

Chapter 6

AI-Driven Route Optimization and Sustainable Logistics: Transforming Stakeholder Perspectives for a Greener Future

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ABSTRACT

This chapter examines how generative AI helps the food SCM evolve and aims to improve its efficiency, robustness, and sustainability performance. Using generative AI models, predictive analytics, and digital technologies, the paper identifies the AI's usage, data availability, digital supply chain, and the accuracy of the demand forecast. Therefore, the structured quantitative approach was adopted, and responses were collected on a seven-point Likert scale from 215 participants: financial ana-

DOI: 10.4018/979-8-3693-9856-2.ch006

lysts, market specialists, and other supply chain practitioners. Simple descriptive statistics such as frequency distributions and measures of central tendencies and variability were used as data analysis tools, and hypothesis testing involved basic bivariate correlation coefficients and bootstrapping to make the results conservative and replicable. The study points out how applying AI enhances decision-making, cuts costs and wastes, and can also enhance logistics. It also provides valuable information on developing sustainable and flexible food supply chains in complex contexts.

INTRODUCTION

Generative AI represents a sophisticated leap in artificial intelligence, evolving significantly since the advent of deep learning in the 2010s. Breakthroughs such as GANs and transformer models have enabled creative synthesis, reshaping industries with applications in content generation, predictive modeling, and decision augmentation (Sengar et al., 2024). Artificial intelligence has revolutionized supply chain management by leveraging predictive analytics, automation, and real-time decision-making to optimize logistics, enhance demand forecasting, mitigate inefficiencies, reduce costs, and adapt dynamically to market fluctuations, fostering resilience and innovation across global networks (Karthiayani & Raman, 2024).

AI and Food Supply Chain Management

In food supply chain management, AI enhances precision and sustainability by forecasting demand, minimizing waste, optimizing perishable inventory, and integrating data across the production-to-consumption continuum to ensure traceability, mitigate disruptions, and address challenges in maintaining food quality and safety (Krupitzer, 2024). Artificial intelligence (AI) has emerged as a transformative force in food supply chain management, seamlessly integrating advanced computational methodologies to enhance efficiency, sustainability, and resilience (Vegesna et al., 2024). By leveraging predictive analytics and machine learning algorithms, AI forecasts demand with unprecedented accuracy, enabling precise inventory control and minimizing waste. Generative AI models further refine these capabilities, synthesizing complex data streams to optimize logistics, from procurement to last-mile delivery (Senanayake et al., 2024). Moreover, AI augments traceability through technologies such as blockchain integration and IoT-enabled sensors, offering unparalleled visibility across the supply chain. This ensures adherence to stringent food safety standards, mitigates risks of contamination, and fortifies consumer trust. Advanced AI systems also address disruptions caused by fluctuating market dynamics, climate variability, and geopolitical uncertainties by dynamically adjusting supply chain

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