Chapter 3
Leveraging Big Data Analytics for Sustainable and Ethical Supply Chains

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ABSTRACT

This chapter explores the transformative role of Big Data Analytics in advancing sustainable and ethical supply chains. It examines how data-driven decision-making enables companies to enhance transparency, reduce environmental footprints, and uphold labour and human rights across multi-tier supply networks. The chapter addresses challenges in data integration, ethical AI use, and balancing cost with sustainability objectives, supported by real-world case studies from fashion, food, and electronics sectors. It highlights technological innovations such as digital twins, AI, and blockchain that empower circular economy practices and supply chain resilience. Offering critical insights and future directions, this chapter serves as a comprehensive guide for academia and practitioners committed to responsible supply chain management.

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INTRODUCTION

Background: The Evolution of Supply Chain Management

Global supply chains today are tangled webs that cross countless borders and legal systems. For decades, Supply Chain Management (SCM) focused on one thing: getting products from A to B as fast and cheaply as possible. But that era is over. Companies today aren't just judged on their balance sheets; they face intense scrutiny regarding their social governance and environmental footprint. This shift stems from the "Triple Bottom Line"—People, Planet, and Profit—which forces organisations to weigh economic survival against ecological stewardship (Elkington, 1999; Seuring & Müller, 2008).

In this new reality, data has become both a massive hurdle and a critical asset. From simple barcode scans to complex sentiment analysis on social media, the modern supply chain is drowning in information. This phenomenon, known as Big Data, is characterised by the "5 Vs": Volume, Velocity, Variety, Veracity, and Value (Wamba et al., 2015). When firms harness Big Data Analytics (BDA) effectively, they can turn this noise into insight, transforming brittle, reactive chains into resilient, predictive networks.

Problem Statement

Even with the promise of BDA, integrating analytics into Sustainable Supply Chain Management (SSCM) is full of contradictions. Analytics tools offer the visibility needed to track carbon emissions or spot labour violations, yet their implementation often hits the "Black Box" wall. The algorithms used for forecasting or selecting suppliers are often opaque, creating unintended ethical messes—like biases that unfairly penalise small farmers in developing nations or invasive monitoring that violates the privacy of logistics workers (O'Neil, 2017).

There is also a widening "digital divide." Suppliers in the Global South, who are essential for sourcing food and electronics, often lack the expensive tech infrastructure to provide the detailed data multinational corporations now demand. This creates a systemic risk: sustainability metrics, meant to lift global standards, can accidentally act as trade barriers that lock out the very people they are supposed to protect (Kshetri, 2018). We need to figure out not just how BDA boosts efficiency, but how to govern it so that sustainability is both ethical and inclusive.