

Impact of Green Supply Chain Management Practices on Organizational Performance of the Manufacturing Sector In Sri Lanka

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Abstract

The present study explores the impact of implementing Green Supply Chain Management Practices on Organizational performance, in terms of environmental, operational and financial performance among manufacturing firms in Sri Lanka. Further the researcher examined the impact of Green Supply Chain Management (GSCM) Practices on three types of organizational performance dimensions (environmental, operational, and financial) separately to identify which performance dimension has the highest impact from the green supply chain management practices in Sri Lanka, especially concerning on manufacturing industry. Survey data were collected from 150 manufacturing firms which have already implemented GSCM Practices and manufacturing industry covering a variety of sectors including automobile, garments, food and beverage, electronics, chemicals. Structural Equation Modeling (SEM) was used to analyze the relationship between variables. The empirical evidence verifies that, a significant positive relationship between GSCM practices and organizational performance is observed. It can be concluded that higher the adaptation of GSCM practices, higher will be the organizational performance in Sri Lankan Context. Further, operational performance dimension has highest impact from GSCM practices. It is also concluded that higher the adaptation of GSCM practices, higher will be the operational performance. This suggests, this means impact of GSCM practices lead to increase amount of goods delivered on time, decrease inventory levels and scrap rate, promote products quality, reducing and eliminating waste, increased product line and finally improved capacity utilization under the operational performance.

Key Words: Green Supply Chain Management, Green Supply Chain Management Practices, Organizational Performance, Structural Equation Modeling (SME)

INTRODUCTION

Today's business environment is more global and competitive than it has been in the past. The modern business is characterized with shorter product life cycles, rapid new product

introductions, sophisticated customers who are increasingly knowledgeable and well informed. In this situation, there has been increasing emphasis on environment-friendly corporate activity in today's business world and many progressive companies are embracing green supply chain management. Increase in globalization in every corner of the world has led most of the firms to recognize the importance of pursuing Green Supply Chain Management (GSCM) practices especially in relation to supply chain management which not only result in environmental benefits but also business benefits (Laosirihongthong, Adebajo & Tan 2013).

Throughout the 1990s, researchers and policy-makers increasingly are concerned with the environment and climate change and have become enthusiastic about greening supply chain (Walker Sisto & McBain 2008). Also companies have realized that environmental management is a key strategic issue with the potential for a lasting impact on organizational performance. For example, more than 40,000 companies have implemented ISO14001, the environmental management system standard (Zhu & Sarkis 2006).

It is important for organizations to well manage its supply chain activities to contest successfully and to testify long term survival. Also due to the today's complex and dynamic business environment, organizations need to focus more on Green Supply Chain Management Practices on a regular basis as customers are shifting towards environmental concerns than ever before.

Zhu, Sarkis & Lai (2012) argue that increasing in both institutional and technical pressures have made firms to focus on GSCM practices. If Organizations fail to implement this type of GSCM Practices, It may result in negative consequences for the entire business because of heavy competition and availability of substitutes. Moreover, scholars argue that "balancing economic and environmental performance had become increasingly important for organizations facing competitive, regulatory and community pressures" (Shultz & Holbrook 1999). Depending on the above we can realize that the importance of practicing GSCM practices in order to enhance the organizational performance and also to be sustainable.

As far as the Sri Lankan business context is concerned there is less evidence in terms of adaptation of green supply chain management practices and the influence of GSCM practices on organizational performance, though Sri Lanka has been noted as one of the important Countries to investigate the above noted areas by some scholars (e.g. Zhu & Sarkis 2004;

Mitra&Datta 2013). That means there is a significant requirement to carry out a research on impact of Green Supply Chain Management Practices on Organizational Performance in Sri Lankan context.

Under that, research objectives are drawn to study the impact of GSCM practices on organizational performance, in terms of environment, financial and operational since less previous studies were found in relation to the Sri Lankan context. Further to examine which performance dimension has the highest impact from the GSCM practices.

Based on that, concept of Supply Chain Management is the basic concept in this study. Supply chain management (SCM) has directed its attention to the role of the supply chain that impacts on the natural environment. A supply chain can be described as a network that consists of all departments such as procurement, buyer, supplier, manufacturer, finance, distributor, forwarded wholesaler, retailer or even customer that can be classified as upstream and downstream through physical product distribution or flow of information. The main focus of SCM is to provide the right product to the right customer, with the right form at the right cost, within the right time and quality. In addition, the major focus of SCM is to reduce cycle time and inventory and thus increase productivity, while the long term goal is to enhance profit through improved market share in the industry and the ability to fulfill customer satisfaction. By adding green concept to the supply chain, it has created a new concept where supply chain will have a direct relation to the environment. With that situation we can identify Green Supply Chain Management as a new systematic environmental approach in supply chain management. That is the main concept in this study. Therefore, we can identify that GSCM has emerged as an important new archetype for enterprises to achieve profit and market share objectives by lowering their environmental risks, and the impacts, while raising their ecological efficiency (Gupta 1995, p. 200). However, Green Supply Chain Management practices (GSCM) can be described as a set of green activities in procurement, manufacturing and distribution.

In specific, the Sri Lankan manufacturing industry has been selected since it contributes towards a relatively higher level of resource consumption and waste release.

In fact, according to Frosa&Venili (2002), manufacturer has been identified as the best person to study in the supply chain, since it utilizes resources to a greater extent. Also it is pointed out that since a major portion of world manufacturing will be taken place in Southeast Asia in the coming decade. Sri Lanka being one of the Asian suppliers for some international markets has

not been given much attention in the literature to investigate the GSCM Practices and its impact on organizational performance. Therefore this study has been considered especially on manufacturing industry in Sri Lanka.

The rest of the paper is structured as follows: In the following section, the literature review is presented. Then the research method and the results of the statistical analysis are given. Finally, the paper concludes with the discussion, implications of the findings and directions for future research.

LITERATURE REVIEW

This section commences with the broader concept of Green supply chain management and then narrows down to the topic of interest, which is Green Supply Chain Management Practices with Descriptions of five practices which is used to this study and finally discusses the organizational performance based on the past Literature.

Green Supply Chain Management (GSCM)

The concept of Green Supply Chain Management (GSCM) has been observed as a recent and novel managerial principle. GSCM is an environmental concept that is gaining popularity in the world. For many businesses in the world, adopting GSCM is a way to demonstrate their sincere commitment to Sustainability. Environmental consideration in the context of SCM has taken a leading attention from multinational enterprises as public pressure grew, for better products. Pressures from consumers, regulators, and other communities led companies to re-think their strategy on environmental SCM which brought about the establishment of the new concept, green supply chain management (GSCM).

Following the journal Webber 1982, the new GSCM concept has taken great attention, describing GSCM as “Integrating environment thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life”. As per Many authors have rendered their viewpoints.

According to Zhu & Sarkis (2004), GSCM is an integrated supply chain system consisting of suppliers, manufacturers, customers and reverse logistics management. Also Rao & Holt (2005), identify that GSCM as a form of Environmental improvement operational initiative that many businesses are adopting to address environmental issues.

Further Hervani et al. defined GSCM as follow:

GSCM = Green Purchasing + Green Manufacturing + Materials Management + Green Distribution+ Marketing + Reverse Logistics (Hervani et al. 2005).

In contrast Amit& Pratik (2012), have viewed GSCM to be functions of external (open system view of organization) and internal environment (management component). The external parties would be the requirements of governmental regulations, the domestic and foreign clients, competitors and neighboring communities which make firms to become aware of the importance of implementing GSCM practices for survival.

On the other hand, top management support, human resource capabilities, employees' involvement and shared expertise are some of the internal factors which are likely to impact GSCM practices. Following topic will be discussed on Green supply chain management Practices based on past literature.

Green Supply Chain Management Practices (GSCMP) in Manufacturing Firms

In the literature, the concept green supply chain practices (GSCMP) is commonly used for a variety of activities performed by an organization in order to minimize their impacts on a natural environment. Supply chains strive to maintain internal health and environmental sustainability using the capability to self-correct based on information from the external environment (Vochon&klessen 2007).

There is no doubt, that every organization must make effective and efficient use of resources. Hence manufacturing firms in particular play a vital role since those firms are of more potential to cause negative impact on the environment, when compared with service oriented firms. Literature on GSCM, further suggests that manufactures need to work with their suppliers of raw materials and component in order to produce environment friendly products (Dheeraj& Vishal 2012). Firms could use the power they possess to set environmental standards and criteria for their suppliers so that best raw material with minimal environmental harm will be provided for production.

As far as the global context is considered, many of the manufacturing firms have already adapted GSCM practices to ensure sustainability in the long run. How international firms adhere to these practices is via proper integration and coordination of all business processes; including purchasing, manufacturing, marketing, logistics, customer focus etc. (Muma et al. 2014).

The following research findings assist in understanding to what extent GSCM practices are being carried out in firms across the globe giving more emphasize to environmental protection and sustainability in the long run.

Depth study of Jordanian Food industry has pointed out that, activities such as cleaner production, environmental management systems and eco efficiency have been adapted in order to be eco-friendly. Further the government had also been considering on imposing green investment and other green related laws for the betterment of the economy (Diab, Bourini&Rumman 2015).

In addition to that research findings by Muma et al. (2014), four different GSCM practices related to the Kenyan Tea processing industry: green purchasing, green manufacturing, green material management, green distribution as well as reverse logistics have been identified. According to Diab, Bourini&Rauman (2014), firms operating in the food and beverage sector are more likely to focus on GSCM concepts like internal environmental management, green purchasing and warehousing and green building. In contrast, this study further presents that practices of eco designing and packaging have no impact on the environment.

Furthermore, other industries like logistics are more likely to adapt GSCM practices if they perceive that adaptation of such practices result in improving performance and better reputation (Lin & Ho 2011). As far as the paper and pulp industry is concerned, firms believe that economic and financial advantages influence firms to adapt GSCM practices.

The above findings from various research studies reveal that GSCM practices vary among different industries. However, less supportive literature was available in the Sri Lankan context within the scope reviewed.

Though increasingly focused and gained attention in the global area, as well as in the Asian context, the green concept is considerably a new phenomenon as far as the Sri Lankan context is considered, though the significance of studying GSCM practices in the Sri Lankan context has been highlighted in the literature (Zhu &Sarkis 2004)

Many Researchers had identified Multiple Dimensions of GSCM Practices. Upon undertaking a strong review of literature it was clear that there are certain dimensions which are being repeatedly used by scholars in measuring the influence of GSCM practices. For the purpose of this study, here consideration is made on the most commonly used dimensions by scholars in measuring the level of GSCM practices adaptation Including green purchasing, eco design, internal environmental management, reverse logistics and investment recovery.

Green Purchasing:-

Green purchasing is a common GSCM practice initiated by firms. As per the literature of Xiao (2006), the increasing environmental consciousness and commitment of businesses, governments and individuals have inspired the development of procurement and purchasing policies incorporated with environmental requirements. In addition to that, Diab, Bourini&Rumman (2015), define green purchasing as environmental plans for a firm's long term material, component or eco system requirements.

Eco Design:-

Firms which practice eco design and packaging, intend to manufacture products and packaging in a way that minimal consumption of materials and energy is utilized. In addition, firms are encouraged to facilitate the reuse, recycle and recovery of component materials and parts (Diab, Bourini&Rumman 2015).

Moreover, research suggests that early eco design work primarily focused on technical improvements to products and processes to mitigate environmental costs (Kumar &Chandrakar 2012). However, firms nowadays realize the fact that designing stage of the manufacturer alone cannot result in an environmentally friendly product. Hence it is important that firms focus on relationships with both direct and indirect parties including suppliers, consumers, recyclers and government authorities.

Internal Environmental Management:-

Internal environmental management is the practice of developing green supply chain management as a strategic organizational imperative through commitment and support of the imperative from senior and mid-level managers (Zhu et al. 2008a)

Further Internal Environmental Management (IEM) or environmental management refers to how organizations address and mitigate the adverse impact of its operations on the environment (Rao 2008).

Reverse logistics:-

Reverse logistics is one of the other main dimensions used by researchers. It is generally associated with recycling and waste management (Onyango et al. 2014). Further the researchers state that activities involved in reverse logistics include repair of failed items, recycle and reuse of materials and packing materials etc.

Investment Recovery:-

In literature, Kumar & Chandrakar (2012) define investment recovery (IR) as 'the organizations strategic use of reverse logistics recycling, redeployment, reselling and similar Techniques. Through investment recovery organizations tend to derive better value from materials and products which they produce.

Organizational Performance in Manufacturing Firms

Performance of a firm is one of the key indicators of how well a firm operates in a given environment. Performance is a measure for assessing the degree of a corporation's objective attainment (Amit & Pratik 2012).

Organizational performance measures can be classified under several categories by reviewing past literature. The main sources were obtained via journal articles of Zhu, Sarkis & Lai (2012); Zhu & Sarkis (2004); Zhu, Sarkis and Geng (2004); Laosirihongthong, Adebajo & Tan (2013). Based on those categories, Under Organizational performance, three dimensions were used to assess the level of GSCM performance in Sri Lanka. A brief description of those dimensions can be presented as follows.

Environmental Performance:-

Environmental Performance includes and concentrates on reduction of air emission, reduction of waste water, reduction of solid wastes, in addition to decrease of consumption for hazardous/harmful/toxic materials, decrease of frequency for environmental accidents, and improve an enterprise's environmental situation (Alvarez 2001).

Further Yang et al. (2013) defined environmental performance as the impact that the enterprise's activity has on the natural milieu.

Operational Performance:-

In general any manufacturing organization despite its scale of operation, needs to be successful in its operation (Diab, Bourini&Runnan 2015). According to Hasan (2013), some of the operational initiatives which firms would thrive to achieve via GSCM include cost savings, increased efficiency, product quality improvement, increase in market share, new market opportunities and increase in sales etc.

Financial Performance:-

According to Melnyk (2002), Financial Performance includes and concentrates on Positive economic performance, decrease of cost for materials purchasing, decrease of cost for energy consumption, decrease of fee for waste treatment, decrease of fee for waste discharge, and at the same time trying to eliminate the negative economic performance, such as, increase of investment, increase of operational cost, increase of training cost, increase cost of purchasing environmentally friendly materials.

Impact of GSCM Practices on Organizational Performance

The majority of previous studies on the effect of GSCM studies on performance identify the fact that there is a positive relationship which exists between the two constructs. Some of the research findings can be summarized as follows.

When the Kenyan Tea Processing industry, it had been found that there exists a positive relationship between GSCM practices and environmental performance (Muma et al. 2014). Similar results were also found by Diab et al. (2015) whose research was based on the Jordanian Food industry. Seman et al. (2012), further stresses some previous studies of GSCM in relation to manufacturing firms.

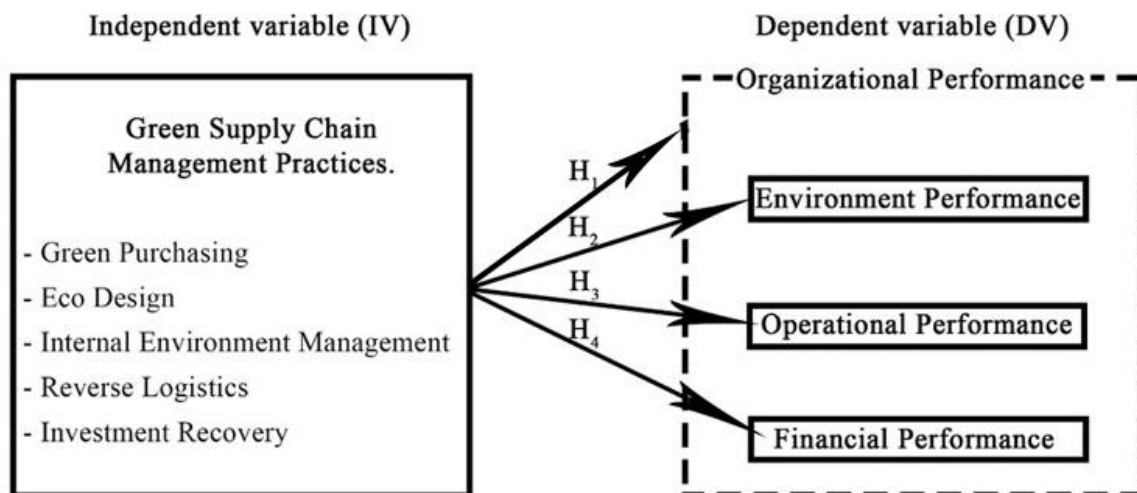
In one of his findings it had been pointed out that there is a direct influence of green supplier assessment and collaboration on environment performance. Further it had been found that greening the suppliers leads to green innovation and competitive advantage, thereby ultimately resulting in higher performance.

Also there are several studies that have attempted to link practices of GSCM with firm performance. While some studies such as Zhu & Sarkis (2004); Rao & Holt (2005); Green et al. (2005) found positive relationships, Giovanni & Vinzi (2012); Huang et al. (2012) showed there is no significant relationship between such practices and organizational performance. However, Azevedo et al. (2011); Wu & Pagell (2011) found a combination of positive and other relationships while Zhu & Sarkis (2007) recommended that economic performance remains the top priority for manufacturers.

METHODOLOGY

Conceptual Framework and Hypotheses Development

The framework shown in Figure 1 had been developed to investigate the primary objectives of this study, which is to identify the influence of GSCM practices on organizational performance and to study which performance dimension has highest impact from GSCM practices.



Source: Researcher constructed

Figure 1: Conceptual Framework with Hypotheses

Based on the above conceptual framework following hypotheses are developed. The Research Hypotheses of this study are derived with respect to the research objectives. First Hypotheses (H1) is derived based on the first objective which is to study the impact of green supply chain management practices on organizational performance.

Hypothesis 1: Green Supply Chain Management Practices have an impact on Organizational Performance

According to the above findings from literature, it is clear that there is less published literature on the influence of GSCM practices on organizational performance in the Sri Lankan context. However, there are a considerable number of research studies which point out that there is a positive relationship which exist between the GSCM practices and performance of the firms in the Asian context (e.g. India, China) (Laosirihongthong, Adebajo & Tan 2013; Zhu, Sarkis & Lai 2004).

Following research hypotheses (H2, H3, and H4) are derived based on second objective. Those hypotheses are aimed to study which performance dimension has the highest degree of impact from GSCM Practices. Also when referring to past literature there are various western research studies considered that the impact of Green supply chain management practices on organizational performance dimension separately.

Zhu & Sarkis argued that that economic performance remains the top priority for manufacturers and also Amit & Pratik (2012) argued that environmental performance remains the top priority. But in Sri Lankan Context less supportive literature was available on that. Therefore following hypotheses are focused to investigate on it.

Hypothesis 2: GSCM practices have an impact on the Environmental performance

Hypothesis 3: GSCM practices have an impact on the Operational performance

Hypothesis 4: GSCM practices have an impact on the financial performance

Operationalization

Operationalization refers to the process by which a Conceptual domain is translated to an analytical domain which is measurable and observable. The constructs, dimensions and related indicators were drawn from previous studies. The first step of the conceptual domain is to define the concept solely based on previous studies since there is few analytical tools which can be used to ensure content validity. As far as this study is concerned the constructs could be identified as GSCM practices and Organizational performance. The Operationalization process is to develop indicators which are measurable and observable behaviors of the dimensions

identified above. In order to operationalize the two constructs: GSCM practices and Organizational performance a survey in the form of a questionnaire was carried out.

The questionnaire consists of thirty one indicators to measure the adaptability of GSCM practices in manufacturing firms in Sri Lanka and twenty one items for measuring the Organizational performance. The indicators of GSCM practices were solely based on past literature (Zhu, Sakis& Lai 2012; Zhu &Sarkis 2004; Zhu, Sarkis&Geng 2004; Laosirihongthong, Adebanjo& Tan 2013). A total of nine items of green purchasing, four items of eco design and eight items of internal environmental management were used in developing the questionnaire. Further the dimensions of reverse logistics and investment recovery included five items each. In addition, twenty one items about the GSCM performance were presented in terms of environmental, operational and financial performance each dimension having six, six and nine items respectively.

The questions of the Questionnaire were measured against a five point likert scale ranging from 1=strongly disagree, 2 = somewhat disagree, 3 = neutral, 4 = somewhat agree and 5= strongly agree.

Participants and Procedure

As per the nature of the objectives, this study falls under the positivist paradigm. This is because, the researcher is working with observable social realities and the end result can be generalized to similar circumstances (Remenyi, D 2002). In this study, the population of this study is all manufacturing firms which operate GSCM practices in Sri Lanka.

According to statistics (Annual Survey of Industries 2013) there are 2554 manufacturing firms operating under the industry sector in Sri Lanka.

From this, simple random sampling technique was employed to draw the sample from the population. A representative sample of 150 of the population was selected for the purpose of this study which is covering a variety of sectors including automobile , garments , food and beverage , electronics , chemicals and other. The target respondents were top management (owner, general manager, Operations manager, supply chain manger) of the organization.

Both personal and online methods were used in administering the survey. Accordingly, 30 questionnaires were personally distributed by the researcher among the sample. More than 180 online questionnaires were sent to randomly selected respondents via e-mails. The response rate for the personal method was 80%, which is a good response rate, while the response rate for the online method was significantly lower, as only 161 responses out of 180 were received. Then, the questionnaires were screened and incomplete questionnaires rejected. Accordingly, 150 questionnaires were forwarded for the data analysis. The data was analyzed using Structural Equation Modeling (SEM) with the aid of AMOS (Analysis of Moment Structures) 23.0.

DATA ANALYSIS AND RESULTS

A pilot survey was conducted using 30 respondents to identify and eliminate potential problems in the questionnaire design (Malhotra & Peterson 2006) and to examine the validity and reliability of the measures used in the questionnaire (Sekaran & Bougie 2009). The Cronbach's alpha coefficient of the pilot survey was greater than 0.7 for all constructs which is an acceptable value for a pilot test (Hair, Black, Babin, & Anderson, 2010).

After the pilot survey, the data collected for this study were first entered in to the IBM Statistical Package for Social Science (SPSS) software version 23.0. The 150 cases were forwarded for removing outliers and missing value analysis. In this study, there were no missing values and outliers in the 150 questionnaires.

After missing value data analysis and outlier detection, the data was tested for multivariate assumptions such as normality, linearity, homoscedasticity and multicollinearity. Normality was tested by skewness and kurtosis. In this study, skewness values of less than 2 and kurtosis values less than 7 suggest that there are no serious violations of the normality assumption. To measure linearity and homoscedasticity normal probability plots (p-plots) and scatter plots were drawn respectively (Hair et al., 2010) and no deviations were identified.

Finally, multicollinearity was assessed using a correlation matrix and all inter-correlation values were less than 0.9. Summarizing the results of multivariate assumptions, all variables were assured of normality, linearity, homoscedasticity and multicollinearity. The Kaiser-Meyer-Olkin (KMO) was used to measure the adequacy of the sample of the study. KMO

results showed that the sample adequacy of all constructs is greater than 0.5 which indicates that the sample is adequate (Malhotra 2011).

The unidimensionality of all constructs was ensured using Exploratory Factor Analysis (EFA). Cronbach's alpha was used to measure the reliability of all constructs and its value is greater than 0.7, and thus, it can be concluded that the reliability is established for all constructs. Thereafter, data was forwarded for multivariate analysis.

The Measurement Model

The measurement model "specifies the indicators for each construct, and enables an assessment of construct validity" (Hair et al., 2010). Based on the conceptual model, there are 8 latent variables, namely, Green Purchasing (GP), Eco Design (ED), Internal Environment Management (IE), Reverse Logistics (RL), Investment Recovery (IR), Environmental Performance (EP), Operational Performance (OP), and Financial Performance (FP). As the initial measurement model portrayed a poor fit, the model was improving using modification indices. Stepwise deletion of items below 0.5 factors loading was applied to further refine the initial model.

During the modification process, following items were removed due to low standardized regression weights. Further, covariances were drawn between the error terms of several items for improvement purpose.

Green Purchasing (GP)

GPd- Suppliers ISO 14000 certification

GPf- Adapting just in time logistic system for supplier cooperation

GPg- Selecting suppliers using environmental criteria

GPi- Requesting suppliers to use environmental packaging

Internal Environment Management (IE)

IEd- Total Quality Management

Investment Recovery (IR)

IRE- Establishing a recycling system for used and defective products

Financial Performance (FP)

FPA- Decrease of cost for materials purchasing

FPc- Decrease of fee for waste treatment

FPd- Decrease of fee for waste discharge

FPh- Decrease in cost of raw materials or components

After removing those items the complete final refine model showed as following figure 2.

Result (Default model)

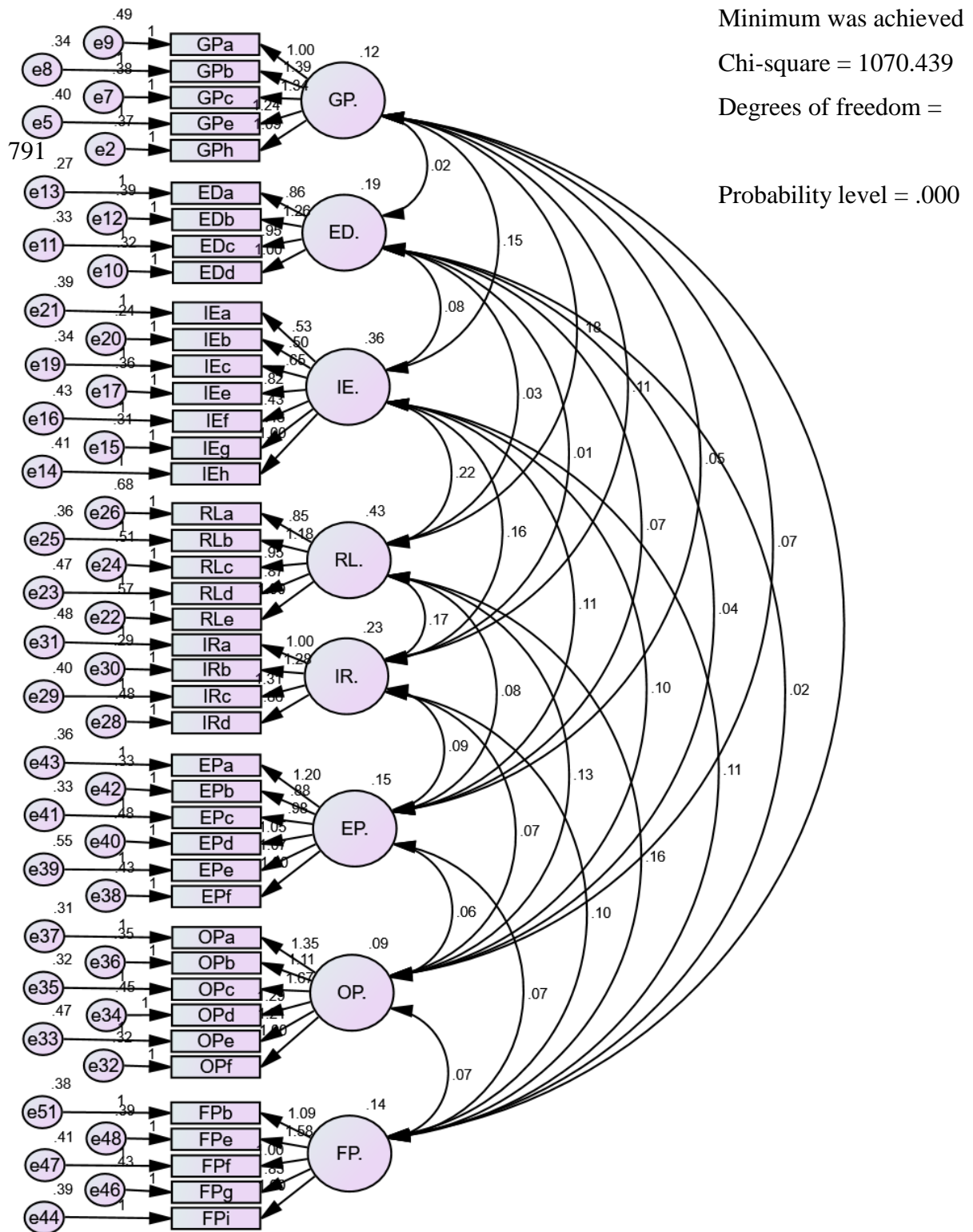


Figure 2: Refine Model

After the testing the refine model, it shows acceptable fit. According to Hair et al., (2010), CMIN/DF (X^2/df) value close to one and not exceeding 3, Comparative Fit Index (CFI) value close to 1 and Root Mean Square Error of Approximation (RMSEA) value of about 0.08 or less indicates a good model fit. As further recommended by Hair et al., (2010), the stated GOF (goodness of fit) indicates must include at least one absolute measure ($X^2/df/ p$ value/GFI/RMSR/RMSEA), one incremental measure (NFI/CFI/TLI/RNI). As shown in following tables, the CIMIN/DF of the measurement model is close to 1 and below 3, the RMSEA is 0.052, thus providing absolute model fit.

Table 1: CMIN value

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	112	1070.439	791	.000	1.353
Saturated model	903	.000	0		
Independence model	42	2423.168	861	.000	2.814

Table 2: GFI value

Model	RMR	GFI	AGFI	PGFI
Default model	.045	.918	.727	.667
Saturated model	.000	1.000		
Independence model	.129	.362	.331	.345

Table 3: CFI value

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.558	.519	.829	.805	.921
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 4: RMSEA value

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.052	.041	.056	.608
Independence model	.110	.105	.116	.000

The Confirmatory Factor Analysis (CFA) was used to further test convergent and discriminant validity of the constructs. As explained by Malhotra& Dash (2011), 0.5 or higher factor loading and 0.5 or greater Average Variance Extracted (AVE) assures satisfactory convergent validity. In addition, Composite Reliability (CR) must be 0.7 or higher. Generally, discriminant validity can be ensured if the square root of the AVE is larger than the correlation coefficients (Malhotra, 2008).

Table 5: Convergent Discriminant Validity Results

	AVE	CR	GP	ED	IE	RL	IR	EP	OP	FP
GP	0.503	0.86	0.503104							
ED	0.628	0.97	0.008417	0.628116						
IE	0.653	0.93	0.263314	0.04538	0.652911					
RL	0.512	0.83	0.34962	0.004185	0.180738	0.512242				
IR	0.58	0.85	0.226903	0.005733	0.154646	0.148438	0.57977			
EP	0.53	0.89	0.075828	0.088195	0.111822	0.051611	0.124414	0.526294		
OP	0.53	0.89	0.243389	0.061253	0.160402	0.216879	0.107112	0.122766	0.534728	
FP	0.53	0.94	0.216295	0.009967	0.100864	0.232165	0.167263	0.110354	0.193935	0.529477

The Structural Model

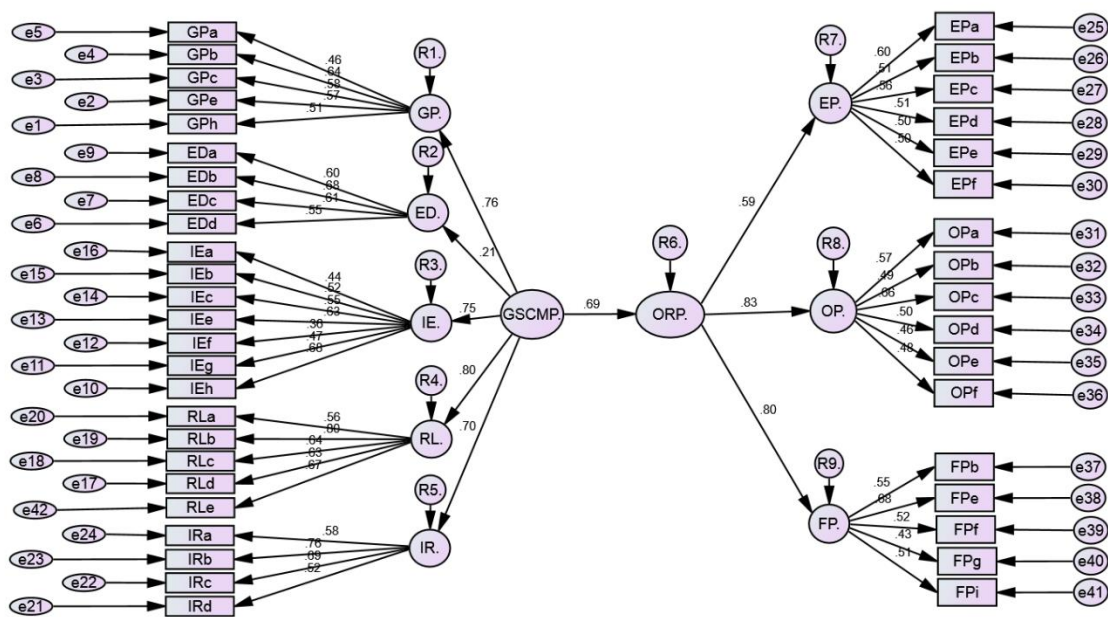
The structural model examines the direct relationships among the constructs. Structural model 1 was developed to test the impact of GSCM Practices on Organizational Performance in Sri Lankan manufacturing firms.

Minimum was achieved

Chi-square = 800.615

Degrees of freedom = 528

Probability level = .000



Source: Survey data
Figure 3: Structural Model 1

It shows that there is a significant impact of GSCM Practices on Organizational Performance. The results demonstrated positive and significant paths from GSCM Practices to Organizational Performance ($\beta = 0.69$, $p < 0.000$).

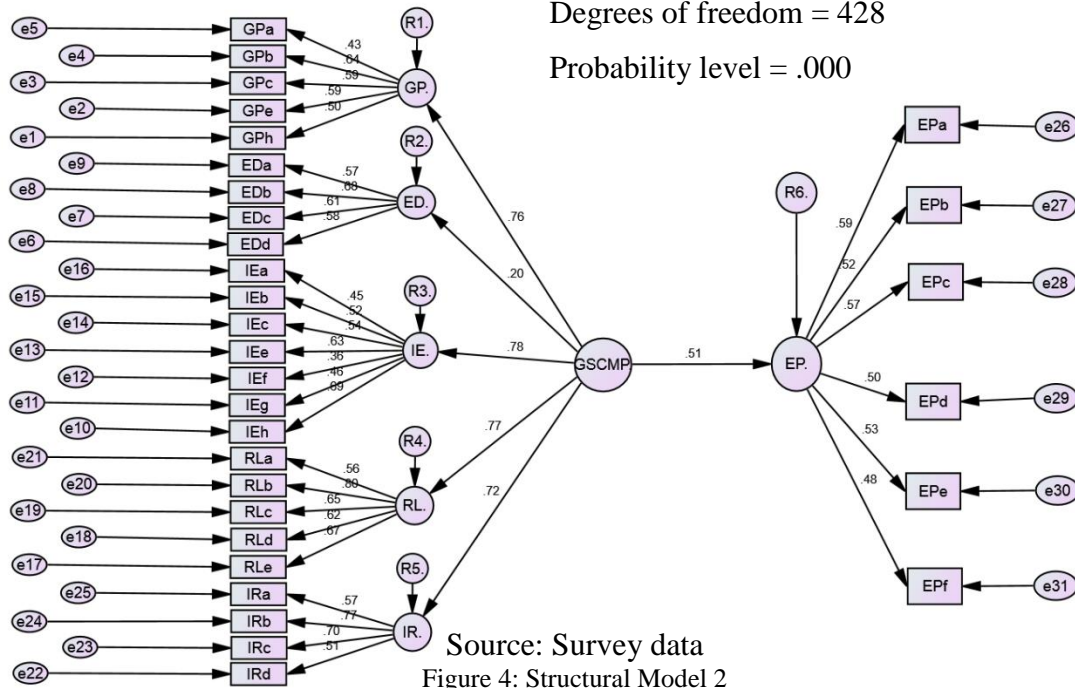
Structural Model 2, 3, 4 are built to identify which performance dimension has the highest degree of impact from the GSCM Practices in Sri Lankan context.

Minimum was achieved

Chi-square = 603.615

Degrees of freedom = 428

Probability level = .000



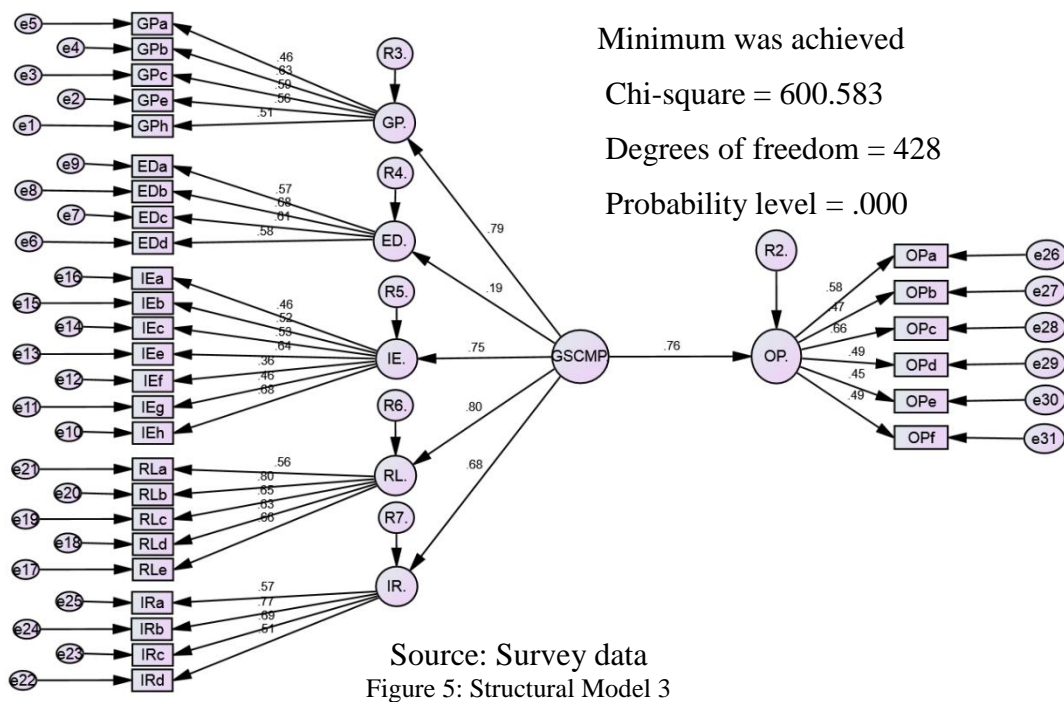
According to the above figure results will be positive and significant paths from GSCM Practices to Environmental Performance ($\beta = 0.51, p < 0.000$).

Minimum was achieved

Chi-square = 600.583

Degrees of freedom = 428

Probability level = .000

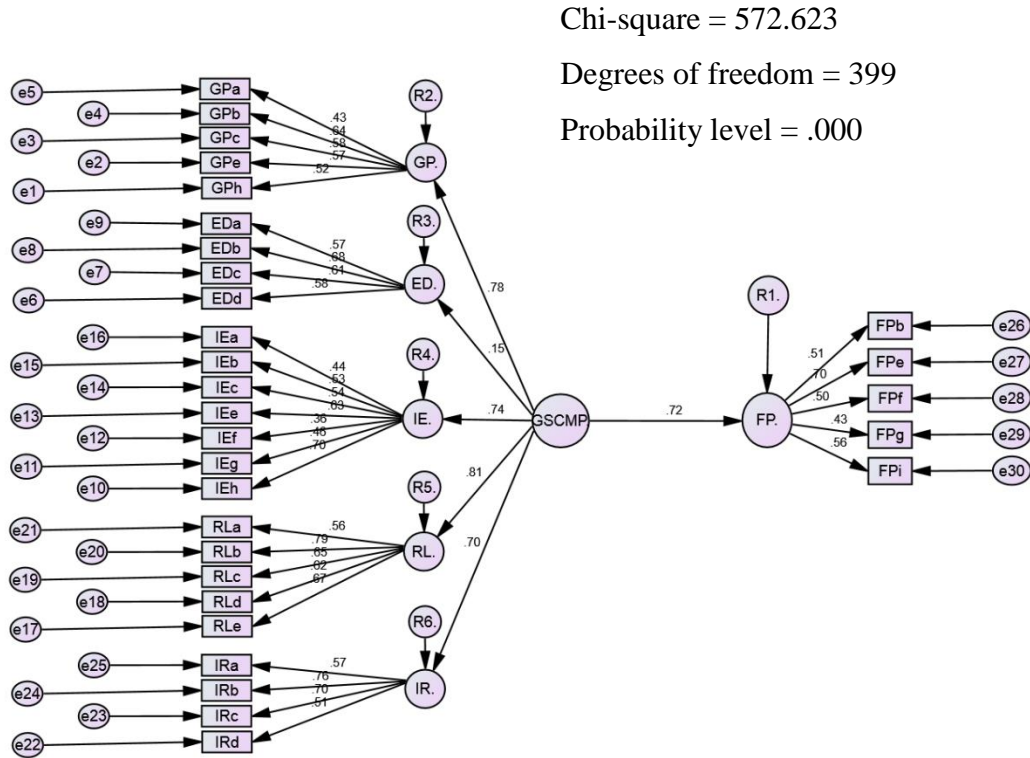


Source: Survey data

Figure 5: Structural Model 3

According to the above chart results will be positive and significant paths from GSCM Practices to Operational Performance ($\beta = 0.76, p < 0.000$)

Minimum was achieved



Source: Survey data
 Figure 6: Structural Model 4

According to the above chart results will be positive and significant paths from GSCM Practices to Financial Performance ($\beta = 0.72, p < 0.000$).

DISCUSSION

The above findings revealed that under structural model 1, there is a 69% significant positive impact of GSCM practices on Organizational performance in Sri Lankan Context regarding Manufacturing Sector. Based on those results we conclude that Sri Lankan Manufacturers are highly engaged with the Green Supply Chain Management Practices. Higher the adaptation of GSCM practices, higher will be the organizational performance in Sri Lankan Context. This claim is highly supported by previous research studies which have been conducted based on several industries, including Automobiles, Food and Beverages, Tea Processing and Pharmaceutical etc. The majority of the studies indicate that there is a positive relationship between the two constructs.

It had been argued that firms around the globe are becoming aware of the green concept and hence tries to focus on adapting green practices for the betterment of the firms, as the top management realizes the importance of adapting GSCM to cope with the future.

Muma et al. (2014) in one of their studies based on the tea processing industry had observed that GSCM practices have a positive influence on performance. In addition, as far as the food industry is concerned, Diab et al. (2015) had proven similar results. Further research suggests that collaboration with all parties of the supply chain is likely to influence positively on performance of firms (Seman et al. 2012). According to the Zhu & Sarkis (2004), Rao & Holt (2005), Green et al. (2005) suggest that There is also a positive relationship with GSCM Practices and the Organizational Performance.

Also past studies include that some Asian countries identified positive relationship with GSCM Practices and Organizational Performance (Laosirihongthong, Adebajo & Tan 2013; Zhu, Sarkis & Lai 2004). But despite the lack of research studies based on the green concept of Sri Lanka, the results of this analysis ensure its applicability in this country.

Structural Model 2, 3, 4 are built to identify which performance dimension has the highest degree of impact from the GSCM Practices in Sri Lankan Manufacturing Industry. But according to the Muma et al. (2014), found highest priority for Environmental Performance by his study and Diab et al. (2015), Seman et al. (2012) also gave priority for Environment Performance from the overall organizational performance dimensions.

Further Amit & Pratik (2012) discussed in his study that both Environmental Performance and Financial Performance having priority among overall organizational performance dimensions. As per Zhu & Sarkis (2007), disclose that financial performance having the more impact of GSCM Practices. That means financial performance remains top priority among manufacturing sector.

According to the current study, it can be finalized that Operational Performance dimension has the highest impact from GSCM Practices which related to the manufacturing sector in Sri Lanka. Most of respondents are realizing that higher the adaptation of GSCM practices, higher will be the operational performance in Sri Lankan Context. This suggests that impact of GSCM practices leads to increase the amount of goods delivered on time, decrease inventory levels and scrap rate, promote products quality, reducing and eliminating waste, increased product line and finally improved capacity utilization under the operational performance. Normally effectiveness, efficiency, quality, timeliness, productivity and safety are the main factors that considered under the operational performance. According to the results it confirms that using GSCM Practices, organizations can reduce and eliminate waste, resource recovery, cost savings & increased efficiency and product quality improvement rather than other performance dimensions. Based on final results, we can finalize that all the green practices considered in this study lead to increase operational performance rather than other performance dimensions related to the manufacturing industry in Sri Lanka. When considering the green purchasing, it facilitates firms to preserve the environment and to enhance the effectiveness and efficiency. Eco design also leads to minimal consumption of materials and energy is utilized. Also involves designing products to avoid or reduce the use of hazardous products, with that product quality improvement will take place. Repair of failure items, recycle and reuse of material, logistics in product returns, source reduction and waste disposal can be achieved through the reverse logistics. Those are the benefits that can be achieved through engaging GSCM Practices to enhance operational performance. Therefore most of respondents are realizing that higher the adaptation of GSCM practices, higher will be the operational performance in Sri Lankan Context.

MANAGERIAL IMPLICATIONS

This study will play an important role for managers and firms, also this study is contributing in increasing the sales through understanding the green supply chain management and got the highest benefits from it. Higher the adaptation of GSCM practices, higher will be the GSCM performance. As such it is important for managers to formulate and implement strong supply chain management strategies in order to cope with severe competition which is dynamic in nature.

Managers also need to understand the importance of the roles played by every member of the supply chain for ensuring performance. GSCM practices cannot be implemented only with the support of the internal parties of a firm.

Rather, there needs to be integration between different stakeholders including suppliers (first tier, second tier), distributors, customers etc. Therefore, it is important for managers to regularly monitor the performance of its suppliers and make improvements in every possible way for the betterment of the entire supply chain.

RECOMMENDATIONS

There are some recommendations, which are Continuing coordination between the different administrative levels to implement the green supply chain, in order to achieving the highest level of quality in this area, trying to find the most friendly environmental raw materials and continuing in Safety environmental design and packaging, create an annual training plan according to the workers training needs related to the green supply chain, increased the budget allocated for scientific research in the field of green supply chain, and finally activate the Governmental rules and regulations to be more careful about the safety of the environment.

LIMITATIONS

There are limitations to this study when interpreting the study results. The study focused on firms in the manufacturing sector in Sri Lanka. Because these findings are specific to the manufacturing sector. Therefore the findings may not be applicable to other sectors in Sri Lankan context.

The data collection was collected by Likert scale questionnaires which might have biases of the respondents reflected in the results. Therefore there is a possibility that if respondents were different, the results might be different. Moreover, data collection was another challenge because some firms were not ready to participate, due to the lack of time.

The impact of GSCM Practices in the long run, is not captured since this cross-sectional study has been done only for a short period of time.

FURTHER RESEARCH

Crucially, this study has some limitations that have the potential to lead to future research and the significance of the study can be further enhanced by the future implication of the study. This study limits its findings to the relationship between GSCM practices and environmental, operational and financial performance. Further research could be done to study the influence of GSCM practices on other dimensions of performance. Similarly different aspects of GSCM practices other than green purchasing, eco design, investment recovery, internal environment management and reverse logistics can be evaluated.

A longitudinal study with a much larger sample, focusing on the influence of other factors such as top management commitment, organizational learning and level of Training and Development on GSCM performance can be studied in depth. In addition, the influence of sustainable green supply chain management on performance can also be studied in depth, since firms are emphasizing more on the sustainable aspect of the firms, without being profit oriented. Moreover, this study has only considered the manufacturing sector of Sri Lanka. An exploratory study can also be done to examine the influence of GSCM practices on GSCM performance based on the services sector of Sri Lanka.

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Industry 4.0 and Lean based Operational Performance Improvement Approach: A Conceptual Framework for the Banking Sector

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Abstract

With the advancement of technology, Industry 4.0 concepts have been thrived up to a state where the applications can be utilized in a wide variety of industries with the focus of improving operational performance. In order to gain market share, as well as to sustain in the economic crisis, operational performance improvement is highly crucial to the banking sector. This study is concerned with the application of industry 4.0 technologies in a lean based environment within the banking sector of Sri Lanka. When considering banking processes, the main question that arises is, the inefficiencies occurred at different stages of conducting business. Hence, the **application of lean tools is a viable solution to address these inefficiencies. Banking processes can be streamlined in order to improve resource utilisation with the elimination of wasteful practices while shortening time and cost to serve, thereby improving the productivity.** With some degree of modifications, concepts and technologies comprised in industry 4.0, can be applied to service sectors such as banking. Combining these advanced technologies with lean principles, may result a better operational performance than application of these concepts distinctly. Therefore, integration of industry 4.0 technologies within a lean based environment can be proposed as a viable solution to improve operational performance of the banking sector. This scrutiny presents findings of a comprehensive and systematic review of literature based on the areas of operational performance improvement, industry 4.0, lean management and banking sector. The article will offer an insight to current state of knowledge available in the corresponding areas and will suggest the path for future research.

Keywords: Industry 4.0, Lean Management, Operational Performance Improvement, Banking Sector