

Carbon Footprint Management for Sustainable Supply Chains

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Abstract

The issue of carbon emissions from industries has emerged as a critical driver of the global climate change crisis, necessitating urgent action. In response, the United Nations' signing of the Paris Agreement in 2016 has galvanized nations worldwide to address this issue and strive towards a sustainable, low-carbon future. However, it is not solely the responsibility of individual companies to adopt environmentally friendly practices within their own operations. Given the interconnectedness of today's globalized economy, companies must extend their efforts to foster sustainability throughout their entire supply chains in order to effectively reduce their carbon footprint. The purpose of this research paper is to comprehensively investigate the intricate relationship between carbon footprints and sustainable supply chains by synthesizing existing literature and analyzing industry practices. By delving into the historical, current, and future dimensions of the carbon footprint sector, this study aims to shed light on its pivotal role in fostering sustainable supply chains. To achieve this objective, a meticulous and systematic approach was adopted. A thorough and extensive literature search was conducted, utilizing the bibliometric tool "Scopus" to identify relevant articles pertaining to the connection between supply chain management and carbon footprint sustainability. Following a rigorous review process, 37 articles were ultimately selected to form the basis of this study, each offering valuable insights into the subject matter. By expanding our understanding of the correlation between carbon footprint and sustainable supply chains, this research endeavors to contribute to the growing body of knowledge on environmentally responsible business practices. Ultimately, it is hoped that the findings of this study will inspire and inform companies, policymakers, and stakeholders, guiding them towards more effective strategies and initiatives aimed at mitigating climate change through sustainable supply chain management.

Keywords: Carbon footprint, supply chain, sustainability, management, profit

INTRODUCTION

Sustainability has become a crucial term for organizations in the 21st century, as it plays a key role in the profitable growth of companies and the preservation of their social and environmental values [1].

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Of the three pillars of sustainability, concerns about environmental degradation have a significant impact on global industries and government policies. This movement began in the late 1990s with increasing awareness of carbon footprint (CFP) and global warming [2]. The Kyoto Protocol, adopted by the United Nations in 1997, aims to reduce greenhouse gases in the atmosphere, and about 150 countries have ratified the protocol to incorporate it into their industrial policies [3]. The Intergovernmental Panel on Climate Change (IPCC) also found in their 2007 assessment report that greenhouse gases are causing significant harm to the environment. To mitigate this, various

regulatory and trading instruments, such as emissions trading systems, carbon caps and trading, and carbon taxes, are being developed in national sustainability policies [4].

Supply Chain and CFP Sustainability

Supply Chain Management, the management of a network of links that optimally deliver goods and services to customers, is also a focus of sustainability efforts. The objective of sustainable supply chain management is to minimize the environmental impact of the supply chain. In the context of sustainability, supply chain management offers organizations the ability to evaluate how each part of their supply chain aligns with their social and environmental obligations. The "triple bottom line" approach, proposed by Elkington (1994), [11] takes into consideration the economic, social, and environmental impacts of a supply chain. The main objective of the supply chain is economic growth, but this approach recognizes the importance of balancing financial performance with social and environmental responsibility. The concept of sustainable development is defined in the report of the World Commission on Environment and Development: Our Common Future (Brundtland et al., 1987) [12]. The goal is to improve profits and reduce losses, while ensuring that the supply chain operates in a socially and environmentally responsible manner.

In order to achieve sustainability in the supply chain, it is crucial to strike a balance between various goals. The importance of sustainable supply chain practices has gained greater recognition in recent years, as both governments and society place increasing pressure on organizations to align their supply chain with sustainable practices. The concept of sustainable supply chain management has been defined in various ways by different researchers. A sustainable supply chain can be described as one that efficiently provides socially valuable goods and services without causing harm to the environment. While there may be some trade-offs between efficiency and sustainability goals, a sustainable supply chain can bring long-term benefits. Key definitions of sustainable supply chain management in the literature generally focus on three integrated areas: economic performance, environmental protection, and social responsibility.

CARBON FOOTPRINT

The carbon footprint refers to the total amount of greenhouse gas emissions, primarily carbon dioxide (CO₂), released into the atmosphere as a result of human activities [5]. It is a measure of the impact of human actions on climate change. Here is some information regarding carbon footprint:

- Greenhouse Gas Emissions
- Fossil Fuel Consumption
- Deforestation and Land Use Changes
- Industrial Processes
- Agriculture and Livestock
- Carbon Offsetting
- Individual Actions

Reducing the carbon footprint is crucial for mitigating climate change and achieving sustainability goals. Governments, businesses, and individuals all have a part to play in adopting low-carbon practices, transitioning to clean energy sources, and promoting sustainable development to minimize the carbon emissions that contribute to the carbon footprint [6].

In today's world, carbon footprint (CFP) has become a significant issue. The CFP is the amount of carbon dioxide and other greenhouse gases released into the environment as a result of human activity. This is a major contributor to global warming and depletion of natural resources. When it comes to greenhouse gas emissions in organizations, there are three types to consider [7]:

- *Direct Emissions:* These emissions are the result of various organizational activities, including energy production and release of carbon dioxide and nitrous oxide into the environment. These emissions can be reduced through the use of environmentally friendly practices.

- *Indirect Emissions:* These emissions are not directly controlled by the organization. They are the result of goods or services used or produced by the organization, which indirectly contribute to carbon emissions. For example, the CO₂ emissions resulting from transportation of goods or services can be considered as indirect emissions.

CARBON FOOTPRINT IN ELECTRICITY PRODUCTION

Electricity production plays a significant role in carbon footprint emissions due to the reliance on fossil fuel-based power generation. Here is some information regarding carbon footprint in electricity production:

- Fossil Fuel Power Plants
- Renewable Energy Sources
- Carbon Capture and Storage (CCS)
- Transition to Low-Carbon Grids
- Life Cycle Assessment (LCA)
- Policy and Regulations

Electricity consumption is a critical aspect of business operations and companies typically source power from various providers. The major sources of electricity include coal, natural gas, and nuclear energy [8]. Although a company has limited control over the emissions generated in electricity production, it still has a responsibility to contribute to reducing carbon footprint. Hence, implementing an effective environmental management system and monitoring CO₂ emissions is vital for businesses. In recent years, numerous organizations have implemented operational and strategic changes aimed at reducing their carbon footprint. Researchers have explored and suggested different ways to address carbon-related issues in supply chain management. One such strategy is the Carbon Trading Scheme, which enables companies to meet their carbon footprint reduction targets [9]. The carbon price in the cap-and-trade framework can be determined using the classic EOQ (Economic Order Quantity) model, allowing the company to calculate the optimal order quantity and effectively manage their carbon footprint in inventory control. Chabanel et al. (2012) proposed a mixed-integer linear program (MILP) to support carbon trading, highlighting effective carbon management strategies to achieve sustainable supply chains. By adjusting operational decisions, companies can reduce their carbon and address the constraints related to carbon emissions in the single-item lot-size problem [10].

The use of electricity in businesses can have a significant impact on carbon emissions and contribute to global warming. Therefore, it is important for organizations to monitor and manage their carbon footprint. To address this issue, various solutions have been proposed in the literature, such as the Carbon Trading Scheme and the use of mixed-integer linear programs. The Economic Order Quantity (EOQ) model has also been adapted to consider environmental policy and carbon emissions, helping companies to optimize their inventory management and reduce their carbon footprint. Other researchers have proposed using cyclical carbon emission constraints, key performance indicators, and circular economy implementation to achieve a more sustainable supply chain. Overall, these solutions aim to help organizations improve their profits while reducing their carbon emissions.

Reducing the carbon footprint in electricity production is essential for mitigating climate change. By increasing the share of renewable energy, investing in clean technologies, and implementing supportive policies, it is possible to significantly decrease the carbon emissions associated with electricity generation.

CONCLUSION

This literature review sheds light on the impact of carbon footprint on supply chains and the importance of implementing carbon regulations for organizations to achieve sustainable growth. The study has highlighted several existing quantitative and qualitative approaches for reducing carbon footprint, as well as identified some research gaps in the field.

It has been noted that increased concern for global warming and CO₂ emissions since 2010 has led to a focus on developing more sustainable supply chains. Although, some articles have explored the relationship between environmental impact and economic performance in sustainability research, there has been a lack of attention paid to social responsibility.

From a business perspective, the goal of maximizing profit is usually the main objective, however, social pressures and regulations require organizations to adopt sustainable practices. Future research could delve more into the aspect of corporate social responsibility and take into consideration various uncertainties, including the impact of events such as the COVID-19 pandemic.

REFERENCES

1. Absi N, Dauzère-Pérès S, Kedad-Sidhoum S, Penz B, Rapine C. Lot sizing with carbon emission constraints. *European Journal of Operational Research*. 2013 May 16;227(1):55-61.
2. Acquaye A, Feng K, Oppon E, Salhi S, Ibn-Mohammed T, Genovese A, Hubacek K. Measuring the environmental sustainability performance of global supply chains: A multi-regional input-output analysis for carbon, sulphur oxide and water footprints. *Journal of environmental management*. 2017 Feb 1;187:571-85.
3. Acquaye, A., Ibn-Mohammed, T., Genovese, A., Afrifa, G.A., Yamoah, F.A. and Oppon, E. (2018), "A quantitative model for environmentally sustainable supply chain performance measurement", *European Journal of Operational Research*, Vol. 269 No. 1, pp. 188-205.
4. Ahmed W, Sarkar B. Management of next-generation energy using a triple bottom line approach under a supply chain framework. *Resources, Conservation and Recycling*. 2019 Nov 1;150:104431.
5. Aljuneidi T, Bulgak AA. Carbon footprint for designing reverse logistics network with hybrid manufacturing-remanufacturing systems. *Journal of Remanufacturing*. 2020 Jul;10:107-26.
6. Allaoui H, Guo Y, Choudhary A, Bloemhof J. Sustainable agro-food supply chain design using two-stage hybrid multi-objective decision-making approach. *Computers & Operations Research*. 2018 Jan 1;89:369-84.
7. Rugani B, Caro D. Impact of COVID-19 outbreak measures of lockdown on the Italian Carbon Footprint. *Science of the Total Environment*. 2020 Oct 1;737:139806.
8. Yang Y, Qu S, Cai B, Liang S, Wang Z, Wang J, Xu M. Mapping global carbon footprint in China. *Nature Communications*. 2020 May 7;11(1):2237..
9. Mi Z, Zheng J, Meng J, Ou J, Hubacek K, Liu Z, Coffman DM, Stern N, Liang S, Wei YM. Economic development and converging household carbon footprints in China. *Nature Sustainability*. 2020 Jul;3(7):529-37.
10. Onat NC, Kucukvar M. Carbon footprint of construction industry: A global review and supply chain analysis. *Renewable and Sustainable Energy Reviews*. 2020 May 1;124:109783.
11. Elkington J. Enter the triple bottom line. *The triple bottom line: Does it all add up*. 2004 Aug 17;11(12):1-6.
12. Keeble BR. The Brundtland report: 'Our common future'. *Medicine and war*. 1988 Jan 1;4(1):17-25.