Bigdata driving Sustainable Supply Chain Management

Technical Research paper

DATA 603: Platforms for Bigdata Processing

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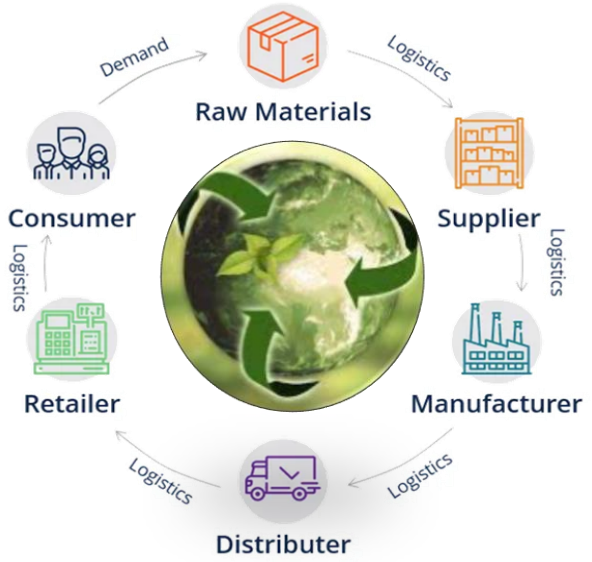
Introduction

Big Data Analytics (BDA) is revolutionizing Sustainable Supply Chain Management (SSCM), enabling improved decision-making, reduced environmental impact, and enhanced overall performance, with the potential for significant environmental and social benefits.

This paper discusses:

- Role of BDA in improving decision-making and reducing environmental impact in SSCM.
- The transformative potential of BDA in revolutionizing traditional sustainable supply chain practices.
- Key technologies, challenges and future scope of leveraging BDA for SSCM



Sustainable supply Chain Management

Bigdata

Adopting sustainable practices is no longer just a strategic decision rather it has become mandatory !!

Methodology

This approach combines an overview of the relevant literature through bibliometric research and content analysis to propose pertinent lessons and future research directions. Over 30 articles were identified through searches conducted on Google Scholar. These searches utilized the title, abstract, and keyword options, employing the query and Boolean operators: "Big Data Analytics," "sustainable supply chain," "green supply chain," and "Big Data Analytics in Green Supply Chain". 10 very significant publications published between 2019 and 2023 were selected in total for in-depth analysis.

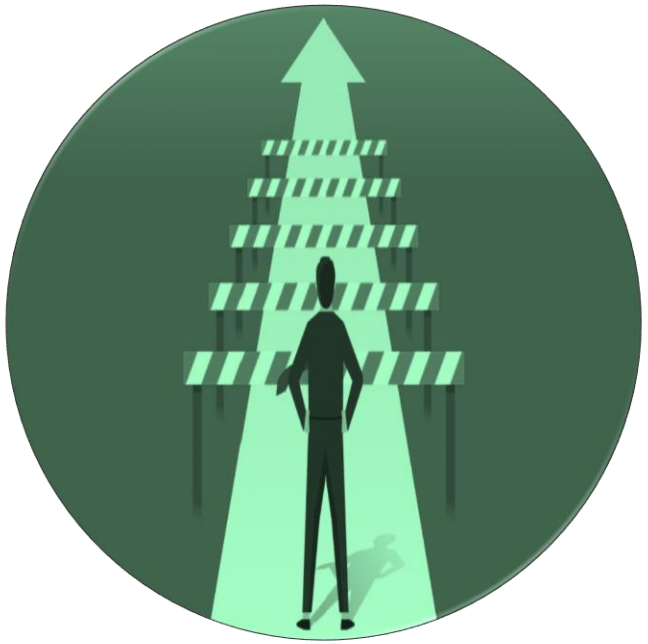
Literature Review

- Bigdata Influences environmental practices and Total Quality Management (Bag et al., 2020; Tseng et al., 2021), enhancing operational efficiency and sustainability.
- Promotes green practices in supply chain management through statistics, machine learning, and data mining (Gopal et al., 2022; Tseng et al., 2021), reducing environmental impact and improving resource use.
- Affects retail performance by evaluating practices like data science and machine learning, ultimately enhancing supplier and customer integration (Raut et al., 2021; Mageto, 2021; Zhu et al., 2022)
- Drives green product development and employee growth, promoting eco-friendly practices and sustainability (Tseng et al., 2021; Mageto, 2021) – Mining Industry.
- BDA enhances hospital environmental performance and green processes through AI integration, improving healthcare services, reducing waste, and creating a healthier environment (Mageto, 2021; Zhu et al., 2022).

Technical Details

Steps	Process	Tools & Techniques
Data Collection	collection of data from various sources (Sensors, GPS trackers, RFID tags)	Apache Kafka, Flume, ETL
Data Storage	Storing large amounts of collected data	HDFS
Data Processing	Data cleaning, transformation and normalization	Apache Spark
Descriptive Analysis	Analyzing the historical data to identify trends	Apache Spark, Apache Hive
Predictive Analysis	Predict future outcomes based on historical data	Machine learning techniques and Time Series Analysis
Real-time Monitoring	Tracking the live data for monitoring	Apache Kafka and Apache Storm
Data Visualization	Present the analyzed data in a visual format through Interactive dashboards and reports	Tableau, Power BI, and matplotlib

Obstacles



1. **Data Quality** — Diverse sources can lead to challenges in ensuring accuracy and reliability.
2. **Privacy and Security** — Managing large volumes of sensitive data raises concerns about privacy and compliance
3. **Cost** — Implementing big data analytics can be expensive, especially for smaller organizations.
4. **Complexity** — Analyzing big data requires specialized skills and expertise
5. **Limited Understanding** — Many organizations lack understanding of how to leverage big data effectively.
6. **Ethical Concerns** — Raises issues of data ownership and bias.

Potential

A sustainable supply chain incorporates social, environmental, and economic factors at every stage of a product's lifecycle, from source to disposal.

Internal Environment

- Predictive maintenance to reduce downtime and improve machine life
- Inventory Optimization
- Waste Reduction
- End-to-end product tracking, ensuring sustainability compliance and enhancing transparency

Procurement

- Track and assess the environmental performance of their suppliers
- Assess products' environmental impact throughout their lifecycle
- Streamlines supplier interactions and facilitates information sharing

Logistics & Transportation

- Enables real-time shipment tracking, enhancing customer satisfaction and accuracy of arrival estimates
- Optimizes transportation routes, reducing fuel consumption, emissions, and costs in SSCM

Empowering Workforce and Innovation

- Improves technical competencies of Employees
- Facilitates data-driven culture fostering collaboration and innovation
- Enhances adaptability to market changes and customer demands

Big data has the potential to revolutionize sustainable supply chain management by enabling unprecedented insights, efficiencies, and environmental benefits across industries.

Recommendations

-Robust Governance Practices:
Implement automated governance frameworks using tools like Collibra or IBM InfoSphere for efficient compliance.
-Advanced Data Protection Measures:
Utilize encryption and access controls from AWS IAM or Azure AD for enhanced security.
-Ethical Guidelines and Regular Audits:
Establish clear guidelines and use tools like OneTrust for compliance monitoring.
-Employee Training and Education Programs:
Provide comprehensive online training via platforms like Coursera or Udemy for skill development.
-Advanced Tools:
Invest in advanced tools and be updated with latest technologies

Future Research :

- Evaluating Cost Incurrence in utilizing bigdata tools and techniques for SSCM.
- Autonomous and decentralized supply chains may result in supply chain networks that are more robust and sustainable.

Conclusion

- ✓ Big data analytics (BDA) significantly enhances Sustainable Supply Chain Management (SSCM), offering opportunities for excellence, risk reduction, and promoting responsibility.
- ✓ Integrating artificial intelligence (AI) and machine learning (ML) can further advance SSCM, enabling automated decision-making and improving practices.
- ✓ Exploring BDA's role in circular economy and decentralized supply chains is key for future insights.
- ✓ Organizations must enhance their BDA capabilities through training and a data-driven culture for improved SSCM.
- ✓ While BDA implementation can be costly, businesses must consider the financial effects and potential returns for resilient and sustainable supply chains.

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Thank you!!