

# **Impact of Green Logistics Management on Sustainable Business Performance of Textile Manufacturing Industries**

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## **Abstract:**

This study investigates the impact of green logistics management (GLM) on sustainable business performance (SBP) in the textile industry of Tamil Nadu, India. Through a structured questionnaire distributed to textile manufacturing firms, the research collected data from 148 respondents, enabling a comprehensive analysis of the relationship between GLM practices and business outcomes. The study employs confirmatory factor analysis (CFA) and structural equation modeling (SEM) to assess the reliability and validity of the constructs. Results indicate a significant positive relationship between GLM and SBP, with firms reporting improvements in green image, sales, and energy cost reductions as key benefits of adopting sustainable logistics practices. These findings contribute to the existing literature by highlighting the strategic importance of green logistics in enhancing operational efficiency and competitive advantage. The study emphasizes the need for textile manufacturers to integrate sustainable practices into their logistics processes as a critical component of their business strategy.

## **Introduction**

Sustainability in the textile and clothing industry has evolved far beyond just using organic materials and efficient processes. Today, it encompasses a holistic approach that includes developing sustainable business models, selecting eco-friendly materials, and adopting sustainable production techniques. This transformation is driven by increasing customer demand and stricter regulations that push the industry toward more responsible practices (Berry & Rondinelli, 1998).

In India, the textile and apparel market is expected to grow at a compound annual growth rate (CAGR) of 10%, reaching \$350 billion by 2030. Currently contributing 2.3% to India's GDP, the industry is projected to increase its contribution to 5% by the end of the decade (Anand et al., 2014; PATEL et al., 2022).

One key aspect of this transformation is the adoption of green logistics. Green logistics refers to business practices that aim to reduce the environmental impact of a company's logistics and supply chain operations while maintaining customer satisfaction and profitability (Karia, 2020). By focusing on reducing their environmental footprint, companies can improve sustainability across the entire supply chain, balancing economic activity with environmental responsibility.

With the growing emphasis on integrated green logistics, an important question arises: Is there a balance between adopting green logistics practices and maintaining strong business performance? Can companies that prioritize environmentally-friendly logistics attract more customers while also achieving better environmental outcomes, or does this come at the expense of profitability?

Many studies indicate that companies focusing on green logistics often see improvements in both operational efficiency and sustainability (Lai & Omega, 2012; McKinnon et al., 2015; Pazirandeh & Jafari, 2013). Practices such as optimizing transportation, reducing waste, and conserving energy can lead to cost savings and more efficient operations.

These changes not only reduce a company's carbon footprint but also improve overall supply chain performance by lowering fuel expenses and enhancing logistics processes.

Additionally, businesses that adopt green logistics can benefit from increased customer interest, as sustainability is becoming a key factor in consumer and partner decision-making. Many customers now prefer environmentally responsible brands, and businesses that demonstrate a commitment to green practices often enjoy a stronger reputation and greater customer loyalty (Borin et al., 2013). Moreover, by proactively adopting sustainable practices, companies are better equipped to meet evolving regulatory requirements, helping them avoid future compliance costs or disruptions.

While initial investment in green logistics may be required, the long-term benefits—such as cost reductions, improved brand image, and enhanced environmental outcomes—often outweigh the short-term challenges. This study tries to find the impact of green logistics on sustainable business performance of textile manufacturing industries.

## Literature review

Green logistics, a concept within green supply chain management (GSCM), is gaining increased attention for its potential to enhance both environmental sustainability and business performance. The question of whether improved environmental management can lead to better business outcomes has been widely debated in literature, yet consensus remains elusive (Xie et al., 2010). Various studies have explored the relationship between green management practices and business performance, yielding contradictory findings.

On one hand, scholars such as (Ambec & P Lanoie, 2008; Huang, P, 2010; Kuei et al., 2013) argue that proactive environmental management practices can help enterprises reduce operational costs, enhance efficiencies, and ultimately boost revenues. They suggest a positive relationship between green management initiatives and business performance, positioning environmental management as a critical tool for enhancing competitive advantage. This view aligns with the broader perspective that green supply chain management (GSCM) can serve as a strategic asset for businesses, enabling them to reduce carbon emissions and waste while maximizing profits (Parven, 2023)

On the other hand, some researchers have found that environmental practices can increase operational costs, reduce profitability, and potentially harm business performance (Bhatia & Awasthi, 2017; Cordeiro & J Sarkis, 1997). This negative relationship may arise due to the high initial investments required for implementing green initiatives and the potential inefficiencies involved in the adoption phase. The divergence in findings may be due to differences in research methodologies and the types of variables considered across studies, as highlighted by Abutabenjeh & Jaradat, (2018).

Moreover, the majority of previous studies have focused primarily on general environmental management practices in manufacturing industries, with limited attention paid to the logistics sector (Vivek & Chandrasekar, 2019; Zhang et al., 2018). This is a significant gap, as logistics plays a critical role in supply chain management, and the concept of green logistics—concerned with reducing the environmental impact of logistical activities—holds particular relevance in the modern business landscape (Maurya et al., 2023). Studies on green logistics, especially in the context of circular economy practices, suggest that it can positively influence organizations' sustainability performance (Zhou et al., 2016). Despite its rising popularity in developed nations, there remains limited research on green logistics practices in emerging markets and industries other than manufacturing.

Green logistics encompasses the integration of environmentally friendly practices across transportation, warehousing, packaging, and inventory management. By doing so, organizations can reduce their carbon footprint, optimize resource usage, and improve operational efficiencies. El-Kassar & Singh, (2019) note that companies face growing internal and external pressures to adopt environmentally sustainable practices, with consumers increasingly demanding eco-labeled goods and services. Companies that successfully implement green logistics can simultaneously enhance their environmental performance and economic competitiveness.

To address the complexity of relationships between green logistics management and business performance, the use of structural equation modeling (SEM) has been proposed. SEM offers a more comprehensive analysis of the causal relationships between green logistics management and sustainable business performance, using both structural and measurement equations (Fan et al., 2016). This approach allows for a deeper exploration of how green logistics influences business outcomes through factors such as cost reduction, revenue enhancement, and improved corporate reputation.

Based on the literature review, the following hypothesis are made

**H<sub>1</sub>:** Green logistics management has a positive impact on sustainable business performance

## **Methodology**

This study employs a quantitative research approach to examine the impact of green logistics practices on sustainable business performance in the textile manufacturing industry. Data was collected through a structured questionnaire, designed to gather insights on various aspects of green logistics and its influence on business outcomes.

### ***Data Collection Instrument***

The primary data collection tool for this study was a structured questionnaire, which was developed based on a review of relevant literature and expert input. The questionnaire included questions related to green logistics practices, challenges, drivers, and performance metrics in the textile manufacturing industry, with a focus on assessing the economic, environmental, and competitive outcomes of implementing such practices. The questionnaire consisted of Likert-scale questions to quantify the perceptions and experiences of the respondents.

Green logistics management involves implementing environmentally sustainable practices across various logistics processes. In this study, 20 detailed items were selected to evaluate these practices, categorized into different aspects of logistics. These items include information sharing, packing, warehousing, distribution, loading and unloading, logistics networking, and emissions reduction. Each of these logistics activities is crucial for minimizing environmental impact, optimizing resource use, and reducing carbon emissions (Yongrok & Ning, 2011).

For sustainable business performance, this study integrates both environmental and financial performance metrics. The environmental performance items include green image gain and green service level improvement, which reflect a company's enhanced reputation and better service levels due to sustainable practices. The financial performance items include sales increase and energy cost reduction, indicating the positive economic impact of adopting green logistics practices, such as increased revenue and lower operational costs through energy savings. These combined measures provide a holistic view of how sustainability initiatives can drive both environmental and financial success in business (Liu et al., 2023).

### ***Sampling and Population***

The target population for this study comprised textile manufacturing firms located in three major districts of Tamil Nadu, India: Coimbatore, Tiruppur, and Erode. These districts were selected due to their prominence as textile manufacturing hubs in India. The study aimed to cover a diverse range of firms, including both small and large-scale manufacturers involved in different segments of textile production.

### ***Data Collection Procedure***

The questionnaire was distributed via email to the identified textile manufacturing firms in Coimbatore, Tiruppur, and Erode. The email addresses of the firms were obtained through industry directories and associations. To increase response rates, two follow-up emails were sent at one-month intervals, reminding the recipients to complete the

survey. The follow-ups were designed to encourage participation and address any queries or concerns the respondents might have had (Sproull, 1986).

### Response Rate

At the end of the data collection period, 148 completed questionnaires were received. These completed questionnaires were deemed sufficient for statistical analysis and were utilized for this study. The responses were carefully reviewed to ensure that they were complete and consistent, and any incomplete or erroneous responses were excluded from the final dataset.

The 148 responding textile manufacturing firms varied in size, age, and location, providing a diverse sample from key textile hubs in Tamil Nadu. Most were small and medium-sized enterprises (SMEs), with 56% having fewer than 100 employees, 32% between 100 and 500 employees, and 12% over 500 employees. In terms of firm age, 41% had been operating for more than 20 years, 36% for 10 to 20 years, and 23% for less than 10 years. Geographically, 42% of the firms were based in Coimbatore, 35% in Tiruppur, and 23% in Erode, reflecting the regional strengths of these textile centers.

### Results

The study reveals several important insights into the relationship between green logistics management (GLM) and sustainable business performance (SBP) in the textile industry.

The reliability and validity of the constructs, as shown by the results of the Confirmatory Factor Analysis (CFA), are strong. Both GLM and SBP demonstrated high internal consistency, with Cronbach's Alpha (C.A.) values of 0.935 and 0.976, respectively, exceeding the recommended threshold of 0.7. The model fit indices, such as Chi-square/df, GFI, NFI, and CFI, all met the recommended standards, indicating that the measurement model is a good fit for the data.

The results of the Structural Equation Modeling (SEM) analysis show a significant positive relationship between green logistics management and sustainable business performance. The path coefficient of 0.078, along with a highly significant p-value ( $***p < 0.01$ ), suggests that GLM positively influences SBP. This indicates that the adoption of green logistics practices, such as emissions reduction, logistics networking, and efficient packing, contributes to improved financial and environmental performance for textile firms.

**Table 1: Reliability validity and CFA results**

Variables	C.A	Chisquare/df	GFI	NFI	CFI	RMSEA
GLM	0.935	1.623	0.961	0.974	0.986	.0081
SBP	0.976	1.853	0.972	0.989	0.963	0.056
Recommended values	>0.7	<3	>0.9	>0.9	>0.9	<0.08

The study found that green logistics management enhances both environmental and financial performance. In terms of environmental performance, firms experience gains in green image and service level improvement, reflecting their commitment to sustainability. Financially, the firms reported increases in sales and reductions in energy costs, which demonstrate that green logistics practices not only align with environmental goals but also lead to tangible business benefits.

**Table 2: Results of SEM analysis**

Path	Coefficient	S.E	C.R	P	Result
PM $\leftarrow$ GLM	0.078	0.246	0.709	***	Accepted

\*\*\*  $p < 0.01$

This suggests that the adoption of green logistics practices positively influences sustainable business performance by enhancing both environmental responsibility and economic outcomes. Firms reported gains in their green image and service level improvement, alongside increases in sales and reductions in energy costs, highlighting that green logistics not only aligns with sustainability goals but also leads to tangible business benefits.

### Discussion:

The findings of this study reinforce existing literature on the positive impact of green logistics management (GLM) on sustainable business performance (SBP). Previous research has shown a mixed relationship between environmental practices and business outcomes, with some studies suggesting that proactive environmental management enhances performance by reducing costs and increasing revenues (Ambec and Lanoie, 2008), while others highlight potential costs associated with these initiatives (Cordeiro and Sarkis, 1997).

This study's significant positive relationship between GLM and SBP supports the view that integrating green practices into logistics yields tangible benefits, aligning with Zhou et al. (2023), who found that green logistics enhances sustainability performance and competitive advantage. The high reliability and validity of the measurement constructs further strengthen these findings, underscoring the importance of robust methodologies in assessing the impact of sustainability initiatives (Szymanski and Tiwari, 2004; Zhu and Sarkis, 2004).

Additionally, the study highlights specific benefits of GLM, such as improved green image, increased sales, and reduced energy costs, which resonate with findings by El-Kassar and Singh (2019) that emphasize the competitive advantages firms can gain from adopting environmentally friendly practices. Overall, this research contributes to the literature by providing empirical evidence that supports the integration of green logistics as a key driver of sustainable business performance in the textile industry.

### Conclusion:

This study demonstrates that green logistics management significantly enhances sustainable business performance within the textile industry. By providing empirical evidence of the positive relationship between green logistics practices and key performance metrics—such as improved green image, increased sales, and reduced energy costs—the findings underscore the strategic importance of integrating sustainability into logistics processes. The strong reliability and validity of the measurement constructs further validate the results, reinforcing the notion that environmental initiatives can lead to tangible business benefits. As firms face increasing pressure to adopt sustainable practices, this study encourages textile manufacturers to embrace green logistics not only as a response to regulatory and consumer demands but also as a vital strategy for achieving long-term competitive advantage and operational efficiency. Future research should continue to explore the dynamics of green logistics in various sectors, contributing to a broader understanding of sustainability's role in enhancing business performance.

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