IQ1 (Timely exchange of information between trading partners) and IQ5 (Reliable exchange of information between trading partners) in order to improve IQ. In addition to that medium scale food manufacturers should also concentrate on IQ4 (Adequacy of information exchanged).

5. CONCLUSIONS

Apparel manufacturers have comparatively higher level of IS practice than printers and food manufacturers while small-scale firms practice lesser IS compared to large firms. In order to improve IS printers and food manufacturers should focus more on 'Sharing business unit proprietary information with trading partners'. Regardless of the industry, small-scale firms should focus on 'Making informed trading partners in advance of changing needs'. Supply Chain Structure also has a significant impact on IS of the firm. Small-scale apparel manufacturers have relatively the highest level of IQ and it is very low in medium-scale food manufacturing firms and small-scale printing firms. Also downstream SC structure has a significant impact on IQ. Manufacturers who sell their main product through distributors/wholesalers and retailers, tend to exchange better quality information with trading partners than who sell only through retailers. There is no significant difference in other SCM constructs does not mean that they all are properly practiced in Sri Lankan manufacturing firms of the three industries because this analysis only focused on existing levels of SCM practices. Therefore, all the comparisons of the study are relative to the existing levels of the practices.

6. FURTHER RESEARCH

The research has focused only three industries and it could be extended to other industries as well. The results might be different from what discovered if it concentrates on industries with different SC characteristics. Since this study only covers SCM practices of manufacturers, it would be interesting if a research covers other positions in the supply chain such as raw material suppliers, distributors or wholesalers and retailers. A study investigating similarities and dissimilarities in the SCM practices of different partners in the SC would also be conducted. A comprehensive investigation of underlying causes for having different impacts of the contextual factors could be focused in another study. This research could not analyze higher order interactions between contextual factors because of having inadequate number of observations for the sub categories. A new research can have the same focus with a sufficiently large sample with adequate data points for each sub category, and then it might discover different types of relationships. A research which focuses one or a few of these SCM practices in depth for a particular industry where those practice(s) is/are perceived to be largely important is also possible.

Table A1: The Attributes of Supply Chain Constructs

SCM Construct	Attributes
(A). Strategic Supplier Partnership [SSP]	I. Relying on few dependable suppliers II. Relying on few high quality suppliers III. Considering quality as the number one criterion in selecting suppliers IV. Striving to establish long-term relationship with the suppliers V. Regular problem solving jointly with the suppliers VI. Helped the suppliers to improve their product quality VII. Having continuous improvement programs that include the key suppliers VIII. Including the key suppliers in planning and goal setting activities IX. Actively involving the key suppliers in new product development process X. Certifying the suppliers for quality
(B). Customer relationship [CR]	I. Frequently evaluating the formal and informal complaints of the customers II. Frequently interacting with customers to set reliability, responsiveness, and other standards for the company III. Having frequent follow-up with for quality/service feedback IV. Frequently measuring and evaluating customer satisfaction V. Frequently determining future customer expectations VI. Facilitating customers ability to seek satisfaction from the company VII. Sharing a sense of fair play with the customers VIII. Periodically evaluating the importance of the relationship with the customers
(C). Information sharing [IS]	I. Sharing the business unit proprietary information with trading partners II. Making informed trading partners in advance of changing needs III. Trading partners share proprietary information with the company IV. Trading partners keeping the company fully informed about issues that affect the business V. Trading partners share business knowledge of core business process with the company

Table A1 Continued...

	VI.	The company and the trading partners exchange information that helps establishment of business planning
	VII.	The company and the trading partners keep each other informed about events or changes that may affect the other partners
(D). Information quality [IQ]	I.	Information exchange between the trading partners and the company is timely
	II.	Information exchange between the trading partners and the company is accurate
	III.	Information exchange between the trading partners and the company is complete
	IV.	Information exchange between the trading partners and the company is adequate
	V.	Information exchange between the trading partners and the company is reliable
(E). Internal lean practices [ILP]	I.	Reducing set-up time
	II.	Having continuous quality improvement program
	III.	Using a "Pull" production system
	IV.	Pushing suppliers for shorter lead-times
	V.	Streamlining ordering, receiving and other paperwork from suppliers
(F). Postponement [POS]	I.	Designing products for modular assembly
	II.	Ability to re-arrange production process modules so that customization can be carried out later at distribution centers
	III.	Delaying final product assembly activities until customer orders have actually been received
	IV.	Delaying final product assembly activities until the last possible position (or nearest to customer) in the supply chain
	V.	Storing the goods at appropriate distribution points close to the customers in the supply chain

Table A2: Normality Test for Residuals of the GLM Analysis

ANOVA Model	P-Value (Anderson Darling Normality Test)
GLM (IS Vs Industry, Size)	0.111
GLM (IS Vs Industry, SC Length)	0.075
GLM (IS Vs Industry, Uncertainty in the Demand)	0.139
GLM (IS Vs Upstream & Downstream SC Structure)	0.368
One-Way ANOVA (All combinations of Upstream & Downstream SC Structures)	0.368
GLM (SSP Vs Industry, Size)	0.718
GLM (SSP Vs Industry, SC Length)	0.631
GLM (SSP Vs Industry, Uncertainty in the Demand)	0.750
GLM (SSP Vs Upstream & Downstream SC Structure)	0.507
GLM (CR Vs Industry, Size)	0.295
GLM (CR Vs Industry, SC Length)	0.790
GLM (CR Vs Industry, Uncertainty in the Demand)	0.396
GLM (CR Vs Upstream & Downstream SC Structure)	0.151
General Linear Model (IQ Vs Industry, Size)	0.836
GLM (IQ Vs Industry, SC Length)	0.893
GLM (IQ Vs Industry, Uncertainty in the Demand)	0.787
GLM (IQ Vs Industry, Size, Uncertainty in the Demand)	0.934
One-Way ANOVA (All combinations of Industry & Size)	0.836
GLM (IQ Vs Upstream & Downstream SC Structure)	0.453
GLM (ILP Vs Industry, Size)	0.418
GLM (ILP Vs Industry, SC Length)	0.125
GLM (ILP Vs Industry, Uncertainty in the Demand)	0.225
GLM (ILP Vs Upstream & Downstream SC Structure)	0.258
GLM (POS Vs Industry, Size)	0.385
GLM (POS Vs Industry, SC Length)	0.138
GLM (POS Vs Industry, Uncertainty in the Demand)	0.358
GLM (POS Vs Upstream & Downstream SC Structure)	0.319

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