



Most Impactful Ways to Incorporate AI and Data Science to Promote Sustainable Procurement Practices and Minimize the Carbon Footprint of Hotel Supply Chains

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Abstract

This study explores the integration of Artificial Intelligence (AI) and Data Science to enhance sustainable procurement practices and minimize the carbon footprint within hotel supply chains. The research highlights the transformative potential of AI-driven solutions and data analytics in optimizing procurement processes, reducing waste, and promoting sustainability. Key findings indicate significant improvements in efficiency, cost savings, and environmental impact reduction. Recommendations for future research and practical applications are discussed.

Subject Areas

Big Data Search and Mining

Keywords

Sustainability, Carbon Footprint, Sustainable Supply Chain Management, Data Science, Artificial Intelligence

1. Integration of AI and Data Science for Sustainable Procurement in Hotel Supply Chains

Globally, organizations are increasingly focused on understanding the sustainability impacts of their supply chains. The hospitality industry, particularly hotels, faces increasing pressure to adopt sustainable practices due to environmental concerns and regulatory requirements. Sustainability refers to the integration of environmental, economic, and social goals to meet current needs without

compromising the needs of future generations. The hospitality industry is still on the path to becoming sustainable. Hotels around the world are at different stages in embracing sustainability; many are just starting, others are making progress, and some are leading the way. Sustainable procurement practices are essential in minimizing the carbon footprint of hotel supply chains. Sustainable supply chain management (SSCM) involves the strategic and transparent management of supply chain activities by integrating sustainability (environmental, social, and economic) goals in all processes to meet stakeholders' requirements [1]. Companies incorporate sustainability goals into supply chain activities to pursue economic, social, and environmental objectives. This study investigates how AI and Data Science can be leveraged to promote sustainable procurement and reduce the carbon footprint in hotel supply chains.

2. Literature Review

2.1. Sustainable Procurement in Hotels

The tourism industry contributes approximately 8% to global carbon emissions, both directly and indirectly. Indirect emissions are often overlooked because they are difficult to quantify [2]. Sustainable procurement involves sourcing goods and services in a manner that minimizes environmental impact and promotes social and economic sustainability. Hotels, as significant consumers of resources, play a crucial role in driving sustainability through their supply chains [3].

2.2. AI and Data Science in Procurement

A supply chain is a complex network of interconnected suppliers, manufacturers, customers, and service providers like logistics and IT services. The complexity makes it challenging to monitor each participant's activities [4]. Sustainability goals become even more complex when a company operates globally, especially if some supply chain partners lack transparency [5]. Data Science and AI offer opportunities to analyze data from various supply chain members and external sources, simplifying the monitoring of activities that may lead to unethical practices. These technologies can integrate the different links of the supply chain, collect data, and generate insights that aid in planning and decision-making [1].

2.3. Carbon Footprint Reduction Strategies

Reducing carbon footprint involves minimizing greenhouse gas emissions associated with procurement activities. Strategies include optimizing logistics, selecting eco-friendly products, and enhancing energy efficiency. AI and Data Science provide valuable insights and tools to implement these strategies effectively, supporting informed decisions about supply chain partners [6].

3. Methods

This study employs Toulmin's model of argumentation to structure the analysis [7]. The model includes claims, grounds, warrants, backing, rebuttals, and qualifiers.

A comprehensive literature review was conducted using databases such as Science Direct, Wiley Online, Taylor & Francis, and Google Scholar, with keywords related to sustainable supply chain management, big data analytics, and hotel supply chains. After screening and eliminating duplicates, seven peer-reviewed articles relevant to the research problem were selected (see **Figure 1**).

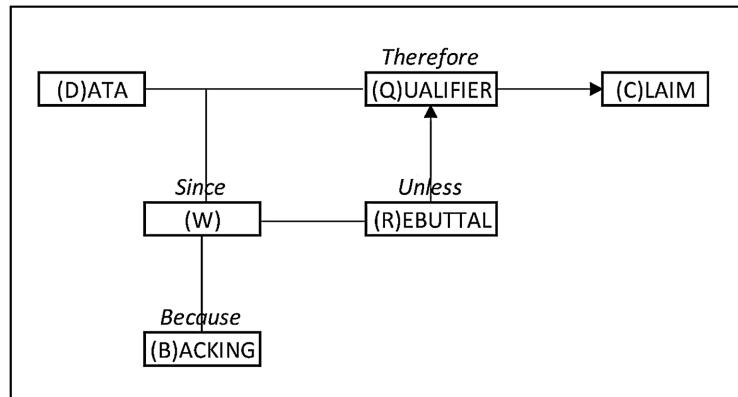


Figure 1. Illustrates Toulmin's model of argumentation.

3.1. Selection of Literature and Analysis

Literature related to sustainable supply chain management in the hotel industry, data analytics, and Artificial Intelligence was searched and retrieved from Science Direct, Wiley Online, Taylor Francis, and Google Scholar. The keywords used for the searches were “sustainable supply chain management”, “big data analytics”, “data analytics” and “hotel supply chains”. The identified articles were screened, and only peer-reviewed articles were selected. Only articles relevant to the research problem at hand were included. Duplicates were eliminated, and the resulting seven articles were considered for this study. **Figure 1** summarizes the research process (see **Figure 1**).

3.2. Data Analysis

The content of the articles was grouped according to the predetermined themes of sustainable supply chain management (SSCM) in the hotel industry. The literature review was performed as per the thematic areas identified. In addition to the mentioned themes, the challenges of AI and data analytics implementation were identified. To establish the relationship between AI, data analytics, and SSCM, the reviewed literature was interpreted in line with Toulmin's model of argumentation using all six steps by stating and supporting the claim and qualifier, grounds, warrant, rebuttal, and backing.

4. Results

4.1. Impact of AI and Data Science on Procurement Efficiency

The study found that AI-driven and data science solutions significantly improved procurement efficiency. Environmental sustainability can be achieved by leveraging

data science and AI to reduce delivery time through the direct connection of millions of customers. Real-time information sharing reduces the amounts of energy consumed in the transport, storage, and sourcing of materials. Data science and AI promote transparency and sharing of information, making it easier to detect unethical practices that may have negative impacts on communities negatively. Data science encourages a collaborative and cooperative culture which results in the ethical conduct of supply chain partners. Big data analytics provides a platform to compare past environmental conduct with the present to help forecast future social problems.

4.2. Challenges of Data

Cyberattacks and data privacy issues are increasingly becoming important, creating a barrier for firms that want to implement data science and AI. Continued development and innovation in ICT promise opportunities to develop robust data science tools to analyze the data generated by manufacturing supply chains while maintaining the required security measures. Barriers such as technology, lack of human resources, and complexity in data integration due to security, privacy, and policy issues hinder integration [7].

4.3. Carbon Footprint Reduction

Hotels that adopt AI and Data Science in their procurement processes report measurable reductions in their carbon footprint. Sustainable supplier selection and optimized logistics are key contributors to these reductions [2].

5. Discussion

5.1. Challenges and Opportunities

While AI and Data Science offer clear benefits, issues like data privacy, high implementation costs, and the need for specialized skills present challenges [5]. Nonetheless, the opportunities for fostering innovation and sustainability outweigh these barriers. Collaboration among hotels, suppliers, and technology providers is essential for success [6].

5.2. Practical Implications

Hotels aiming to adopt sustainable procurement practices should consider the integration of AI and Data Science. Recommendations include investing in technology, training staff, and partnering with sustainable suppliers [8].

6. Conclusion

This paper sought to identify the elements of data science and AI that could enhance sustainability in the hotel industry, propose the relationship between data science, AI, and SSCM, and determine the challenges of implementing the nascent technologies in supply chains. An effective data science and AI system is identified consisting of data processing capabilities, which incorporate the use of intelligent

devices and software to collect heterogeneous data. The data processing dimension should nurture transparency within the supply chain by promoting the accountability of all partners. The study identified the security and ethical issues of AI systems. Security includes data privacy, protection from internal and external cyberattacks, and legal frameworks to govern data privacy. Effective security requires technical software technologies that support advanced features, such as fraud analytics for quick detection of unwanted activities.

Conflicts of Interest

The author declares no conflicts of interest.

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