

Chapter 11

Equitable Green Innovation in Supply Chains Harnessing Machine Learning for Sustainable Development

Sri Bhargav Krishna Adusumilli

 <https://orcid.org/0009-0005-4059-387X>

MindQuest Technology Solutions LLC, USA

ABSTRACT

The intersection of equitable innovation, sustainability, and machine learning is transforming global supply chains into efficient, environmentally conscious systems. This chapter explores how machine learning is driving green innovation across various stages of the supply chain, from resource sourcing to final delivery, while ensuring inclusivity and fairness. By leveraging predictive analytics, optimization algorithms, and real-time monitoring, machine learning enables organizations to reduce carbon footprints, minimize waste, and enhance operational efficiency. The chapter also delves into the role of AI in addressing challenges such as ethical sourcing, energy-efficient logistics, and circular economy practices. Case studies highlight successful implementations, demonstrating how equitable machine learning applications can foster sustainable growth and empower marginalized communities. By integrating technology with sustainable practices, this chapter provides a roadmap for achieving a resilient, green, and inclusive supply chain ecosystem

INTRODUCTION

The global challenges of climate change, resource depletion, and environmental degradation have underscored the urgent need for sustainable solutions. At the same time, issues of inequity and exclusion in technological and industrial advancements have raised questions about who benefits from innovation. **Equitable green innovation** seeks to address these dual concerns by promoting environmentally sustainable solutions that are inclusive, fair, and accessible to all. This approach goes beyond traditional sustainability by integrating social equity into the design and implementation of green technologies. It

DOI: 10.4018/979-8-3693-9471-7.ch011

ensures that the benefits of innovation are distributed fairly across communities, especially marginalized and underserved populations, while fostering environmental stewardship.

1.1 The Need for Equitable Green Innovation

The transition to a greener and more sustainable world cannot occur in isolation from social justice. Traditional innovation often prioritizes profit and efficiency over inclusivity, leading to disparities in access to resources and benefits. Equitable green innovation emphasizes the need to balance economic growth with environmental sustainability and social fairness. For instance, renewable energy projects should not only reduce carbon emissions but also create opportunities for local communities through job creation and affordable energy access. In supply chains, equitable green innovation ensures that all stakeholders, from resource producers to end consumers, are included in the transition to sustainable practices. This paradigm shift is essential for building a resilient global economy that addresses environmental challenges without exacerbating social inequalities.

1.2 Role of Machine Learning in Sustainability

Machine learning (ML) has emerged as a powerful tool in the quest for sustainability. By analyzing vast amounts of data, ML algorithms can identify patterns, optimize processes, and make accurate predictions, enabling more efficient and sustainable decision-making. In renewable energy, ML is used to forecast energy demand and optimize power generation. In agriculture, it helps monitor soil health and predict crop yields. Similarly, in supply chains, ML enhances resource allocation, reduces waste, and ensures transparency. The integration of ML into sustainability efforts not only accelerates progress but also democratizes access to innovative solutions. By leveraging ML, even small and medium enterprises can adopt green practices, making sustainability a shared responsibility rather than a privilege of the few.

Literature Review

The growing demand for sustainability in business practices has led to the integration of machine learning (ML) into green supply chain management (GSCM). Machine learning is increasingly being recognized as a powerful tool to optimize processes, reduce environmental impacts, and foster equitable innovation. This literature review explores the role of ML in promoting sustainable supply chains by examining recent research on its applications, challenges, and future directions.

Machine Learning in Sustainable Supply Chain Management

Agboola and Olanrewaju (2023) highlight the potential of machine learning to optimize resource management and improve decision-making in supply chains. They emphasize that ML algorithms can be used for demand forecasting, route optimization, and waste reduction, which are crucial for achieving sustainability goals. Similarly, Bassi and Kumar (2022) discuss the role of AI in supply chain sustain-

14 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/equitable-green-innovation-in-supply-chains-harnessing-machine-learning-for-sustainable-development/370247

Related Content

Heritage and Museums as Objects of Education for Citizenship in the Teaching of History

Ainoa Escribano-Miralles, Pedro Miralles-Martínez and Francisca-José Serrano-Pastor (2020). *Handbook of Research on Citizenship and Heritage Education* (pp. 103-126).

www.irma-international.org/chapter/heritage-and-museums-as-objects-of-education-for-citizenship-in-the-teaching-of-history/246778

Peer Support of Graduate Students of Color Through a Formal Graduate Student Association

Kya Rose Roumimper and Audrey Faye Falk (2021). *Research Anthology on Empowering Marginalized Communities and Mitigating Racism and Discrimination* (pp. 1089-1107).

www.irma-international.org/chapter/peer-support-of-graduate-students-of-color-through-a-formal-graduate-student-association/277613

Challenges and Prospects of Women Entrepreneurs Within Micro and Small Enterprises: Case of Salon Business in Bahir Dar City, Ethiopia

Yetimwork Anteneh Wondim (2020). *International Journal of Political Activism and Engagement* (pp. 14-31).

www.irma-international.org/article/challenges-and-prospects-of-women-entrepreneurs-within-micro-and-small-enterprises/256923

Preparing College Students to Facilitate Action Civics Among K-12 Students

Jason Fitzgerald, Alison K. Cohen and Barbara Ferman (2019). *Handbook of Research on Education for Participative Citizenship and Global Prosperity* (pp. 447-457).

www.irma-international.org/chapter/preparing-college-students-to-facilitate-action-civics-among-k-12-students/217230

Poor Public Management and Public Governance Failure: Nigerian Experience on Oil Resource Curse or Blessing Debate

John Ugoani (2020). *International Journal of Political Activism and Engagement* (pp. 56-72).

www.irma-international.org/article/poor-public-management-and-public-governance-failure/258307