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Sustainability in Logistics: Evaluating the Performance of IGBC-Certified Green Warehouses vs Conventional Systems

Noorullah Nadvi¹, Santosh Kinayekar², Reshma Fegade³, Akanksha Dontula⁴, Mubeen Kharbe⁵,

Bhavana Bhalke⁶, Harsh Gulavi⁷

Assistant Professor, Department of Civil Engineering, Alamuri Ratnamala Institute of Engineering and Technology,

Thane, Maharashtra, India^{1,2,3}

U.G. Student, Department of Civil Engineering, Alamuri Ratnamala Institute of Engineering and Technology, Thane,

Maharashtra, India^{4,5,6,7}

ABSTRACT: In today's world, warehouses have become significant contributors to greenhouse gas emissions within the supply chain. As a result, academic research is increasingly focusing on green and sustainable warehousing. In recent years, there has been notable growth in publications on this topic. Recognizing this trend, the present paper offers a comprehensive literature review on green warehousing. It provides a detailed overview and classification of existing studies, aiming to summarize key trends, identify research gaps and propose new directions for future investigation.

Citation and network analysis have been used to explore the relationships and connections between various studies in this field. The results indicate a continuous rise in interest in sustainability within warehousing literature. The primary focus areas include energy savings, followed by the environmental impact of warehouse buildings and the broader concept of green warehousing.

One major gap identified in the literature is the lack of case studies and empirical data without real-life examples, theoretical research often struggles to achieve practical applicability. The core contribution of this review is the structured summary it provides, which includes macro-themes, specific research topics and a systematic classification of methodologies. In addition to summarizing the literature, the paper also offers practical managerial guidelines for green warehouse management.

The logistics sector plays a pivotal role in global supply chains, yet it is also a significant contributor to environmental degradation due to high energy consumption and emissions. In response, green building standards such as the Indian Green Building Council (IGBC) certification have been increasingly adopted to enhance the sustainability of logistics infrastructure. This study evaluates the performance of IGBC-certified green warehouses in comparison to conventional warehouse systems, with a focus on environmental, operational and economic metrics. Through a mixed-method approach involving case studies, energy audits and stakeholder interviews. The research identifies key differences in energy efficiency, water usage, waste management and operational productivity. The study concludes with recommendations for policy-makers, logistics providers and developers to promote green warehousing as a strategic component of sustainable supply chain management in India and beyond.

KEYWORDS: Green warehousing, Conventional System, IGBC Certification etc.

I. INTRODUCTION

The logistics and supply chain sector plays a vital role in the global economy by ensuring the efficient movement, storage and distribution of goods. However, it also contributes significantly to environmental degradation through high energy consumption, emissions and resource use, particularly in warehousing operations. As sustainability becomes a





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central concern in business operations, there is a growing emphasis on designing and operating environmentally responsible logistics infrastructure.

Warehouses, traditionally seen as passive storage spaces, are now recognized as critical nodes with substantial environmental footprints. In response to these concerns, various green building certifications have emerged to promote sustainable practices. Among them, the Indian Green Building Council (IGBC) certification has gained prominence in India for promoting environmentally friendly and energy-efficient warehouses. IGBC-certified green warehouses incorporate advanced design elements, materials and technologies aimed at reducing energy consumption, minimizing waste, improving indoor environmental quality etc.

Despite the rising adoption of green practices, a systematic performance evaluation comparing IGBC certified green warehouses and conventional warehouse systems remains limited in academic literature. Understanding the tangible benefits and trade-offs between these two types of facilities is essential for developers, logistics operators and policymakers aiming to balance sustainability with operational efficiency.

This study aims to fill this gap by evaluating the environmental, operational and economic performance of IGBCcertified green warehouses in comparison to conventional systems. Through literature analysis, the research highlights key advantages, limitations and opportunities associated with green warehousing. The findings not only reinforce the value of sustainable logistics infrastructure but also provide a foundation for future research and informed decision making in warehouse planning and design.

II. LITERATURE SURVEY

In the last two decades, sustainable development has emerged as a major global trend, significantly influencing warehousing systems and related technologies. Green logistics has become a key component of modern production systems, as highlighted by Noel Mariya Kuruvilla (2020), who explores how companies can adapt their logistics methods to minimize environmental impact. Her study also addresses the specific challenges faced by Indian businesses and proposes practical strategies for adopting greener logistics practices. Similarly, Lilyana Mihova (2020) emphasizes the environmental impact of warehouse construction and operations, advocating for sustainable warehouse models and energy efficient practices to reduce harmful emissions. Anil Kumar (2015) defines logistics as the comprehensive process of planning, implementing, and managing the movement of goods from raw materials to final products and underscores the urgent need for greener practices, particularly in urban areas where transportation has significant negative environmental effects. Vineet Prabha (2018) notes that the rapid transformation of India's supply chain industry, driven by globalization and e-commerce, has made sustainability increasingly relevant. He outlines the future challenges and opportunities that may influence India's supply chain in balancing growth with environmental responsibility. Ramlal Naik L (2022) adds that logistics plays a vital role in the value chain by ensuring timely and accurate product delivery. However, increasing uncertainties have complicated this task. His research recommends the integration of Industry 4.0 technologies, innovative business models and advanced systems to enhance the resilience and adaptability of the logistics sector.

III. METHODOLOGY

• Site visit and Observation

To enhance the authenticity of the study, a site visit was planned to the Welspun One, is a one of the IGBC-Certified Green Warehouse in Bhiwandi. The main objective of this visit was to gain firsthand experience of sustainable practices in real-time, complementing the theoretical understanding. During the visit, a visual inspection was conducted to observe the energy-efficient systems, waste management processes and eco-friendly infrastructure in place. It was observed that the indoor temperature of the green warehouse remained cool despite minimal use of air conditioning, which was attributed to natural ventilation and insulated roofing. Additionally, employees reported improved air quality and lighting, contributing to better overall working conditions.

• Stakeholder Surveys & Mixed Methods Approach

This study adopts a mixed-method approach, combining both qualitative (Perception based) and quantitative (numerical) data to enable a more realistic and comprehensive comparison. On site surveys will be conducted involving





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employees, management and stakeholders to gather insights into operational efficiency, environmental benefits with economic viability. These surveys will also explore comfort levels, productivity and maintenance experiences, particularly in comparison to traditional warehouses. The data collected will serve to practically validate the performance of green warehouses.

• Research Design

This research follows a comparative case study design, using the Welspun One Logistics Park in Bhiwandi as an example of a green logistics park. This design enables an in depth analysis by allowing comparisons with traditional warehousing to identify specific advantages and limitations. A mixed-methods approach will be employed, where quantitative data will provide measurable comparisons, while qualitative data will offer contextual insights into stakeholders' perspectives and day-to-day operations.

• Data Collection (Primary & Secondary)

Primary data will be collected through multiple site visits, semi-structured interviews, and surveys. Interviews will be conducted with project managers, sustainability personnel, and operational staff to explore the reasons for adopting green practices, the challenges faced during implementation, and the impact of IGBC certification. Surveys will be distributed among employees, clients, and suppliers to assess satisfaction levels, perceptions of efficiency, and views on green building design. For secondary data, relevant research papers, industry reports, IGBC certification documents, and Welspun company reports will be reviewed to align existing literature with on-ground realities.

Ccomparative Framework & Data Analysis

A structured comparative framework has been developed to evaluate key parameters of green warehouses versus traditional warehouse systems. These parameters include energy efficiency, environmental impact, operational efficiency, economic benefits, and stakeholder satisfaction. Quantitative data will undergo statistical analysis to calculate metrics such as resource consumption and cost savings, with findings visually represented through graphs and charts. Qualitative data, collected through interviews and surveys, will be analyzed using thematic and content analysis to extract meaningful insights and explanations. Additionally, the case study findings will be compared with broader green logistics literature to contextualize and validate the results.

• Ethical Considerations & Limitations:

Informed consent will be obtained from all participants, and data will be stored securely and anonymously to ensure privacy. The research will be conducted using objective and unbiased methods. However, there are certain limitations to consider. As this is a single case study, the generalizability of findings may be limited. Additionally, complete data availability could pose a challenge, and stakeholders' personal opinions may influence the qualitative data. Despite these limitations, the chosen methodology is expected to provide valuable insights into green logistics and sustainable warehousing.

IV. EXPERIMENTAL RESULTS

Although the initial investment in green warehouses is slightly higher, they offer substantial long-term savings and a strong return on investment (ROI) due to reduced energy bills and lower maintenance costs. From an environmental perspective, IGBC-certified warehouses make a significant contribution toward sustainability goals by reducing carbon emissions, improving energy efficiency, and supporting energy independence through the use of renewable energy sources. These warehouses demonstrate positive performance metrics, including a higher percentage of energy savings, lower operational costs, and reduced carbon footprints.

However, some practical challenges exist. Implementing green technologies can be complex, requires regular maintenance, and may occasionally face technical limitations. Despite these obstacles, the future of logistics in India is clearly moving toward sustainable practices. Green warehouses are poised to play a critical role in building an environmentally responsible and efficient supply chain network.





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Table 1. The Threshold Criteria for Certification Levels

Certification Level	Logistics Parks				Recognition
	Owner Occupied		Tenant Occupied		
	Existing	New	Existing	New	
Certified	40-49	40-49	36-44	36-44	Best Practices
Silver	50-59	50-59	45-53	45-53	Outstanding Performance
Gold	60-74	60-74	54-62	54-62	National Excellence
Platinum	75-100	75-100	63-90	63-90	Global Leadership



Fig. 1 Certification Levels





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Fig. 2 SDG Goals



Fig. 3 Prototype Modal of Greenhouse





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V. CONCLUSION

This article highlights the fundamentals of sustainable warehousing, emphasizing the environmental impact during both the construction and operational phases. Green warehousing has emerged as a fast-growing trend in the logistics industry, driven by the need to reduce energy consumption and carbon emissions. It incorporates eco-friendly practices such as energy-efficient lighting, insulation, and the use of renewable energy sources like solar and wind. Daily operations are also aligned with sustainability goals through recycling, efficient transportation, and waste reduction. Green building certifications play a crucial role in assessing the sustainability level of such facilities. As businesses increasingly recognize the benefits—such as lower operating costs and a reduced environmental footprint—more are adopting green warehousing practices to support long-term sustainability goals.

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