Chapter 3
Artificial Intelligence in Green Logistics: A Predictive Modeling Approach

Usharani Bhimavarapu
https://orcid.org/0000-0002-0246-1420
Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, India

ABSTRACT

This study explores the implementation of green warehousing practices through the integration of advanced artificial intelligence techniques, specifically using a Bi-Stacked Artificial Neural Network (Bi-Stacked ANN) for predictive modeling. Data were collected via structured questionnaires from four stakeholder groups—enterprise employees, consumers, public officials, and producers—yielding 469 valid responses. Following preprocessing and feature normalization, Ant Colony Optimization (ACO) was applied to select the most relevant features influencing sustainable warehousing. The Bi-Stacked ANN model was then developed to analyze patterns and predict the effectiveness of green practices. The model demonstrated strong predictive performance and offered insights into critical sustainability factors.

INTRODUCTION

Green warehousing becomes the focus to take along with it sustainability in nature to leverage in supply chain management and logistics. Polluting, green house gas emission, and energy are the attributes of conventional warehousing. Green warehouses utilize natural resources like wind turbines and solar panels to reduce carbon footprint. Green building materials and low energy technology are employed

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by them. Electricity use is reduced through insulation and daylight. Green warehousing, in the spirit of seeking sustainable development, is challenged by drivers of climate change. They force organizations to embrace long-term environmental management. It is easily brought about by policy actions through the implementation of green certifications. As the world transforms and develops, sustainable practice is not a choice but a must. Green warehousing is just such a practice most crucial in keeping energy efficiency and minimizing operational expense.

Traditional warehouses are very energy-hungry because they make use of artificial lighting, heating, cooling, and machinery. Green warehouses make use of smart thermostats, sensors, and LEDs to conserve power. They are costly but conserve utilities. Off-grid power systems restrict the use of fossil fuels. Green technology investment leads to massive savings in the long term. Energy usage is maximized to prevent a power blackout. Companies become cost-saving sustainableness if they are cost-saving sustainableness. Reduction is done with the needs of the environment in mind. Green warehousing is complete recycling equipment and waste reduction to a bare minimum. Warehouses generate different wastes from packaging materials, pallets, plastics, and electrical appliances.

Green warehousing is a closed-loop waste reduction system where reuse or recycling of material is done wherever it is possible. It reduces landfill inputs and optimizes resource conservation. Recyclable and biodegradable packaging is best. Wastes separation, composting, and waste-to-energy plants are environmental components. Environmental suppliers have meeting needs that minimize wastes to the lowest extent. Effective traceability systems for wastes enable monitoring of performance and monitoring of compliance. Waste management also assists in cleaner and healthier workplaces construction. Green warehouses have promoted indoor air quality and employee health by ensuring proper ventilation and low-emitting materials. The traditional warehouses have poor airflow, and therefore they develop respiratory diseases and reduce productivity. Green buildings have access to HVAC that purifies toxins and maintains consistent humidity levels.

Toxic paints, adhesives, and sealants restrict the release of odious fumes. Ergonomics and natural lighting improve physical and psychological health and well-being of staff. Landscaping and greenery are used to purify air pollutants from the atmosphere and improve appearance. Safer workplaces reduce turnover and absenteeism. Office morale and job commitment are increased by employee satisfaction. Occupational health and safety are exceeded or attained. Green warehouses have water-conserving technology fitted in a bid to avoid wastage and conserve natural water sources. Water is conserved in the warehouse for use in sanitizing, maintaining the lawn, and perhaps industrial operations. Green facilities use low-flow toilets, automatic-off devices, and low-flow faucets. Rainwater collection systems pipe rainwater into storage to save it for use in non-potable applications. Greywater