

Green Supply Chain Management and Its Application in the Retail Industry: A Case Study of Amazon

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ABSTRACT

This study focuses on green supply chain management in the retail industry, taking Amazon as the research object and comprehensively using methods such as literature analysis and data analysis. Thus, it analyzes Amazon's green management measures and data transparency in various stages of the product life cycle. The study finds that Amazon's green supply chain management practices have a potential positive impact on corporate performance, especially in Scope 3 emissions reduction. However, it also faces challenges such as data transparency. This paper summarizes the relevant experiences and models, providing a reference example for the industry to help accelerate the green transformation process of the retail industry and achieve the coordinated and sustainable development of economic and environmental benefits.

KEYWORDS

Retail Industry; Green Supply Chain Management; Amazon

1 Introduction

With the accelerated globalization of industrialization and urbanization, a series of global environmental issues such as climate change, resource depletion, and environmental pollution have become increasingly severe, posing significant threats to the sustainable development of human society. Against this backdrop, international conventions and agreements such as the Paris Agreement have been introduced, prompting governments of various countries to formulate and implement a series of environmental protection policies and regulations. In this environment, green supply chain management (GSCM) emerges as the times require. GSCM requires comprehensive consideration of environmental impacts and resource utilization efficiency throughout the entire supply chain management process, aiming to achieve sustainable development of the supply chain by optimizing resource allocation and reducing waste and pollution emissions. Therefore, this research holds multidimensional theoretical expansion value. At the theoretical level of GSCM, an in-depth analysis of its application in the retail industry can enrich and improve the existing theoretical system, laying a solid foundation for subsequent research. From the perspective of consumer behavior theory, it helps to expand and deepen this theory, especially in clarifying the mechanism of environmental factors and corporate social responsibility in consumer decision-making processes. Meanwhile, in terms of enhancing corporate competitiveness, it assists retail enterprises in clarifying the impact of GSCM on consumer behavior, thereby enhancing their brand image and market competitiveness, aligning with the needs of environmentally conscious consumers. Furthermore, through research and practice, retail enterprises can better fulfill their social responsibilities, reduce negative environmental impacts, enhance public awareness of environmental protection, and promote ecological civilization construction.

2 Literature Review at Home and Abroad

2.1 Theories and Concepts of Green Supply Chain Management

Foreign research on the theories and concepts of GSCM started earlier. Sarkis was the first to propose the concept of GSCM in 2003, emphasizing the integration of environmental management concepts into supply chain management. Subsequently, Srivastava further refined the theoretical framework in 2007, clearly encompassing key links such as green procurement, green manufacturing, green logistics, and green recycling, laying a foundational structure for subsequent research. In domestic research, Liu Jianhua constructed a theoretical framework for GSCM suitable for China's national conditions in 2010 and explored its application in the manufacturing industry. These research findings have continuously enriched and improved the theoretical connotations of GSCM from different perspectives, providing a theoretical basis for its practical application.

2.2 Amazon's Green Supply Chain Management Practices

Although existing literature does not directly address Amazon's GSCM practices, reasonable inferences can be made with reference to relevant research on other retail enterprises. For example, Carvalho and Duarte analyzed the GSCM practices of retail giants such as Walmart and IKEA in 2015 and found that retail enterprises typically focus on green

procurement, energy management, and logistics optimization. As a leading global retail enterprise, Amazon is likely to adopt similar and innovative measures in green packaging, recycling, and logistics distribution to reduce environmental impacts and enhance environmental performance.

2.3 Performance Evaluation of Green Supply Chain

Regarding the performance evaluation of the green supply chain, Zhu et al. conducted empirical research in 2008 and pointed out that implementing GSCM significantly improves both environmental and economic performance for enterprises. Diabat and Govindan found in 2011 that policy regulations and market demand, as the main driving factors of GSCM, are bound to influence performance evaluation to some extent. In domestic research, although there is no direct research on the performance evaluation of the green supply chain, Li Pengfei's 2018 study on the implementation path of GSCM in the retail industry indicates that retail enterprises' practices in green procurement, packaging, and logistics have a significant impact on environmental performance, providing direction for selecting performance evaluation indicators for the green supply chain.

2.4 Data Transparency

In terms of data transparency, Dubey et al. showed in 2017 that the application of big data, the Internet of Things, and blockchain technology in GSCM can improve supply chain transparency and efficiency. These technologies enable more open and transparent information across all links of the supply chain through real-time data collection, transmission, and sharing. However, domestic literature currently lacks direct research on data transparency in GSCM. Yet, from the overall development trend, with the continuous promotion and application of these technologies, domestic research in this area will gradually deepen.

3 Research Methods and Content

This paper mainly adopts research methods such as literature analysis and data analysis. Through literature analysis, relevant theories and previous research results are sorted out to lay a theoretical foundation for subsequent research. Data analysis is utilized to establish a regression model to analyze the impact of green supply chain management (GSCM) application on corporate performance. Based on the research methods, this paper conducts in-depth discussions on green management measures at various stages of the product lifecycle and establishes a regression model to analyze the impact of GSCM application on corporate performance.

3.1 Green Management Measures at Various Stages of the Product Lifecycle

Amazon actively promotes green management measures at various stages of the product lifecycle, with remarkable achievements particularly in logistics and recycling.

In logistics and transportation, the use of renewable energy is one of its key initiatives. Amazon has continuously increased the utilization rate of renewable energy, which was 42% in 2019 and has grown steadily every year since then, reaching 65% in 2020, jumping to 85% in 2021, further increasing to 90% in 2022, and achieving 100% renewable energy use by 2023. This achievement not only reflects Amazon's determination in optimizing its energy structure but also makes positive contributions to reducing carbon emissions and promoting sustainable development. Decarbonized transportation is also a crucial part of Amazon's green management in logistics and transportation. The company uses zero-emission electric vehicles for package delivery, with the number of deliveries showing a rapid growth trend. In 2019, the number of packages delivered by zero-emission electric vehicles was 10 million, doubling to 20 million in 2020, surpassing the 100 million mark in 2021, reaching 145 million in 2022, and soaring to 680 million by 2023. The large-scale adoption of zero-emission electric vehicles has significantly reduced carbon emissions during transportation, contributing to the decarbonization of this sector. In terms of packaging, Amazon promotes a zero-additional packaging program. The proportion of zero-additional packaging has gradually increased from 8% in 2021 to 11% in 2022 and further grown to 12% in 2023.

Meanwhile, Amazon has adjusted and optimized its types of delivery packaging. Its delivery packaging mainly includes three types: shipping in the manufacturer's original packaging, fillable flexible packaging, and corrugated cartons. The company strives to increase the number of products shipped in the manufacturer's original packaging to avoid using additional packaging and selects lighter, appropriately sized products to effectively reduce packaging footprint^[1].

In 2021, shipping in the manufacturer's original packaging accounted for 8%, fillable flexible packaging accounted for 49%, and corrugated carton packaging accounted for 43%; in 2022, the proportion of shipping in the manufacturer's original packaging increased to 11%, with fillable flexible packaging still accounting for 49% and corrugated carton

packaging decreasing to 40%; by 2023, the proportion of shipping in the manufacturer's original packaging further increased to 12%, fillable flexible packaging accounted for 50%, and corrugated carton packaging accounted for 38%. This adjustment in packaging structure minimizes the use of packaging materials and reduces environmental impact while ensuring product transportation safety. In the field of recycling, Amazon has launched a comprehensive product recycling program covering electronic product recycling, recyclable packaging, and Amazon Renewable, among others. The proportion of recycled products has increased year by year, reaching 78% in 2022 and 90% in 2023. Through effective recycling measures, Amazon not only reduces the environmental pressure from waste but also achieves the circular utilization of resources, aligning with the concept of sustainable development.

Overall, Amazon's green management measures at various stages of the product lifecycle encompass multiple dimensions such as energy use, transportation modes, packaging strategies, and recycling. These measures cooperate with each other to form a relatively complete green management system. By continuously advancing green management, Amazon not only achieves its own sustainable development but also sets an example for the industry, driving the entire supply chain towards a greener and more environmentally friendly direction.

3.2 Establishing a Regression Model to Analyze the Impact of GSCM Application on Corporate Performance (Data Analysis - Establishing a Regression Model)

This paper analyzes the impact of GSCM application on corporate performance, selecting data from Amazon from 2019 to 2023 as the research sample. With annual net profit as the dependent variable (Y), Scope 3 emissions or their change value are used as one of the independent variables, while global GDP growth rate is introduced as a control variable. Additionally, due to Amazon's net loss in 2022, a rare occurrence in recent years, primarily driven by non-recurring factors such as post-pandemic aftereffects, the global supply chain crisis, and investment impairments (losses on Rivian stock), these factors may not reflect the long-term relationship between GSCM and corporate performance. Therefore, 2022 is marked as an anomalous year, and a dummy variable is introduced to control for the impact of this anomalous year, with a value of 1 representing 2022 and 0 for other years.

$$\text{Net_Profit} = \beta_0 + \beta_1 \cdot \text{Scope_3} + \beta_2 \cdot \text{Global_GDP_Growth} + \beta_3 \cdot \text{Is_2022} + \epsilon$$

The regression model results indicate that the R-squared value is 0.998, suggesting that the model can explain 99.8% of the fluctuations in net profit, demonstrating an excellent fit. The coefficient for Scope 3 emissions is 1.4984, implying that a reduction of 1,000 kilotonnes in emissions may lead to an increase of approximately \$150 million in net profit, although its p-value is close to the significance level but has not fully reached it. The coefficient for global GDP growth rate is not significant, indicating its limited impact on net profit based on the current sample. The coefficient of the dummy variable Is_2022 is significantly negative, confirming that the negative impact on net profit in 2022 was primarily driven by special circumstances.

The analysis results show that the reduction of Scope 3 emissions may positively contribute to corporate performance, although this result has not reached full significance, it still suggests that green supply chain management practices may have practical implications for businesses. Meanwhile, the abnormal losses in 2022 are identified as resulting from special circumstances, unrelated to the direct effects of green supply chain management. Global GDP growth rate does not show a significant impact in this study, suggesting the need to further explore other macro or industry variables with greater explanatory power.

Based on the above analysis, the following improvement suggestions are proposed in this paper: Firstly, expand the sample size to include data from more years to enhance the robustness and statistical power of the model; secondly, introduce more control variables such as R&D expenditure, capital expenditure, logistics costs, etc., to more comprehensively analyze the impact of Scope 3 emissions reduction; finally, further investigate the long-term effects of Scope 3 emissions reduction and explore its lagged effects across different time periods to gain deeper insights into the potential contribution of green supply chain management to corporate performance ^[2].

4 Data Transparency

4.1 Comparison of ESG Data Disclosure Requirements

ESG data disclosure mandates that companies comprehensively and accurately disclose their environmental and social performance. Amazon, as a global retail giant, still has many imperfections in data disclosure. For example, regarding Scope 3 emissions data, while the overall emissions have been disclosed, there is a lack of detailed categorization, such as

specific emissions data for different business segments and geographical regions. This makes it difficult for stakeholders to accurately assess the environmental impact of various links in Amazon's supply chain ^[3]. In terms of supply chain transparency, Amazon has failed to fully disclose information such as the environmental performance of its suppliers and the greenness of production processes, hindering consumers and investors from gaining a comprehensive understanding of the sustainability of its supply chain. Additionally, the lack of product lifecycle analysis data prevents the outside world from knowing the environmental impact throughout the entire product lifecycle, from raw material acquisition, production and manufacturing, transportation and sales, to final disposal.

4.2 Challenges and Deficiencies

4.2.1 Complexity of the Supply Chain Leading to Data Transparency Issues

Amazon's supply chain spans the globe, involving numerous suppliers, partners, and logistics links. This complexity makes data collection and integration extremely challenging, as data formats and statistical standards may differ across different links, impeding accurate data aggregation and effective disclosure.

4.2.2 Unclear Data on Renewable Energy Coverage

Although Amazon uses renewable energy in some of its operations, it lacks clear explanations regarding the proportion of renewable energy in overall energy consumption and the coverage of specific application scenarios. This makes it difficult for the outside world to judge its actual progress and effectiveness in energy transition.

4.2.3 Insufficient Disclosure of Waste Management and Circular Economy Data

Amazon has not fully disclosed the quantity, types, and disposal methods of waste generated during its operations. In terms of the circular economy, data on product recycling rates and remanufactured products are missing, hindering the assessment of its efforts and achievements in resource recycling.

4.3 Optimization Suggestions

4.3.1 Enhance Supply Chain Visibility and Data Collection

Amazon should leverage advanced information technologies such as blockchain and the Internet of Things (IoT) to achieve visible management of all supply chain links. By deploying sensors and data collection equipment within the supply chain, it can collect data in real-time and establish a unified data management platform to ensure data accuracy and timeliness ^[4].

4.3.2 Increase the Granularity of Scope 3 Emissions Data

Further categorize and statistically analyze Scope 3 emissions data, clarifying specific emissions for each business segment and supply chain link.

This will provide data support for formulating targeted emission reduction measures and also meet stakeholders' demands for detailed environmental information ^[5].

4.3.3 Promote Renewable Energy and Energy Efficiency

Increase investment and application of renewable energy, clarify the usage targets and plans for renewable energy in different business segments, and regularly disclose data on renewable energy coverage and energy efficiency improvements, demonstrating its commitment and progress in energy transition ^[6].

5 Conclusion

5.1 Summary of Research Findings

This study analyzes Amazon's practices in green supply chain management and data transparency issues, drawing the following conclusions: Green supply chain management is of great significance in corporate sustainable development, but companies face many challenges in its implementation, such as data transparency issues and supply chain complexity. Furthermore, data transparency is crucial for the supervision and evaluation of corporate green supply chain management. Companies should strengthen data collection and disclosure to improve data quality.

5.2 Directions for Future Research

Future research can be conducted in the following directions: Firstly, further in-depth research should be conducted on the comprehensive impact of green supply chain management on corporate economic and environmental benefits, establishing a more comprehensive evaluation model. Secondly, explore how to leverage emerging technologies such as artificial intelligence, big data, and blockchain to better promote the implementation and optimization of green supply chain management. Thirdly, strengthen comparative research on green supply chain management practices among different industries worldwide, summarizing successful experiences and models for reference by more companies. Fourthly, focus on the development trends of green supply chain management in the context of global supply chain restructuring, studying how to address the impact of changes in the international trade environment on green supply chain management. Through these studies, it is hoped that more targeted and forward-looking theoretical guidance and practical suggestions can be provided for the development of corporate green supply chain management.

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