

# **The Impact of Green Supply Chain Management Practices on Operational Performance and Customer Satisfaction**

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## **Abstract**

Today, the business world is moving towards the “Green Concept” and most organizations focus on increasing performance in their operations while reducing the impact on environment. In manufacturing sector, adopting green concept in to managing supply chains is getting an increasing attention due to higher possibility of environmental impact during supply chain activities. The purpose of this study is to identify the direct impact of green supply chain management (GSCM) practices on different dimensions of operational performance (flexibility, delivery, quality, & cost) and the indirect impact through these on customer satisfaction. Data have been collected through a survey for which a total of 94 managers in manufacturing organizations responded. Partial Least Square Structural Equation Modeling (PLS-SEM) was applied to analyze the data and SmartsPLS software was used. The study revealed that (GSCM) Practices lead to improve all dimensions of operational performance (flexibility, delivery, quality and cost) where only production flexibility and delivery significantly in turn improves customer satisfaction. Any indirect impact of GSCM practices on customer satisfaction through production cost and quality was not found in the study.

This research has several important implications for manufacturers who have implemented and are willing to implement GSCM practices in their firms. In addition, the study significantly contributes to the literature by providing empirical evidence for the impact of four dimensions of GSCM practices (green purchasing, cooperation with customers, eco-design, and investment recovery) on operational performance and customer satisfaction.

**Keywords:** Green Supply Chain Management Practices, Operational Performance, Customer Satisfaction.

## **1. Introduction**

Today, the business world is moving toward the “Green Concept”. Most of organizations focus on increasing efficiency of resources while reducing the impact on human health, productivity and environment. Supply chain management is the main activity in the manufacturing firm. Therefore, most of manufacturing firms are incorporating with the green supply chain management (GSCM) practices into their operations for reducing pollution and wastage, recycling and reusing, minimizing natural resource uses and reducing emission. (K. G. A. S. Waidyasekara and R. L. N. Sandamali , 2012). Many manufacturers pay attention to customer expectations and current customers are highly knowledgeable and consider the environmental impact mostly. They pressure to manufacturer to avoid the environmental harmful activities and protect the environment. Most of customers are becoming increasingly knowledgeable and demanding for environmentally friendly products (Thoo Ai Chin, et al., 2015). Supply chain management interacts with suppliers, manufacturers and customers to enhance the efficiency and productivity. Customer is an important party for business organizations for their sustainability. Therefore, it will be worthwhile to study the impact of green supply chain management (GSCM) practices on operational performance and customer satisfaction.

Existing literature suggests that manufacturing organizations should adopt environmental sustainability and successful implementation of GSCM practices will lead to reduce waste, save money, green marketing awareness, improve employee morale, fulfill public response and then increase organization overall performance including environmental, economic and operational performance ( Lorette, Kristie, 2018)

A comprehensive investigation on the relationship of GSCM practices with operational performance and customer satisfaction was not found in literature. Researchers have found that the impact of GSCM practices such as green purchasing, cooperation with customers, eco-design and investment recovery on economic, environmental and overall operational performance (Kenneth W. Green Jr, et al., 2012). But no empirical evidence related to GSCM practices on specific dimensions of operational performance, namely, flexibility, delivery, quality and cost was not found. Therefore, this study addresses the research question: “What is the impact of green supply chain management practices in manufacturing firms on operational performance and customer satisfaction?”

## **2. Literature Review**

### **2.1 Green Supply Chain Management Practices**

GSCM focuses on wide range practices related to purchasing, production and marketing. There are several definitions for GSCM. These are: “the way in which innovations in supply chain management and industrial purchasing are considered in the context of the environment” (Green, et al., 1998), “purchasing function’s involvement in activities that include reduction, recycling, reuse and the substitution of materials” (Narasimhan, R., and J.R. Carter, 1998), “the practice of monitoring and improving environmental performance in the supply chain” (Godfrey, R., 1998), “integrating environmental thinking into a supply chain management, including product design, material resourcing and selection, manufacturing processes, delivery of the final product to the consumer as well as end-of-life management of the product after its useful life” (Srivastava, S.K., 2007). Drawing on those definitions, four main GSCM practices were identified such as green purchasing, cooperation with customers, eco-labeling and investment recovery (Kenneth W. Green Jr, et al., 2012).

*Green Purchasing* has been defined as integrating environmental problem and concerns into the procurement process (Purba Rao and Diane Holt, 2005). Selecting the right supplier has significant effect on organizational objectives. In green purchasing, organizations get attention towards eco labeling of purchased products, supplier’s cooperation for environmental objectives, supplier’s environmental audit, supplier’s ISO 14000 certification, supplier’s environmentally friendly practice evaluation, and providing design specification of environmental requirements to suppliers (Kenneth W. Green Jr, et al., 2012).

*Cooperation with customers* requires working with customers to design cleaner production process that produce environmentally sustainable products with green packaging (Qinghua Zhu , 2008).

*Eco-design* can be defined as a design for environment or green design with a purpose of reducing environmental impact throughout the product development and the entire product lifecycle starting from obtaining raw materials from suppliers to final disposal of those materials (G. Johansson, 2002). Eco-design requires that manufacturers design products that minimize consumption of materials and energy that facilitate the reuse, recycle and recovery of component materials and parts, and that avoid or reduce the use of hazardous product within the manufacturing process (Kenneth W. Green Jr, et al., 2012).

*Investment recovery* requires the sale of excess inventories, scraps and used materials, and can bring additional revenue into firm, if properly managed (Kenneth W. Green Jr, et al., 2012). The objective of investment recovery is to recover the highest value from obsolete end-of-life product and surplus items (Ayres, et al., 1997).

### **2.2 Operational Performance**

Operational performance relates with the manufacturing plant’s capabilities to more efficiently produce and deliver products to the customer (Qinghua Zhu , 2008). According to Narasimhan (2001), operational performance refers to the strategic dimensions by which company chooses to compete Manufacturing capabilities and resources should focus on developing competitive priorities as the achievement of competitive advantage depends on the effective translation of competitive priorities into strategic capabilities (Ho, D., Au, K. and Newton, E., 2002). Operational performance has multiple dimensional, namely, flexibility, delivery, quality and cost (Roberto Chavez, et al., 2014).

*Flexibility* facilitates the response to challenges like globalization, technological changes, innovation and the continuous economic uncertainty with little penalty in time, cost or performance (Zhang, Q. et al., 2006). Green supply chain flexibility can be improved by supply chain redundancy because supply chain flexibility depends on resource reservations and the effectiveness of reallocating redundant resources (Dolgui, et al., 2018).

*Delivery* process is related with all activities in supply chain management. Supply chain management concept grew out of recognition that process of transforming raw material into final product and delivering those products to customers (Benita M. Beamon, 1999).

*Quality* is very important dimension of operation performance. Both the final product and raw materials should have standard quality for sustainability of the organization. The activities in the green supply chain execution are to ensure that the product outcome is qualified with the product quality requirements and the raw materials supply by the suppliers are fulfilled with the controlled substances policy. Experts believe that the quality check will ensure that the product adheres to the green policy (Chien Khay Choong, et al.).

*Cost saving* links with GSCM practices because GSCM highlights the need of cost effectiveness. Today, manufacturers have a huge challenge of reducing cost and risk and increasing revenue. GSCM involves with source of cost and source of competitive advantage for companies. So, organizations pay attention to cutting waste and operating efficiently to adopt the strategy of lean and clean to be really green (Gaurav. B. Patil, and Dr. Dhananjay R Dolas, 2015).

### **2.3 Customer Satisfaction**

Customer satisfaction is a main objective of any firm for maximizing revenue. If organizations provide high value to their customer, they can achieve high level of customer satisfaction (Stank TP, et al., 2003). Customer satisfaction is a reflection of operational elements related to efficient cost structures, quality product, speed and responsiveness (Kim SW., 2006). Speer (1997) found that individual consumer interest in the environment and environmentally a sound product is quite substantial, even though there has been a slight decline (Speer, T.L., 1997). Organizations now face the challenge of increasing environmental regulations and eco-consumers and obtain more and more negative information about the activity and product pollution of the companies (Larsson R, et al., 1996). Satisfied customers involve in recommending the company to others, providing positive word of mouth, a willingness to behave as a partner with the organization and remaining being loyal to the company (Brown, et al., 2005).

### **2.4 The Relationship between GSCM Practices and Operational Performance**

There are several impacts of GSCM practices on performance outcomes. Generally, the adoption of GSCM practices by manufacturing organizations lead to improved environmental performance and economic performance, and on operational performance. Operational performance improves the organizational performance (Kenneth W. Green Jr, et al., 2012). There is a positive relationship between customer-centric GSCM and multiple operational performances in flexibility, delivery, quality and cost (Roberto Chavez, et al., 2014). According to Samuel (2018), GSCM practices lead to increased operational performance in terms of cost, quality and flexibility, but have no impact on delivery time. The researchers have used the Pearson correlation coefficient and established a positive significant relationship between environmental management practices and industry flexibility (Rha, J.S, 2010). According to Nyirenda and Ngwakwe (2014), environmental management practices have a positive effect on delivery time. Melnyk, et al. (2002) identified significant positive relationship between the environmental practices and product quality. Yang, J., Han, Q., Zhou, J. and Yuan, C. (2015) also indicated that customers' participation in environmental management practices can help to improve customer satisfaction with lower cost and higher product quality. Hence following hypothesis are developed to study the relationship between GSCM practices and operational performance dimensions.

- H<sub>1a</sub>: GSCM practices lead to improve the Flexibility
- H<sub>1b</sub>: GSCM practices lead to improve the Delivery
- H<sub>1c</sub>: GSCM practices lead to improve the Quality
- H<sub>1d</sub>: GSCM practice lead to reduce the Cost

## 2.5 The Relationship between Operational Performance and Customer Satisfaction

In literature it was found that operational performance dimensions are related to customer satisfaction. (Roberto Chavez, Wantao Yu, Mengying Feng and Frank Wiengarten, 2014). The studies of Stank (1999) and Zhang et al. (2003) provide evidence for a positive association between operational performance and customer satisfaction. They show that the operational performance in terms of flexibility, delivery, quality and cost are positively associated with customer satisfaction. According to Rosenzweig et al. (2003), only delivery and flexibility are positively associated with customer satisfaction. Kumar et al. (2011) found that quality and dependability positively affect customer loyalty. Swink et al. (2007), found that delivery and quality are positively associated with customer satisfaction but not cost efficiency and new product flexibility, and process flexibility was significantly negatively associated with customer satisfaction. Roberto Chavez, et al. (2014) found that production cost and flexibility appear to have no significant impact on customer satisfaction and product quality and delivery are significantly and positively associated with customer satisfaction. Accordingly, the following hypotheses are proposed to identify the relationship between operational performance dimensions and customer satisfaction.

- H<sub>2a</sub>: Flexibility lead to increasing Customer Satisfaction
- H<sub>2b</sub>: Delivery lead to increasing Customer Satisfaction
- H<sub>2c</sub>: Quality lead to increasing Customer Satisfaction
- H<sub>2d</sub>: Low cost lead to increasing Customer Satisfaction

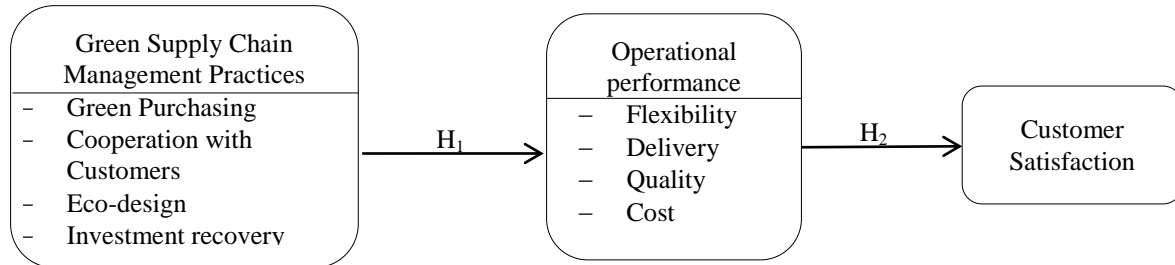


Figure 1: Conceptual framework

## 3 Methodology

### 3.2 Sample and Data

This study focuses on the relationship in between GSCM practices, operational performance and customer satisfaction. The target population of the study was managers in manufacturing firms in Sri Lanka. Purposive sampling method was used to select the sample due to difficulties of using a random sampling method. Hence, managers having knowledge in providing correct information for the study were selected to the sample. An online questionnaire was developed to collect data and 94 managers in manufacturing organizations responded to the survey. There were four parts in the questionnaire, namely demographic information, GSCM practices, operational performance and customer satisfaction. All items in GSCM practices, operational performance and customer satisfaction were measured on a five-point Likert scale. The industry of the respondents and the field of working are presented in Table 1 and experience of the managers in current organization and other organizations are presented in table 2.

Table 1: Industry and working field of respondents

	Number of respondents	Percentage (%) in the sample
<i>Industry</i>		
Clothing and Textiles	28	29.8
Petroleum, Chemical and Plastics	6	6.4
Electronic, Computers and Transportation	22	23.4
Food and Beverage	21	22.3
Metal Manufacturing	7	7.4
Wood, Leather and Paper	7	7.4
Other	3	3.2
Total	94	100.0
<i>Field of Working</i>		
Production Management	17	18.1
Logistics Management	17	18.1
Inventory Management	3	3.2
Store Management	7	7.4
Supply Chain Management	44	46.8
Other	6	6.4
Total	94	100.0

Table 2: Experience of the managers'

	Experience in current organization		Experience in other organizations	
	Number of respondent	Percentage of sample (%)	Number of respondent	Percentage of sample (%)
Below 1 years	23	24.5	30	31.9
1 to 3 years	33	35.1	27	28.7
3 to 6 years	15	16.0	12	12.8
6 to 9 years	11	11.7	9	9.6
Above 10 years	12	12.8	16	17.0
Total	94	100.0	94	100.0

### 3.2 Measures

Reliability and validity relates to the consistency and the accuracy of measures respectively. According to the model developed, GSCM practices was considered as a second-order construct including four first order construct (green purchasing, cooperation with customers, eco-design and investment recovery). The reliability and validity of the collected data were tested using PLS structure equation modeling. Internal consistency reliability of the variables was examined using 'Cronbach's alpha' and 'composite reliability'. Convergent validity of the constructs was examined using 'average variance extracted (AVE)' values. The results are presented in Table 3. All the Cronbach's alpha and composite reliability values are greater than the minimum recommended of 0.7. AVE values are also greater than 0.5, the recommended level (Joe F. Hair, et al., 2011) Therefore, internal consistency reliability and convergent validity of the variables in the model are satisfactorily confirmed.

Table 3: Reliability and convergent validity assessment

	Cronbach's Alpha	Composite Reliability	AVE
Green Purchasing (GP)	0.853	0.891	0.580
Cooperation with Customers (CC)	0.878	0.916	0.733
Eco-design (ED)	0.903	0.939	0.838
Investment Recovery (IR)	0.881	0.926	0.807
Flexibility (FLX)	0.866	0.918	0.789
Delivery (DEL)	0.883	0.928	0.810
Quality (QUA)	0.893	0.933	0.823
Cost (COS)	0.912	0.937	0.789
Customer Satisfaction (CS)	0.827	0.896	0.742

To test the discriminant validity, the indicator loadings are compared with its cross loading values. (Joe F. Hair, Christian M. Ringle, and Marko Sarstedt, 2011). Table 4 presents the results obtained in the present study.

Table 4: Discriminant validity assessment

	GP	CC	ED	IR	FLX	DEL	QUA	COS	CS
GP	0.761								
CC	0.777	0.856							
ED	0.612	0.789	0.915						
IR	0.572	0.673	0.775	0.898					
FLX	0.408	0.421	0.516	0.427	0.888				
DEL	0.381	0.414	0.531	0.422	0.627	0.900			
QUA	0.508	0.498	0.528	0.416	0.737	0.801	0.907		
COS	-0.331	-0.375	-0.428	-0.252	-0.512	-0.647	-0.654	0.888	
CS	0.277	0.314	0.322	0.321	0.524	0.573	0.514	-0.468	0.862

Note: GP = Green Purchasing  
IR = Investment Recovery  
QUA = Quality  
CC = Cooperation with Customers  
FLX = Flexibility  
COS = Cost  
ED = Eco-design  
DEL = Delivery  
CS = Customer Satisfaction

## 4 Result and Discussion

### 4.2 Results

The structural model involves verifying the hypothesized relationships in the study. The study developed hypotheses concerning a direct positive effect of GSCM practices on operational performance and an indirect effect of operational performance on customer satisfaction. Table 5 presents the descriptive statistics of all the variables. A few variables have somewhat higher averages, and these are: Flexibility, Delivery, and Customer Satisfaction.

Table 5: Descriptive statistics

	Mean	Std. deviation
Green Purchasing	2.986	0.953
Cooperation with Customers	3.404	1.043
Eco-design	3.496	1.122
Investment Recovery	3.507	1.096
GSCM Practices	3.348	0.926
Flexibility	3.716	0.831
Delivery	3.879	0.936
Quality	3.886	0.893
Cost	2.532	0.898
Customer Satisfaction	4.220	0.658

The correlation values describe the relationships between the variables. Table 6 presents the Pearson correlation coefficient values between the variables. Accordingly, all the correlations coefficients values are agreed with the hypotheses of the study.

Table 6: Correlations of the variables

	GP	CC	ED	IR	GSCM	FLX	DEL	QUA	COS	CS
GP	1									
CC	0.772*	1								
ED	0.605*	0.788*	1							
IR	0.565*	0.669*	0.772*	1						
GSCM	0.825*	0.916*	0.908*	0.863*	1					
FLX	0.409*	0.419*	0.515*	0.429*	0.506*	1				
DEL	0.385*	0.385*	0.413*	0.530*	0.500*	0.625*	1			
QUA	0.502*	0.494*	0.527*	0.459*	0.563*	0.734*	0.801*	1		
COS	-0.318*	-0.365*	-0.416*	-0.243**	-0.382*	-0.503*	-0.684*	-0.647*	1	
CS	0.276*	0.315*	0.323*	0.321*	0.382*	0.517*	0.572*	0.510*	-0.457*	1

Note GP = Green Purchasing CC = Cooperation with Customers ED = Eco-design  
 IR = Investment Recovery FLX = Flexibility DEL = Delivery  
 QUA = Quality COS = Cost CS = Customer Satisfaction

GSCM practices showed a significant direct effect on customer satisfaction (without the mediator) with 0.382 coefficient value. Figure 2 present the path model coefficients after adding the mediator of operational performance.

According to the result, there is a significant difference in path coefficients after adding the mediator. Therefore, Sobel test was applied to test the mediating effect of independent variable (GSCM practices) on dependent variable (customer satisfaction). The path coefficients and their standard deviation values were used to calculate that mediating effect. Table 7 presents the result of the Sobel test.

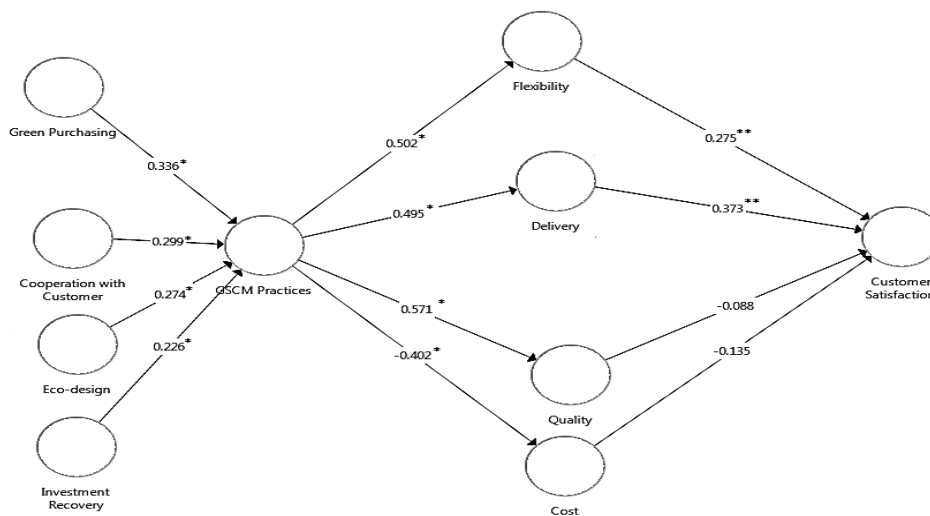


Figure 2: Path Model

\*Significant at 0.01 level; \*\*significant at 0.05 level.

Table 7: Sobel test results

Mediator	a	b	SE <sub>a</sub>	SE <sub>b</sub>	Z	P-value
Flexibility	0.5017	0.2787	0.0923	0.1240	2.0770	0.0377
Delivery	0.4955	0.3749	0.0944	0.1763	1.9709	0.0487
Quality	0.5715	-0.0801	0.0741	0.1893	-0.4225	0.6726
Cost	-0.4020	-0.1353	0.0887	0.1084	1.2033	0.2288

Only flexibility and delivery are significantly influencing on the relationship between GSCM practices and customer satisfaction as a mediator. Quality and cost do not mediate the relationship between GSCM practices and customer satisfaction.

Table 8: Results of hypothesis tests

Hypothesis	Std. coefficient	Result
GSCM Practices → Flexibility	0.092*	H <sub>1a</sub> is supported
GSCM Practices → Delivery	0.094*	H <sub>1b</sub> is supported
GSCM Practices → Quality	0.074*	H <sub>1c</sub> is supported
GSCM Practices → Cost	0.089*	H <sub>1d</sub> is supported
Flexibility → Customer Satisfaction	0.124**	H <sub>2a</sub> is supported
Delivery → Customer Satisfaction	0.176**	H <sub>2b</sub> is supported
Quality → Customer Satisfaction	0.189	H <sub>2c</sub> is not supported
Cost → Customer Satisfaction	0.108	H <sub>2d</sub> is not supported

Note : \*significant at 0.01 level; \*\*Significant at 0.05 level

Table 8 presents the results of hypothesis tests. Accordingly, GSCM practices lead to increasing the operational performance in the organizations such as flexibility, delivery, quality and cost. But quality and cost are not influencing on customer satisfaction, only flexibility and delivery has significant effects. However, GSCM practices lead to increasing the customer satisfaction. Table 9 presents the indirect effect of GSCM practices on customer satisfaction.

Table 9: Indirect effect of GSCM on customer satisfaction

Total effect of GSCM Practices → customer satisfaction = 0.334*	
	Indirect effect
GSCM Practices → Flexibility → Customer Satisfaction	0.140*
GSCM Practices → Delivery → Customer Satisfaction	0.189*

Note: Significant at 0.01 level

In this study, GSCM practices are conceptualized to be consist of four practices; green purchasing, cooperation with customers, eco-design and investment recovery. GSCM practices considered as a second order construct including four first order constructs. Table 10 presents the indirect effects of those variables on customer satisfaction.

Table 10: Indirect effect of individual GSCM practices

	Indirect effect
Green Purchasing → Flexibility	0.169*
Green Purchasing → Delivery	0.167*
Green Purchasing → Quality	0.193*
Green Purchasing → Cost	-0.136*
Green Purchasing → Customer Satisfaction	0.113*



Cooperation with Customer → Flexibility	0.150*
Cooperation with Customer → Delivery	0.148*
Cooperation with Customer → Quality	0.171*
Cooperation with Customer → Cost	-0.120*
Cooperation with Customer → Customer Satisfaction	0.100*
Eco-design → Flexibility	0.138*
Eco-design → Delivery	0.136*
Eco-design → Quality	0.157*
Eco-design → Cost	-0.111*
Eco-design → Customer Satisfaction	0.092*
Investment Recovery → Flexibility	0.112*
Investment Recovery → Delivery	0.111*
Investment Recovery → Quality	0.128*
Investment Recovery → Cost	-0.090*
Investment Recovery → Customer Satisfaction	0.075*

*Note: \*Significant at 0.01 level*

Table 11 presents the R<sup>2</sup> values of the model. All the R<sup>2</sup> values are less than 0.5 (R<sup>2</sup> < 0.5). Therefore, the effects of GSCM practices on the performance dimensions are classified as low.

Table 11: R<sup>2</sup> values

	R Square (R <sup>2</sup> )	Adjusted R <sup>2</sup>
Flexibility	0.252	0.244
Delivery	0.246	0.237
Quality	0.327	0.319
Cost	0.162	0.152
Customer Satisfaction	0.383	0.355

### 4.3 Discussion

GSCM practices mostly affect the quality (0.571) compared to the other performance indicators. Cost is affected at minimum although its value is also not very low (0.402). The individual dimensions of GSCM practices such as green purchasing, cooperation with customers, eco-design and investment recovery significantly and positively linked with all dimensions of operational performance (flexibility, delivery, quality and cost) and customer satisfaction. Among those dimensions of GSCM practices, green purchasing highly affects flexibility, delivery, quality and cost individually. Consequently, green purchasing mostly contributes to increasing the customer satisfaction. Today, a lot of manufacturers follow suppliers' ISO 14000 certification and second-tier supplier environmentally friendly practice evaluation and provide design specifications to suppliers that include environmental requirement for purchased items. Cooperation with customers highly affects quality improvement with 0.171 effect size. Most of managers in the survey have responded that they are cooperating with customers for eco packaging and using less energy during product transportation. Eco-design and investment recovery also highly impact on quality improvement. The effect size is 0.157 and 0.128 respectively. Under that, most of the manufacturing managers design products for reuse, recycle recovery of material; designing products to avoid or reduce use of hazardous products/manufacturing process; selling excess inventories, scrap and used materials.

Another significant finding of this research is the relationship between operational performance and customer satisfaction. Quality and cost are not significantly linked with customer satisfaction; only flexibility and delivery are positively associated with customer satisfaction. Although GSCM practices highly linked with quality improvement, quality improvement is not linked with customer satisfaction. The practices of eco-labeling, green packaging, using less energy during product transportation, selling scrap and used materials had not been attracted to customers.

## **5 Conclusion**

There is no comprehensive investigation of the relationship of GSCM practices (green purchasing, cooperation with customers, eco-design and investment recovery) with operational performance (flexibility, delivery, quality and cost) and customer satisfaction. Therefore, this research study contributes to the literature providing empirical evidence for the impact of GSCM practices on operational performance and customer satisfaction. According to the results of the study, both of individual dimensions of GSCM practices and overall GSCM practices are significantly and positively linked with all the dimensions of operational performance. However, only the indirect impact through flexibility and delivery on customer satisfaction are indirectly associated with customer satisfaction while quality and cost have no significant mediating effect impact.

## **6. Theoretical and Managerial implications**

This research study provides empirical evidence for the impact of four dimensions of GSCM practices (green purchasing, cooperation with customers, eco-design and investment recovery) on four operational performance dimensions (flexibility, delivery, quality, and cost) and customer satisfaction. According to the respondents of the study, most of the manufacturing firms already have begun to implement GSCM practices such as considering suppliers' ISO 14000 certification; providing design specification to suppliers that include environmental requirement for purchased item; cooperating with customers for green packaging; cooperating with customers using less energy during product transportation; designing product for reuse, recycle, recovery of material/components parts; selling the scrap and used materials etc. Existing literature suggests that specific activities to support environmental collaboration, monitoring and control including monitoring reverse flows of materials; sharing techniques and knowledge related to environmental management with supply chain partners; working to control the environmental risk associated with suppliers' operations; and working to assure proper product use (Vachon, S., 2007). These findings offer directions to manufacturers to enhance operational performance and customer satisfaction while implementing environmental practices throughout their supply chain.

## **7. Limitations and future research**

This study has a few limitations that might be overcome in future research in similar field. Data were collected only from manufacturing managers in Sri Lanka. If a future study increases the sample size and collect data from worldwide manufacturers, those findings will be valid to a broader context. In particular, the mediating role of quality and cost which found insignificant in this study can be reexamined, as a mediator. In addition, in depth studies that collect data from different managers within a selected manufacturing firm may explore a detailed information related to the relationships revealed in this study.

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