The Level of Green Supply Chain Practices Adoption in Sri Lankan Manufacturing Companies

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Abstract - It is been topical to discuss about Green Supply Chain Management due to increasing environmental issues all over the world. Therefore many scholars have been given their attention to do more research on this area based on their own countries. Through this study researcher expects to strength existing body of knowledge regarding green supply chain management based on the Sri Lankan context. Thus this paper attempts to identify the current level of green supply chain practices adoption in Sri Lankan manufacturing companies and gives comparative analysis of green supply chain practices adoption with Chinese and Japanese manufacturing companies. For this study structured questionnaire was used to collect data from the sample of 125 manufacturing companies in Sri Lanka and data were analyzed using descriptive analysis. In order to have general understanding about the level of green supply chain practices adoption, five stages of adoption level was used as a theoretical base. Findings of this study will be more contributed to strengthen the green supply chain management further for managers, relevant authorities and the government of Sri Lanka.

Key words- Environmental Issues, Green Supply Chain Management, Green Supply Chain Practices, Level of Adoption, Manufacturing Companies.

1. Introduction

Green Supply Chain Management (GSCM) is one of the newest trends in supply chain evolution and it is been emerged due to increasing market complexity and competitive pressure [13]. The complete concept of "green supply chain" (GSC) was first proposed by the Manufacturing Research Consortium (MRC) of Michigan State University in the U.S. in 1996, for comprehensively considering environmental impacts and resources optimization of manufacturing supply chains [3]. With the emergence of this new concept ample studies were previously conducted by addressing different aspects such as implementation of GSCM strategies [19], the adoption of green supply chain strategy [7], boundaries & flows perspectives of GSCM [20], the influence of green practices on supply chain performance [6], determinants of green supply chain practices [8]. Those studies evidenced that many authors have focused on range of topics in GSCM. However it was found that many studies were conducted based on developed countries while little research attention was given by developing countries on this area. Furthermore literature on this area were hardly any found based on the Sri Lankan context as well. This was the prime motive of the researcher to interest in finding the level of adoption of green supply chain practices in Sri Lanka. Therefore this paper attempts to investigate the level of GSC practices adoption in new aspect within the context of Sri Lanka.

2. Literature Review

2.1 Green Supply Chain Management in Asian Region

Little research attention has been given to the GSCM in developing countries especially in Asian region [1]. Most companies in developing countries adopted the green solutions into their business due to reduce the negative environmental effects rather than adopting a proactive approach to reduce the sources of waste or pollution [4]. [17], shown that environmental supply chain practices had started to takeplace the implimentation of divers of GSCM at his study on green supply chain in South East Asian Region (Philippines, Indonesia, Malaysia, Thailand, and Singapore). Recent literature showed that most researchers starting investigate on GSCM in East Asian Region like China as developing country. It is critical to research on GSCM in China since it has to deal with huge environmental problems as a major manufacturing country. Hence [26], studied pressures, practices and performance of Green supply chain management in China. Another study by [27], on Green supply chain management in leading manufacturers was done as Case studies in Japanese large companies. The study by [25],

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analyzed the relationship between operational practices and performance among early adopters of green supply chain practices in chinese manufacturing enterprices. Another study caried out by [28], shows drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. [12], confirmed that the Chinese companies are still at a preliminary stage of GSCM practices in their study of Sustainable Production;Practices and Determinant Factors of Green Supply Chain Management of Chinese Companies.

Not only China, interest of researchers on GSCM has been raised in another Asian countries such as India,Thailand and Malaysia. Thailand analyzed the recent green activities in computer parts' manufacturers and also measured the level of green supply chain management. [14],Indian automobile industry was analyzed to study the barriers to impliment GSCM.

2.2 Green Supply Chain Practices

In green supply chain management literature, level of green supply chain practices adoption is measured in different practices used by different studies. [2], pointed out all the steps and elements of the supply chain must be analyzed for its environmental impact in order to adopt green practices. According to [2], supply chain element as purchasing, warehousing, distributing/transporting, manufacturing and consumption are analysed to measure the green supply chain practices adoption. The key practices mentioned in previous studies include green design, green operations, reverse logistics, waste management and green manufacturing [23]. However a framework proposed by [11], categorized green supply chain practices in to inbound practices, operations practices, outbound practices, reverse logistics, management support, and customer support. Most of the previous studies have considered the green supply chain practices under the four basic categories as internal environmental management, external GSCM including green purchasing, customers corporation with eco design, and investment recovery [25],[26],[27].

2.3 Level of Adoption

The term adoption simply means to what extent do people apply new process or follow new practice. According to the [10], the term adoption is used as a way of describing a conscious decision to implement a new practice or apply a new technology. Adoption is therefore used to describe the results of processes of decision making and behavior change [16]. During this decision making process beneficiaries can reject the change and seek to re-establish the previous practice or technology, [10], [16]. In order to measure the level of adoption different studies used different scales [9], [24]. Many researchers used five stages of adoption to measure the adoption level [18], [15], [24]. The pyramidal five stages include awareness, interest, evaluation, trial, and adoption. However [22], argued that five stages process of adoption was dynamic not static. All the adopters do not follow the same stages and sequence is not always the same. Hence he developed seven stages of adoption namely need, awareness, interest, deliberation, trial, evaluation and adoption.

3. Methodology

3.1 Sample Selection

The current study considers all the manufacturing companies in western province of Sri Lanka as population. According to the [5], more than 50% of establishments are concentrated in to western province and all other provinces represent less than 12% of number of establishments. (see figure 1).For this study 125 manufacturing companies in the western province were selected as the sample representing five major industrial sectors as follows. (see table 1)

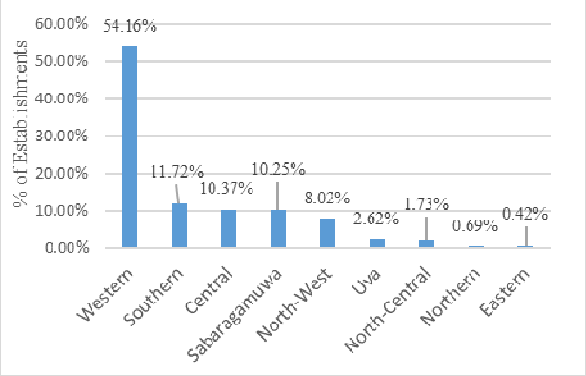

Figure 1: Distribution of Industrial Establishment by Province-2013

Table 1. Selection of Sample Subjects

Industrial Sector	Selected Sample Subject	%
Food & Beverages	42	32%
Apperal & Textile	31	26%
Rubber & Plastics	13	10%
Chemical & chemical products	5	4%
Electrical	2	1%
Other Manufacturing	32	25%
Total	125	100 %

The researcher used heterogeneous sample in this study regardless the industry which they operate their business. Researcher received 125 valid responses and composition based on industry type is shown in table 1. Out of the valid responses, 34 percent represents the food and

beverage industry, 26 percent represents the apparel and textile, 10 percent represents rubber and plastics, 4 percent from chemical and chemical products, 1 percent from electrical and 25 percent represents other manufacturing industries.

The sample was further characterized by the age of the company. The purpose of that is to identify how long a company has been doing their business.

Based on the research data, researcher categorized the age of the responded companies into five levels and the highest number of companies in the sample represents less than 24 years category. (see figure 2). That is 55% of the sample and 45% of the sample represent the companies which are have been doing their business more than 25 years.

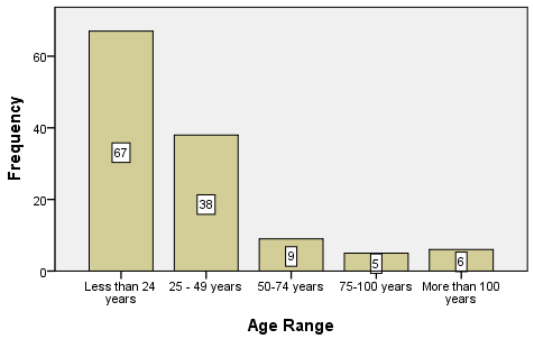

Figure 2: Age Composition of the Companies

3.2 Questionnaire Development

In this study level of green supply chain practices adoption is measured by 19 items based on the standard questionnaire used by previous studies [25], [26], [28]. In their study green supply chain management practices were identified within four basic categories of internal environmental management, external GSCM including green purchasing, customers corporation with eco design, and investment recovery. In order to assess the constructs of the green supply chain practices, respondents were asked to evaluate each question in terms of level of implementation of each practice in their company using five point likert scale (1- Not considering, 2- Planning to consider, 3- Considering it currently, 4- Initiating implementation, 5-Implimenting successfully). Owing to the suggested scoring method of [21], summated value of green supply chain practices is taken by adding individual scores of the 19 items and that score can obtain any value between 19 (1 x 19) to 95 (5 x 19). For univariate analysis the range (19-95) is sub devided into five levels as mentioned by [15], [18], [24], as follows.

19 – 34 Awareness - 1

35 – 49 Interest - 2

50– 65 Evaluation - 3

66 – 80 Trial - 4

81- 95 Adoption - 5

4. Results & Findings

4.1 Overall results

For the general understanding of the level of adoption in green supply chain practices in Sri Lanka, responses were analyzed in overall. The level of green supply chain practices adoption was measured by the summated value of the 19 items under four basic categories of green supply chain practices. Adoption level was categorized in to five stages as awareness, interest, evaluation, trial and adoption as proposed by [18].

According to the Table 2, 32% of respondent companies are in trial level, 28.8% of respondent companies are already adopted and 24.8% are in the evaluation level. 12% of respondent companies are interesting to adopt green supply chain practices and only 2.4% of the respondent companies are at awareness level.

Table 2. Current Level of GSCP Adoption

Level	Score Range	Frequency	Percent	Cumulative Percent
Awareness	19-34	3	2.4	2.4
Interest	35-49	15	12.0	14.4
Evaluation	50-65	31	24.8	39.2
Trial	66-80	40	32.0	71.2
Adoption	81-95	36	28.8	100.0
Total		**125**	**100.0**	

Mean: 34.82 Median: 35.73 Mode: 43.72 SD: 7.72

4.2 Comparative results

In order to have general understanding about GSCP adoption of Sri Lankan companies, current study calculated means of each GSC practices and compare those with Chinese and Japanese companies based on previous studies.[26], [27].

As per the table 3, Sri Lankan manufacturing companies are practicing internal environment management practices at high level than Chinese companies but lower level than the Japanese companies. Green purchasing practices are practicing all three countries slightly similar level. But customer coorperation with environmental consideration & eco design practices and investment recovery practices are practising at high level in Sri Lanka than Chinese and Japanese companies. In Sri Lanka, means of all practices are higher than 3.0 except two practices in Green purchasing namely environmental audit for suppliers' internal management and Second-tier supplier environmentally friendly practice evaluation.

Table 3. Comparative results of GSCPs

	N	Min.	Max.	Mean	S.D	Means in China	Means in Japan
Internal environmental management							
1) Cross-functional cooperation for environmental improvements	125	2.00	5.00	3.64	0.987	3.96	4.56
2) Total quality environmental management	125	1.00	5.00	3.88	0.997	3.82	4.78
3) Environmental compliance and auditing programs	125	3.00	5.00	4.30	0.835	3.91	4.89
4) ISO 14001 certification	125	1.00	5.00	3.41	1.380	3.36	4.89
5) Environmental Management Systems exist	125	1.00	5.00	3.86	1.255	3.53	4.67
Green purchasing							
6) Providing design specification to suppliers that include environmental requirements for purchased item	125	2.00	5.00	3.48	0.947	3.53	3.33
7) Cooperation with suppliers for environmental objectives	125	1.00	5.00	3.41	1.392	3.25	3.71
8) Environmental audit for suppliers' internal management	125	1.00	5.00	2.96	1.291	3.04	3.29
9) Suppliers' ISO14001 certification	125	1.00	5.00	3.16	1.370	3.18	4.00
10) Second-tier supplier environmentally friendly practice evaluation	125	1.00	5.00	2.79	1.220	2.88	1.80
Customer cooperation with environmental considerations & Eco design							
11) Cooperation with customers for Eco design	125	1.00	5.00	3.24	1.279	2.64	2.60
12) Cooperation with customers for cleaner production	125	1.00	5.00	3.43	1.291	3.22	2.00
13) Cooperation with customers for green packaging	125	1.00	5.00	3.22	1.261	3.15	2.00
14) Design of products for reduced consumption of materials/energy	125	1.00	5.00	3.90	1.160	3.86	3.33
15) Design of products for reuse, recycle, recovery of materials, component parts	125	1.00	5.00	4.02	1.171	3.35	2.80
16) Design of products to avoid or reduce use of hazardous products and/or their manufacturing process	125	3.00	5.00	4.34	0.793	3.79	4.17
Investment recovery							
17) Investment recovery (sale) of excess inventories/materials	125	1.00	5.00	3.90	1.187	3.49	3.00
18) Sale of scrap and used materials	125	3.00	5.00	4.40	0.803	3.50	4.00
19) Sale of excess capital equipment	125	1.00	5.00	3.48	1.484	3.27	2.67

Notes: 1= Not considering 2= Planning to consider, 3= Considering it currently, 4= Initiating implementation, 5= Implementing successfully; n= number of respondent companies

5. Findings

Based on the current study, researcher found that Sri Lankan manufacturing companies are currently considering all the practices of GSCM and most of them have initiated implementation. According to the age composition of the sample it was found that more than 50% of the sample companies has been doing their business less than 25 years. Therefore the reason for not fully adopting for GSCP may be it takes some time to adopt new practices since the adoption is a part of decision making process and the behavior change as described by [6].

However as per the above results it was found that majority of the manufaturing companies (more than 50%) have taken steps to adopt green supply chain practices. This is evidenced that Sri Lankan manufacturing companies are more concerning about environmental impact of their operation. Thus researcher concludes that Sri Lankan manufacturing companies are more tend towards adopting green supply chain practices. On the other hand this is a good sign for demanding our products at global market since global attention is more on green concepts than Sri Lanka. According to the comparative results of this study it is further confirmed that there will be more demand for Sri Lankan products since Sri Lanka is at compititive level of GSCM practicing compared to two major exporting countries in Asian region such as China and Japan. And also identification of the current level of GSCP adoption is more important for the government to think about new ways to encourage other businessess to adopt GSCP. These findings can be useful for relevant authorities and persons to enhance the adoption of GSCP in Sri Lanka further.

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