

---

## Sustainable Green Supply Chain Management and Waste Management in Construction Industry

---

DR.D. BARANIKUMAR<sup>1</sup>, MR. MESFIN LEGESE BIKILA<sup>2</sup>, MR. GUDETA CHALA<sup>3</sup>

<sup>1</sup>Associate Professor, Bule Hora University, Ethiopia.

<sup>2</sup>Lecturer, Bule Hora University, Ethiopia.

<sup>3</sup>Lecturer Bule Hora University, Ethiopia

---

**Abstract:** The contemporary trends of Green supply chain management (GSCM) are creating awareness within construction industries rapidly. It is functioning as a catalyst to realize competitive advantage and sustainability, environment consciousness and globalizing. Environmental pollution and global climate change have turned out to be one of the greatest challenges which have constrained governments and businesses alike to assess the environmental impacts of their activities. The green construction sector has therefore turn out to be critically important. Green supply chain management is taken into account as an environmental innovation in construction industry. At present scenario the environmental issues and the concern for sustainability is encouraging more effective usage of energy, water and material currently used, ensure the prevention of any kind of waste, perform environmentally sensible and eco-friendly building design and be environmentally friendly in the process of the construction. Industries are aware of their responsibilities about the environment depending on regulations. This leads to sustainable systems that will continue their processes without giving any harm to the environment. Environmental issues are seen at every step of supply chain that starts from getting the raw material and ends with reuse or recycle or disposal. Sustainability is very important to improve the quality of systems to have a healthy environment with high level of social, economic and environmental conditions to future generations. It identifies linkages between research and practice in the area of reverse supply chain and how it can facilitate the management of waste. The entire stream of research on reverse supply chains is motivated by the observations that by reusing, remanufacturing, and recycling used products/components it is possible to reduce landfill waste. This article is the benchmark of further research to find out the relationship between GSCM practices and construction industry for improving sustainability.

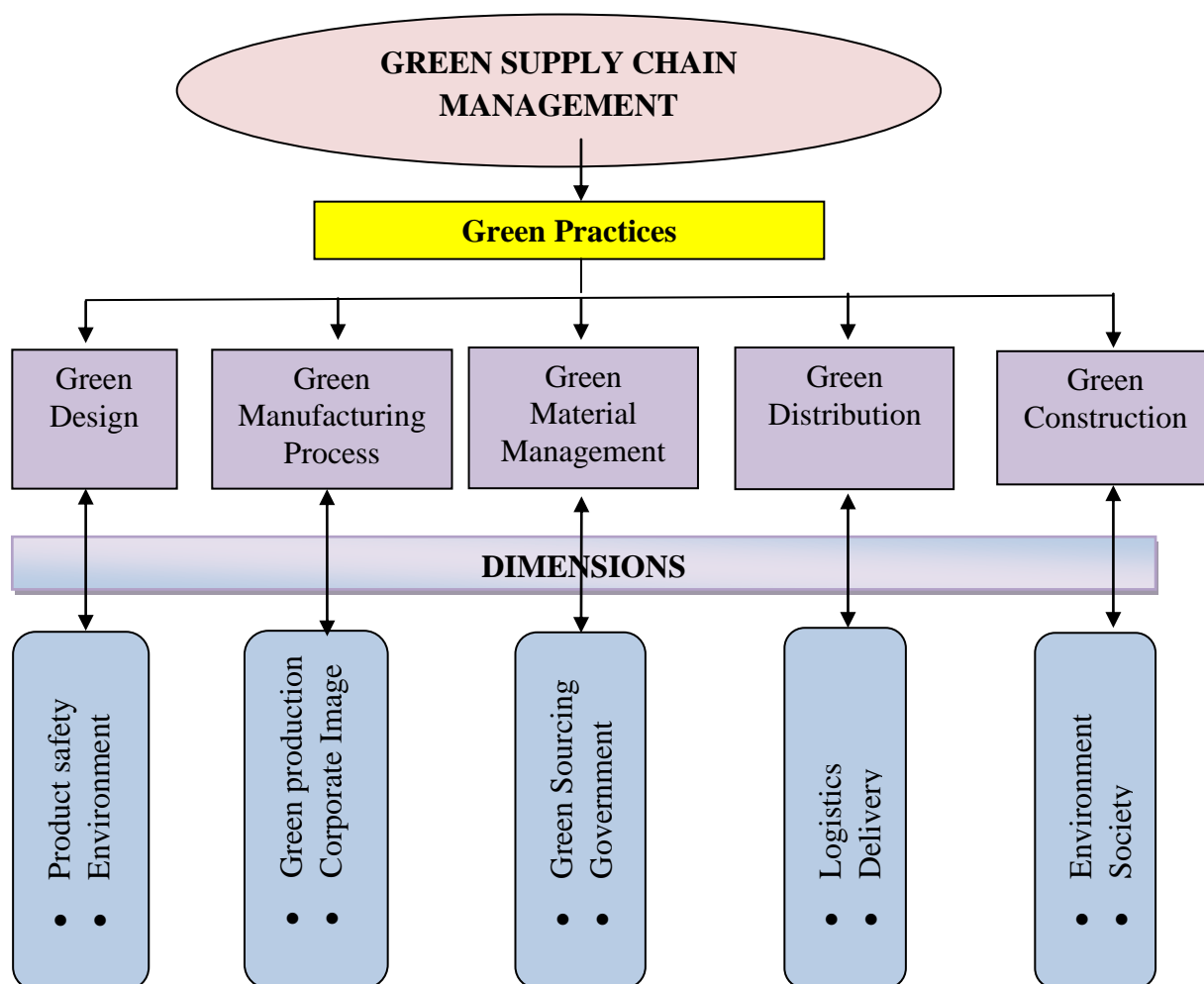
**Keywords:** Green Supply Chain Management, Construction Industry, Waste Management , Green practices and Sustainability.

---

### INTRODUCTION

The activities of the construction industry are primarily criticized for their negative environmental effects, such as high energy consumption, emissions of greenhouse gases and waste generation. Subsequently, in reconsidering its traditional Green Supply Chain Management practices. Growing industries today are causing pollution that directly affects our lives. It damages our health and is a major threat to the next generation. Green products and services are becoming more prevalent in this situation. Production systems are customer-focused, with high quality, to meet their demands on time. Even in the construction business, it is important to manage every step, beginning with the building design to the demolition. Green construction design, as a solution, reduces the use of raw materials at the initial stage, resulting in a higher percentage of recyclable materials for a sustainable structure. The company's contemporary GSCM practices are widely distributed to improve environmental performance and gain competitive advantages in the company. Sustainability, social progress, competitiveness, globalization, economic dynamism and environmental performance, however, go hand in hand. Sustainable competitiveness is a fresh concept in global globalization for sustainable development and well-being that policymakers in developing countries are concerned about their national competitiveness in relation to international competitiveness. This competitiveness brings the revolutionary changes in construction industry for example lean construction. Thus, green supply chain management (GSCM) can be recognized as one of the best solution to resolve the above mentioned issues.

## CONCEPTUAL FRAMEWORK OF THE STUDY



### Applications of Green Supply Chain Management in Construction Industry

Naniek Utami Handayani et al. (2018) conducted a study on the factors implementing GSCM in construction industry. This paper aimed a framework for the implementation of GSCM in construction industries. The framework includes the concepts and the dimensions of the GSCM model that was adapted from manufacturing industry. This study is rooted in a background of managed GSCM in construction that has increased efficiency and productivity in construction projects. These advantages can be obtained in the construction industry by means of reducing waste, energy used, and negative impacts on the environment. The concepts of GSCM in construction include green initiation, green design, green materials management, green construction processes, and green operation and maintenance. The author concluded that these concepts can be integrated throughout the project life cycle from the initiation phase to the operation and maintenance phase.

Balasubramanian et al. (2017) have investigated a study on Green supply chain management: an empirical investigation on the construction sector through the context of the UAE sector and incorporating inputs from all key stakeholders including Developers, Architects or Consultants, Contractors and Suppliers. The study contributed for improving the efficiency and effectiveness of greening of the construction sector. The qualitative assessment of this research was based on only 31 interviews. Therefore, the empirical generalizations drawn are indicative rather than conclusive, and the qualitative assessment of the relationships is more intuitive than statistically based.

### GSCM, Globalization and Sustainability

The conventional green initiatives are related with several weaknesses such as environmental consciousness, weather change, natural calamities ecological imbalance, general supply chain are upgraded to green supply chain to decrease the influence and improve the environment with sustainable practices of organizations. The construction impact on the environment is a major issue in India. Construction industry produces the bulk quantity of waste and practices traditional supply chain without sustainable concern .Due to globalization, the

GSCM principal practices are playing a significant role not only in manufacturing but also in technology, can be used by the other business sectors such as government, education, and services Green supply chain aims for continuous growth of industrial processes and products to reduce or prevent pollution to air, water and land. They also suggested that through enhancement, there is possibility of minimizing risks to human's beings and other species.

### **GSCM practices in construction industries**

Waste has been identified as a main problem in the construction industry because of its direct impact on the environment and the productivity of the construction industry. Many studies have shown that during the design and development phases there are many extravagant procedures. Similar to the manufacturing supply chain, a construction supply chain is typically more complicated compared to multiple production supply chain. Compared to the manufacturing supply chain, a building supply chain is more complicated and typically consists of a complex network of several members. The efficient construction supply chain of SCM application practices in the construction industry depends on the collaboration and cooperation between supply chain partner's contractors who have increasingly adopted supply chain collaborations as an approach..

### **Construction waste management**

Today, buildings cause air, water and noise pollution with environmental concerns of global warming became very relevant. Green materials are favored even in building design to reduce waste and construction companies are beginning to use green supply chain management to make their work sustainable. Green buildings, sustainable design and constructions, construction waste management are some of the sustainability topics that are being used by producers. Disposal is the best way to minimize the construction waste generation. Sustainability is important which leads to improved quality of systems to leave a healthy environment with high level of social, economic and environmental conditions to future generations, By applying precise waste management, the construction sector may experience efficiency, sustainability and economic benefits and minimize the construction cost. Cost savings in buying goods, shipping costs of materials and waste, waste minimization and waste management and tipping impact some aspects of achieving cost advantages.

### **Green Design**

The most important stage is green design, as conclusions made in the design phase will have a serious impact on the project system's life cycle environment. The concept of green design reduces the environmental impact resulting from the construction design and construction processes being established. Green design aims at designing construction projects in an environmentally friendly manner.

### **Green Manufacturing Processes**

Green processes of production consist of three main phases as , decrease in resource utilization, decrease in waste and emissions. Green manufacturing processes aim to reduce the consumption of pristine substances and other resources in order to indirectly minimize the total amount of waste during the manufacturing phase by reducing the use of energy and resources; green manufacturing can reduce the environmental impact by selecting recycled or reused products. Emission decrease, another critical aspect of green development, is aimed at reducing pollution with two key features: regulation and prevention. Control implies that, using pollution control devices, pollutants and waste are trapped, stored, treated and disposed of. Prevention involves reducing, altering or stopping emissions of sand waste jointly by replacing better materials, recycling, reuse or process innovation.

### **Green Materials Management**

The management of green materials applies to replacing potentially harmful practices or materials with more environmentally friendly ones. It is split into two phases, as follows: procurement of green materials and selection of green materials. Material selection parameters that can be processed in the management of green materials include materials used in building, which should be easy to process. separate, adaptable or useful in streamlining existing processes.

### **Green Distribution and Marketing**

Green Distribution is the process of green packaging and logistics, including the characteristics of green packaging such as green packaging, size shape and materials affecting distribution, as well as the characteristics of product transport Green marketing can be defined as product promotion or advertisement, changes in production processes or changes in packaging that are weighed in terms of environmental impact. Green distribution is a significant component of GSCM due to its potential for having a large positive influence on the environment.

**Green Construction**

Green construction seeks to optimize resource conservation and minimize construction activities that have negative environmental effects, while at the same time achieving the target of savings in four resource areas as energy, land, water and materials, in addition to preserving the environment. The general reduction, reduction of waste and reduction of emissions are integral elements of green construction.

**Objective**

This paper is also aiming to empirically study the contribution of each component of green supply management to the green supply management in construction industry in the Ethiopian context.

**METHODOLOGY**

The study is an empirical in nature and have been done in the \*\*\* city, Ethiopia. 50 construction engineers are considered as sample and data were collected through questionnaire using Google Forms. The data were analysed with the help of parametric test.

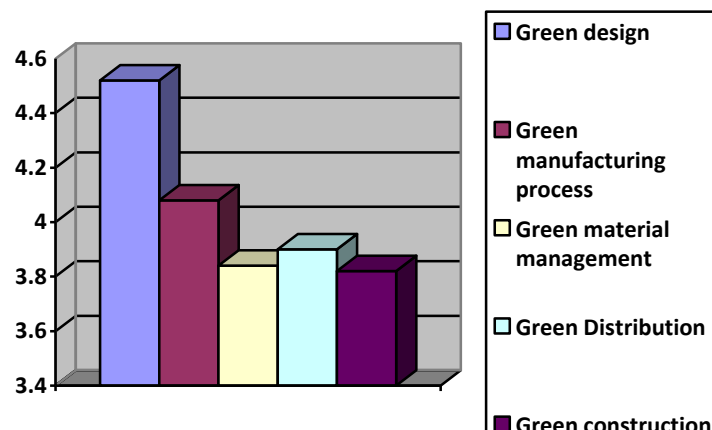
**The five components of green supply chain management in construction industry**

The components of the Green Supply Chain Management in the construction industry are considered in the study. The respondents are asked to mention the level of possibility of green supply chain those components. The possibility of each component is measured based on the scale used in the model using five point Likert scale. According to the opinion of the respondents, it is understood the most possible component for green supply chain management. One sample t test is used to find the difference in the opinion of the respondents.

**Table 1: Green supply chain management: One sample t test**

Components	Mean	Std. Deviation	t	Sig
Green design	4.52	0.580	18.533	0.000
Green manufacturing process	4.08	0.900	8.486	0.000
Green material management	3.84	0.817	7.269	0.000
Green Distribution	3.90	0.707	9.000	0.000
Green construction	3.82	0.691	8.394	0.000

The Table 1 shows the result of One Sample t test for the 5 components. It shows the significant difference in the mean of the sample from the mean of the population. The mean of the green design (4.52) is highest among components. It shows that the sample respondents have opined that green design is highly possible than other measures in the GSCM. Green Manufacturing Process is the second highest component with a mean of 4.08. The values are more than 1.96 for all the components and they are found significant at 1 level (p<0.01). It is concluded that the opinion of the sample respondents towards the achievement of Green Supply Chain Management construction industry based on the five components is positive (The expected population mean is 3). The result is also shown in the following diagram.



**Diagram: Green Supply Chain Management**

The above diagram shows that the possibility of green supply chain management in the green design is highly possible than other components. Green construction is the least scored component. Further, this paper is also trying to find the inter relationship between the opinion about the different components. The result of the correlation test is given below.

**Table 2: Inter relationship with components of Green Supply Chain Management: Correlations**

Components of GSCM		Green Design	Green Manufacturing Process	Green Material Management	Green Distribution	Green Construction
Green Design	Pear. Correlation	1	0.153	0.394**	0.179	-0.067
	Sig. (2-tailed)		0.288	0.005	0.213	0.643
Green Manufacturing Process	Pear. Correlation	0.153	1	0.157	0.109	0.056
	Sig. (2-tailed)	0.288		0.278	0.451	0.697
Green Material Management	Pear. Correlation	0.394**	0.157	1	-0.064	-0.052
	Sig. (2-tailed)	0.005	0.278		0.661	0.720
Green Distribution	Pear. Correlation	0.179	0.109	-0.064	1	-0.079
	Sig. (2-tailed)	0.213	0.451	0.661		0.584
Green Construction	Pear. Correlation	-0.067	0.056	-0.052	-0.079	1
	Sig. (2-tailed)	0.643	0.697	0.720	0.584	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The Table 2 indicates the relationship between each component of the GSCM of construction industry. Regarding to the opinion of the respondents, the possibility of implementing GSCM practices in the construction industry is similar for Green design and Green Material Management. The significant value is 0.005. It shows that the respondents are having a positive opinion about these two components.

### SUGGESTION

The paper analysed the Green Supply Chain Management in the construction industry. The conceptual framework explained five components in GSCM. The finding shows that the possibility of implementing the green supply chain management in the green design is possible. It is also found that other components are needed to focus to improve GSCM. The stakeholders in the construction industry should take necessary steps to improve GSCM in all the areas to get 360 degree development and inclusive growth for the healthy environment.

### CONCLUSION

This research study is based on a conceptual framework of Green supply chain management activities in the construction industry, which illustrates the green supply chain management of environmental sustainability and is easy to implement. There are several challenges to the adoption of GSCM practices in India's construction industry and most businesses do not respond positively. This study is the benchmark of further research to find out relationship between GSCM practices and construction industry for improving sustainability. Evaluating supply chain sustainability can be useful and applicable for industries to make more informative and reliable decisions in anticipated changes of construction markets.

### REFERENCE

1. Abidin, N.Z. (2010).” Investigating the awareness and application of sustainable construction concept by Malaysian developers”, *Habitat International*, Vol. 34(4), pp.421-426.
2. Balasubramanian S and Shukla V. (2017), “Green supply chain management: an empirical investigation on the construction sector”, *Supply Chain Management: An International Journal*” Vol- 22(1), pp: 58-81
3. Begum, R. A., Siwar, C., Pereira, J. J., & Jaafar, A. H. (2006) “A benefit–cost analysis on the economic feasibility of construction waste minimization: The case of Malaysia. *Resources*”, *Conservation and Recycling*, Vol.48 (1),pp. 86-98.
4. Ghobakhloo, M., Tang, S.H., Zulkifli, N., & Ariffin, M. (2013). “An integrated framework of green supply chain management implementation. *International Journal of Innovation, Management and Technology*”, Vol. 4(1), pp.86-88.
5. Naniek Utami Handayani, Anita Mustikasari (2018), “Factors for Implementing Green Supply Chain Management in the Construction Industry”, *Journal of Industrial Engineering and Management*”, Vol-11(4), pp: 651-679.
6. Sarkis, J., Zhu, Q. and Lai, K., 2011. “An organizational theoretic review of green supply chain management literature”, *International Journal of Production Economics*, Vol.130 (1): pp.1–15.
7. .Vrijhoef R., Koskela L., (2000) “The four roles of supply chain management in Construction”, *European Journal of Purchasing & Supply Management*, Vol.6,(2) pp.169- 178.
8. Yuan, H. (2012). “A model for evaluating the social performance of construction waste management”, *Journal of management*, Vol.32 (6), p.1218-1228.