

# **Economic Impacts of Applying Green Supply Chain Management Practices to Organizations in Sri Lanka**

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## **1. Introduction**

Although the concept of green supply chain management has come into play with the fact of increasing environmental pollution, its intentions also relate to good business sense and higher profits, extending beyond just the achievement of environmental goals [1]. When it comes to the key motives of a green supply chain, the fact remains that organizations cannot survive without economic sustainability [2] [1]. Therefore, this research is carried out to find out drivers for implementing GSCM, the economic impact of greening supply chains and the relationships between different GSCM practices in the Sri Lankan context.

## **2. Literature Review**

With increasing environmental concerns globally, attention to developing environmental strategies for managing operations along the supply chains is also increasing [3]. The definition of green supply chain practices has expanded from green purchasing to include other logistics operations on the forward supply: from suppliers to manufacturers and customers, and even to reverse logistics: thus ‘closing the loop’ in supply chain parlance [2]. GSCM is defined as a means of combining environmental thinking into supply chain management concepts in areas such as product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumer, and end-of-lifecycle management [1]. Environmental improvement is evolving as an operational initiative that many organizations are adopting to address environmental issues [4]. The cost of environmental protection mechanisms has been increasing since 1970 and continues to grow [5]. Since developing countries like Sri Lanka focus more on profit, it is important to highlight the benefits of adopting GSCM practices in organizations from an economic perspective as there is not much research available in the domestic context.

## **3. Research Methodology**

This research was designed to be conducted mainly through a qualitative method. An online questionnaire was prepared using Google forms and distributed to 80 organisations through email and LinkedIn. The questionnaire had five main sections collecting general information of the respondent and the relevant organisation, major

drivers for GSCM implementation, and the economic impacts of GSCM on procurement operations, manufacturing operations, transportation, and warehousing. Respondents' perception of the impact of each practice on organisational profit was used to measure the economic impact. Altogether 39 responses were collected. At the end of data collection and analysis a model was developed to identify the relationships between the identified latent variables. The target populations consisted of companies in the manufacturing, transport and warehousing industries in Sri Lanka.

## 4. Research Findings and Discussion

### 4.1. Main Drivers to implement GSCM practices

The analysis identified nine factors as drivers to encourage implementing GSCM practices in Sri Lanka. As shown in Figure 1, three major driving factors are the practices of supply chain partners which drive organizations to implement GSCM practices, top management commitment, and maintaining the image of the organisation. Different industries use various green practices to minimise environmental impact.

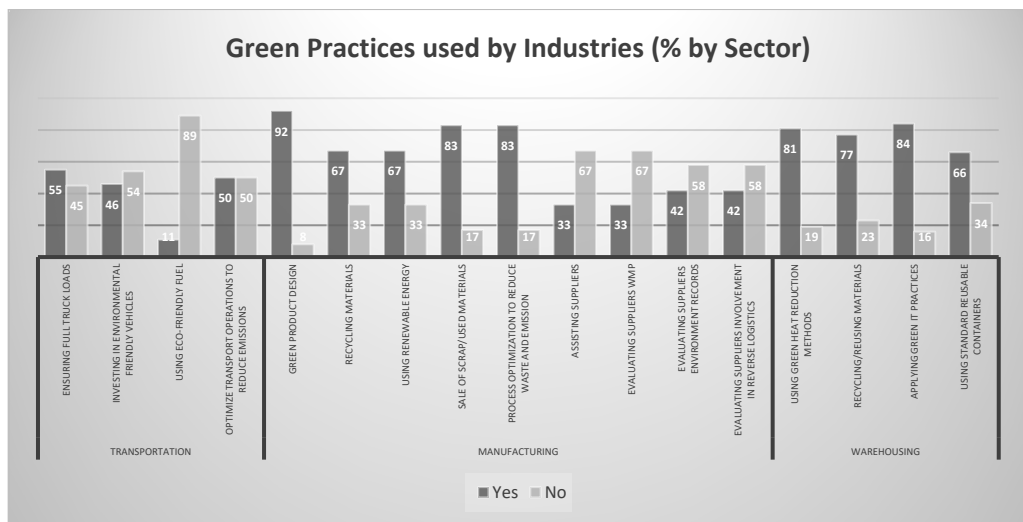


Figure 1: Green Practices used by Industries

As shown in Figure 1, green product design is the most-used GSCM practice in the manufacturing sector, where 91.6% of the respondents indicated that they are implementing innovative methods to minimize negative impacts of the manufacturing process. Assisting suppliers and evaluating their waste management practices are the least used green practices in this sector. In the freight transport industry in Sri Lanka, ensuring full truckloads (55%) is considered as the most-used green practices whereas the use of eco-friendly fuels (10%) is the least-used green practice. This might be due to the unavailability of vehicles that can be operated by eco-friendly fuel types and eco-friendly fuel. In the warehousing industry, the most-used practice is ‘applying green IT

practices' whereas the least-used practice is the use of standardized reusable containers (66%).

#### 4.2. GSCM practices and Impact on organizational profit

Descriptive analysis of types of GSCM practices shows that all practices other than evaluation of suppliers' environmental records and providing assistance to the supplier

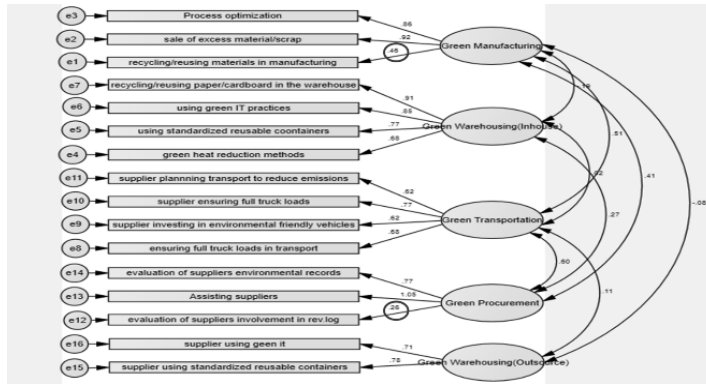


Figure 2: Output from CFA - Initial

for implementing green practices have an impact on the profit. In order to further explore this, an Exploratory Factor Analysis (EFA) was carried out. Varimax rotation was used and values below 0.5 were suppressed in order to get a more reliable output from the EFA.

Five latent constructs emerged as a result of analysis, including green manufacturing, green transport, green procurement, green warehousing (in-house) and green warehousing (outsourced). Cronbach alpha test was used to measure the reliability of factors, which were categorized as latent factors (Figure 3). Since some of the Cronbach alpha values got lower values (less than 0.5) (Table 1), these factors were removed and carried out EFA again. With this, the alpha values were improved (Table 1), which is accepted as reliable. Sixteen factors were selected under the five components which emerged from analysis. The KMO measure has further increased (0.655) showing a higher sampling adequacy. From the analysis, each latent factor has gained at least two observed variables which

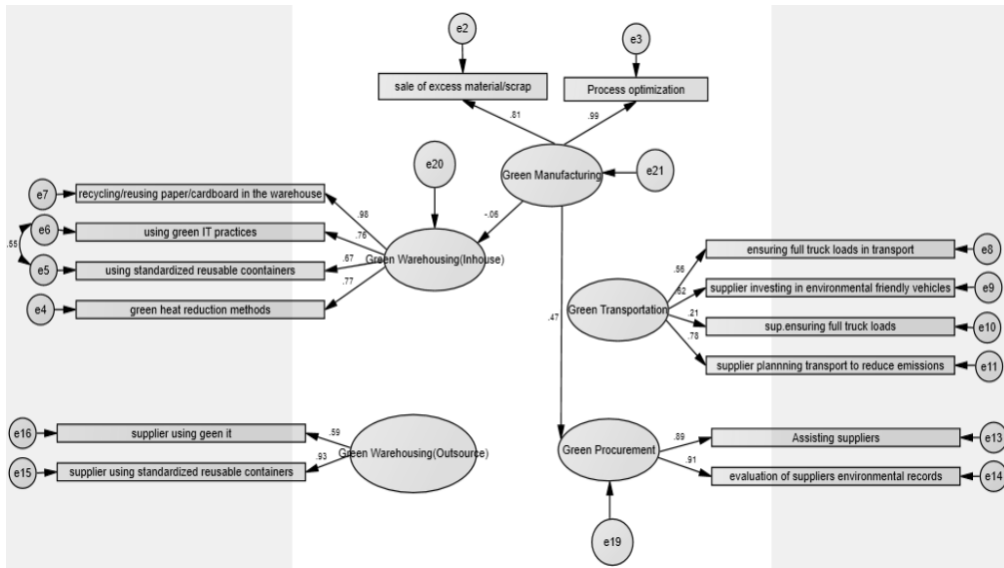
Table 1: Output of Cronbach's alpha test (Initial and Final)

Latent variable	Initial	Final
1. Green warehousing (in-house)	N/A	0.860
2. Green manufacturing	-0.103	0.731
3. Green transport	0.298	0.759
4. Green procurement	N/A	0.722
5. Green warehousing (outsource)	N/A	0.709

are enough to continue to the next step of the analysis which is CFA. All the factors taken from the final output of EFA was used in CFA. Accordingly, the final CFA path diagram consisted with 14 observed variables under five latent constructs.

In the case of absolute fit, the model has the RMSEA value as 0.092, less than 0.1, hence the CFA model achieves the absolute fit. GFI value, which is 1.0, indicates the perfect fit of the model, whereas the model achieves a value of 0.767 for the GFI index which can be read as moderately acceptable. In terms of incremental fit, the CFI value is

greater than 0.9, which marks the incremental fit of the model. The AGFI value which indicates the complexity of the model is 0.650, indicating that the model developed is slightly complex as it is less than 1. The Chi-square/df value is 1.319, being in the acceptable range of 1.0-3.0. All these values obtained from the confirmatory factor analysis indicates that the models are valid. Cronbach's alpha test also confirms that the model is reliable. The output of the CFA was used to develop the SEM model and as a first step, seven Hypotheses were developed and tested using the structural equation model. Figure 3 illustrated the model developed from SEM.



**Figure 3: Output from SEM**

**Table 2: Hypotheses**

Hypotheses		Result
H3	Profit increment from Green manufacturing has a positive impact on profit increment from Green procurement.	<b>Accepted</b>
H5	Profit increment from Green procurement has a positive impact on profit increment from Green transport.	<b>Accepted</b>
H6	Profit increment from Green procurement has a positive impact on profit increment from Green warehousing (in-house).	<b>Accepted</b>

The validity of the SEM shows that the RMSEA value has come closer to the acceptable value and the GFI value also to a closer value. The incremental fit, a CFI value of 0.826, is again closer to the acceptable minimum value of 0.9. Chi-square/df value, which shows the parsimonious fit of the model, is within the acceptable range of one to three. Even though the GFI and AGFI values do not meet the exact requirement, the values are closer to one which results in a moderately-fitting model.

## 5. Conclusions

As a summary of findings, the factor driving the manufacturing, transport and warehousing companies in Sri Lanka to implement GSCM practices are identified as the practices of supply chain partners which make the organizations drive to implement GSCM practices, top management commitment, and maintaining the image of the organization. In the manufacturing industry, the most-applied GSCM practice is identified as green product design, whereas for transport and warehousing companies, the most-applied GSCM practices are ensuring full truckloads and use of green IT practices respectively. Finally, through the developed model, it is identified that there are significant positive relationships between the economic impacts of implementing, green manufacturing on green procurement, green procurement on green transport and green procurement on green warehousing which is happened in-house.

The sample size is the main limitation of the study. In order to be more reliable with the findings of the research, having a large sample is vital. Inability to collect actual profit data for the companies was also another main limitation of the study, hence limited to perception., hence, it is recommended if the future researchers can do a comparison of the results generated from this research to see how the economic impacts and the relationships between each practice change, depending on the industry by using a larger sample. Further, using actual cost and profit data from the organizations, would generate more reliable results.

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