


Chapter 15

Transformative Artificial Intelligence for Sustainable Supply Chains: Optimizing Green Logistics and Circular Economy

Ananya Pandey

 <https://orcid.org/0000-0002-2419-6314>

Christ University, Bangalore, India

ABSTRACT

Artificial intelligence (AI) is revolutionizing supply chain management by providing ways to improve operational effectiveness and sustainability. In supply chain operations, businesses can decrease waste, and lower carbon footprints by utilizing machine learning, predictive analytics, and decision-making. As environmental concerns grow, industries are using AI technologies more and more to improve supply chains' sustainability, efficiency, and transparency. AI greatly enhances distribution and transportation networks by assisting with fuel efficiency, route planning, and emission monitoring via green logistics. Furthermore, by making it easier to reuse, recycle, and remanufacture things, AI advances circular economy models. It helps companies make the shift from linear to circular production systems by forecasting product lifecycle stages and controlling material flows. Keeping in view the above, this chapter analyzes the critical role of AI in shaping future supply chains, where economic performance aligns with environmental stewardship, fostering a more sustainable global economy.

DOI: 10.4018/979-8-3373-0923-1.ch015

INTRODUCTION

Across all industries, sustainability has become a top corporate objective, making it difficult for businesses to compete globally on sustainability. Sustainability was defined as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” by the United Nations Brundtland Commission in 1987. Nearly 140 developing nations are currently looking for solutions to meet their development needs, but given the growing threat posed by climate change, significant efforts must be made to guarantee that current progress does not have an adverse effect on future generations (Luther, 2021). A supply chain that successfully and competitively incorporates moral and ecologically conscious behaviour is said to be sustainable. Transparency in the whole supply chain is essential; sustainability efforts must cover everything from the procurement of raw materials to last-mile logistics, as well as product returns and recycling procedures (Jadhav et al., 2019). The development of supply chain sustainability is being significantly influenced by digital transformation and the increasing complexity of digital supply chain technologies. Artificial intelligence (AI), big data management, advanced analytics, and security solutions like blockchain and RFID sensors have given contemporary supply chains previously unheard-of visibility and responsibility (Closs et al., 2011). Businesses are now far more able—and obligated—to share best practices for sustainable logistics and green supply chains, as well as to exhibit corporate social responsibility (Sanchez-Flores et al., 2020). In addition to promoting green operations, supply chain management sustainability initiatives within an organization's Corporate Social Responsibility (CSR) initiatives also save money and enhance the supply chain over time (Osei et al., 2023). Artificial Intelligence (AI) is used by businesses to improve worker safety, estimate demand for parts and components, track inventory, manage warehouse capacity, optimize shipping and delivery, and help maintain the integrity of transaction records across international supply chains (Boute & Udenio, 2022). Workflow management and optimization across practically every supply chain link is being greatly aided by these kinds of capabilities. For instance, supply chain systems that use machine learning algorithms can predict consumer demand more precisely, which results in more cost-effective inventory management, by identifying patterns and linkages in data sets that are frequently invisible to humans or non-AI systems. In order to suggest alternate shipping routes and lower the possibility of unforeseen delays, AI can also evaluate variables like traffic and weather (Islam et al., 2024). This improves delivery times. In order to identify inadequate quality control practices and health and safety infractions, it can monitor work environments. As supply chain experts continue to test the system, new use cases are continually being developed. Although AI has the potential to significantly increase supply chain productivity and

22 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/transformational-artificial-intelligence-for-sustainable-supply-chains/387707

Related Content

Intrusive Evaluation of Ambient Displays

Xiaobin Shen (2009). *International Journal of Ambient Computing and Intelligence* (pp. 12-31).

www.irma-international.org/article/intrusive-evaluation-ambient-displays/37473

Unleashing the Power of Generative Adversarial Networks for Cybersecurity: Proactive Defense and Innovation

Kritika (2025). *Utilizing Generative AI for Cyber Defense Strategies* (pp. 137-168).

www.irma-international.org/chapter/unleashing-the-power-of-generative-adversarial-networks-for-cybersecurity/356580

Towards a New Model of Storage and Access to Data in Big Data and Cloud Computing

Houcine Matallah, Ghalem Belalemand Karim Bouamrane (2017). *International Journal of Ambient Computing and Intelligence* (pp. 31-44).

www.irma-international.org/article/towards-a-new-model-of-storage-and-access-to-data-in-big-data-and-cloud-computing/187066

Improving Polarity Classification for Financial News Using Semantic Similarity Techniques

Tan Li Im, Phang Wai San, Patricia Anthony and Chin Kim On (2018). *International Journal of Intelligent Information Technologies* (pp. 39-54).

www.irma-international.org/article/improving-polarity-classification-for-financial-news-using-semantic-similarity-techniques/211191

An Agent-Based Approach for Sourcing Business Rules in Supply Chain Management

Sudha Ram and Jun Liu (2005). *International Journal of Intelligent Information Technologies* (pp. 1-16).

www.irma-international.org/article/agent-based-approach-sourcing-business/2376