

GREEN SUPPLY CHAIN MANAGEMENT – BENEFITS AND CHALLENGES

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Abstract

Green Supply Chain Management (GSCM) integrates environmental considerations with traditional supply chain management practices. The necessity of implementing green practices in supply chain has become increasingly evident in today's world, where environmental challenges such as climate change, resource depletion, and pollution are intensifying. Green practices in the supply chains can reduce environmental impact, improve resource efficiency and cost savings, enhance company reputation, ensure regulatory compliance, and strengthen long-term resilience. Considering this the aim of the paper is to examine the theoretical foundations for GSCM, highlighting its role in promoting environmental sustainability and improving operational efficiency.

Key words: supply chain, green practices, green supply chain management, environmental challenges

Introduction

Supply chain is a very dynamic upstream to downstream distribution system that aims to provide product/service with lower cost and superior value includes a lot of activities which need to be managed. The operations and processes in supply chain are usually categorized from the view of a producer of consumer products and services, as planning, sourcing, making, delivering, and returning.

Supply Chain Management basically looks into the interrelationship and inter-linkages between various functions, processes and chain members and analyses the impact of their interaction on value additions and profit maximization (Ballou, 2007). The effective supply chain management has become an important enabler to improve organization performance and valuable way of securing competitive advantage since competition is no longer between organizations, but among supply chains (Li et al, 2006).

But today, considering the need for environmental protection, it is not enough to simply manage activities in the supply chain, but also to integrates environmentally responsible practices into every stage of the supply chain and to reduce negative impacts on the environment. Today, the green supply chain management issue is very topical, green supply chain management (GSCM) has emerged as a key strategy for providing comparative advantages for companies.

Considering this the aim of the paper is to review green supply management in way to enhance organizational performance, reduce waste and conserve renewable and nonrenewable resources. The paper is structured as follows. Section 2 is theoretical overview for green supply chain and green supply chain management. Section 4 focused on benefits and challenges of implementing green practices in supply chain and the last section concludes.

Theoretical overview for green supply chain management

Supply chain management is a key aspect of modern business operations. It encompasses the planning, organization, and coordination of all activities related to the movement of materials, information, and products from suppliers to end consumers. In the area of globalization and increased competition, effective supply chain management plays a key role in improving productivity, reducing costs, and increasing customer satisfaction.

The Council of Supply Chain Management define the SCM as active management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage. Supply chain activities cover everything from product development, sourcing and production to logistics, as well as the information systems needed to coordinate these activities (Council of SCM). While Ballou and Gilbert give the following definition "supply chains refer to all those activities associated with the transformation and flow of products and services, including the flow of information that follows, from the sources of raw materials to the end users and management refers to the integration of all these activities, both internal and external to the firm". Namely, the components of SCM are: (Gligorovski et al, 2023)

- Plan. The company should have a strategy on how to manage the available resources to respond to the different needs of consumers for the products or services they use, that is, there should be a strategic planning for cost rationalization in the use of personnel and financial potential;
- Sources. The company has to choose from which places it will be supplied with raw materials for the production sector. When defining the supply chain, managers should pay attention to the formation of prices for products/services, the method of payment, the availability of sources of funds, etc. Specifically, it should be a continuous cooperation with all those from whom they procure materials and raw materials, as well as external financial sources;
- Production. The next component of the model is the production (as a process) of the finished products and the activities related to all the operations that follow it, which refer to testing, control, packaging and preparation for delivery. In this segment of the company's operation, the level can be measured product quality, employee productivity, financial results, etc.;
- Delivery. This is the segment of the company's operations where managers coordinate the receipt of orders from customers, deliver products and establish a transaction system;
- Return. The last segment is the design of the policy for tracking the return of individual purchased products. The after-sales system should provide a flexible and reliable way to return products, while the company should show readiness for good communication and provide support to those customers who had problems with the products.

Supply chain activities are influenced by numerous internal and external factors that can significantly impact its efficiency and success. According to Bošković (2013) significant factors are:

- Reduction in the number of suppliers. Today, each company in the chain strives to reduce the number of suppliers and maintain long-term cooperative relationships with them. Managers believe in establishing long-term relationships with a few trusted suppliers and it is increasingly common for a company to have a smaller number of suppliers, while offering a wide selection of products to its customers.
- Increased competition - In conditions of increasingly pronounced globalization, competition is increasing, and the consequence of this is the growth of the chain backwards towards suppliers in other countries and forwards towards new customers in those same other countries.
- Shortening of the product life cycle. The life cycle of products is shorter due to the emergence of new products and a company, in order to be competitive, must react in a timely manner to respond to new customer demands.
- Technology. The most important factor affecting supply chain management is technology. The information technologies that have had a significant impact on the development of this concept are ERP (enterprise resource planning) and APS (advanced planning and scheduling) systems.

Nowadays, due to increasingly common environmental problems, traditional supply chains are considered responsible for generating huge amounts of waste, emissions of harmful gases, high consumption of resources, etc. For this reason, the concept of a green supply chain is becoming increasingly relevant and important. (Boskoska et al)

Environmental factors and sustainability requirements are increasingly influencing organizations to implement green practices in their supply chains because effective management of these factors enables organizations to reduce costs, improve operational efficiency, and increase market competitiveness. The concept of GSCM started to take shape as organizations explored eco-friendly practices, including pollution prevention and waste management, within their supply chains (Zhu and Sarkis, 2004). The green supply chain as a modern concept combines economic goals and environmental protection. With proper management, companies can simultaneously increase their efficiency, reduce costs and contribute to sustainable development and environmental protection. Zhu and Sarkis(2004) define green supply chain management (GSCM) as ranging from green purchasing to integrated supply chains starting from supplier, to manufacturer, to customer and reverse logistics, and according to Srivastava (2007) GSCM implies integrating environmental thinking into the chain that includes product design, procurement and selection of materials, the production process, delivery of the final product to consumers, as well as product management after its useful life. Also, GSCM can be defined as an approach to improve performance of the products and processes keeping in mind to the requirements of the environmental regulations predefined by government and aims at confining the wastes within the industrial system so that energy resources are conserved and prevent the dissipation of harmful materials into the environment, including all phases of product's life cycle which includes the design phase, production phase and the distribution phase to the end users of the product and also its disposal at the end of product's life cycle. (Dashore & Sohani²013). GSCM integrates environmentally friendly practices into every stage of the supply chain, from procurement and production to distribution and disposal. (Irshadullah, 2025).

Since GSCM is closely linked to technological advancement, numerous innovative applications are continuously being integrated into various management practices and business improvement initiatives. Selecting the most suitable technologies and identifying key areas for further development are essential for maintaining both organizational performance and outcomes. (Mamamayusupova, 2025).

Benefits and challenges of implementing green practices in supply chain

Today, companies are increasingly adopting green practices in their supply chains to contribute to sustainable development through more efficient use of resources and greater environmental responsibility. The application of these practices allows companies to integrate environmental aspects into all stages of the supply chain, from raw material procurement, through production and distribution, to waste management and product recycling.

Picture 1. Green supply chain



Source: [The green supply chain: Sustainable future - Tona Syntegra Solar](#)

Some of the practices that are often highlighted are: (Albrecht, 2021)

- Green purchasing refers to environmentally friendly ways of purchasing materials or components. The assessment of supply chain partners includes the implementation of electronic order processing systems (e-procurement), the use of long-term contracts with environmental agreements to reduce non-environmental behavior, collaboration on common goals, auditing suppliers' internal environmental management systems and finally the integration of environmental performance measures into existing supplier assessment and evaluation systems. In this context, suppliers that offer environmentally friendly products or packaging that can be reused, recycled or reprocessed should be used first.
- Green manufacturing practices, which involve the use of green resources, lead to competitive advantage by reducing product costs and improving product quality. Lean and green manufacturing work to eliminate waste and improve the efficiency of production processes.
- Eco design - product design impacts the environment through the selection and use of materials and energy. In design, it is particularly important to consider the possibilities for reuse, recycling and recovery of materials and components. Alternatives in design and production processes should be assessed in terms of avoiding or reducing the use of hazardous substances, with the active involvement of internal and external partners.
- Green distribution and warehousing can reduce waste and play an important role in reducing energy and adding value to green products in warehousing, significantly improving the overall performance of the organization with a better corporate image. Green distribution helps enterprises achieve superior financial and environmental performance.
- Green transport and reverse logistics create opportunities for companies to improve their image and reduce their costs. The efficiency of the transport system can reduce overall logistics costs, and by improving customer connectivity, greater profitability can be created. Reverse logistics is related to reuse, recycling and reprocessing that can produce products that can be reused for customers.

Considering the practices that are part of the GSCM it can be conclude that adopting green supply chain management practices is a strategic approach that allows organizations to align economic goals with the principles of sustainable development and to create value for both business and society as a whole.

The implementation of green practices in supply chains offers numerous benefits that extend beyond environmental protection, some of them are: (Institute of Supply Chain Management , 2024)

- Reduced Environmental Impact
- Cost Savings
- Employee Satisfaction
- Improved Brand Image
- Regulatory Compliance
- Enhanced Efficiency
- Competitive Advantage
- Risk Management
- Innovation Opportunities
- Local Community Impact

According to Jaggernath (2015), green supply chains benefit not only companies but also the environment, by reducing negative impacts and encouraging responsible resource management.

Companies	Environment
- Improved customer service and retention - Risk mitigation and management of environmental, social and market risks - Improved distribution efficiency - Optimizing asset utilization	- Energy reduction - Waste reduction - Greenhouse gas emission reduction - Pollution reduction - Less packaging in distribution activities

- Reduced transit time - Improved inventory - Increased innovation and reliability - Improved business continuity - Improved reputation - Improved relationships with legal and government agencies, etc.	- Water saving - Increased energy efficiency - Improved processing operations - Reduced toxic chemicals released into water, etc.
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Source: Jaggernath R. (2015). Green supply chain management, *World Journal of Entrepreneurship Management and Sustainable Development*

Although green, i.e. sustainable supply chains are taking an important place in companies' business operations, their implementation is increasingly fraught with certain challenges. The most common reasons for this are the significant financial resources required to introduce new technologies, improve processes and product education, and the lack of knowledge and experience in the analysis of sustainable solutions.

Green supply chains contribute to sustainable development and more efficient use of resources, but organizations face numerous challenges due to their implementation. Some of them are: (Vasanthi, 2025. p.45)

- Expensive initial outlay: It costs a lot of money to implement sustainable technologies and procedures. The hefty initial expenses of green innovations and infrastructure make many businesses hesitant. However, the early costs are frequently outweighed by the long-term savings and environmental advantages.
- Compliance of Suppliers: Because of differing requirements, ensuring sustainability among international vendors can be difficult. Some providers may lack the funds or dedication necessary to implement eco-friendly procedures. To maintain compliance, strong collaborations and frequent audits are required.
- Implementation Complexity: The process of reorganizing current supply chains for sustainability is difficult. Companies need to integrate new technologies, retrain staff, and reorganize operations. Time, preparation, and strong leadership support are necessary for this shift.
- Lack of Awareness: Sustainability may not be given top priority by many stakeholders, including as suppliers and employees. Businesses find it difficult to promote sustainable activities in the absence of appropriate training and incentives. Aligning sustainable goals can be facilitated by awareness campaigns and effective communication.
- Regulatory Variability: Regional variations in environmental regulations and practices make compliance difficult. Businesses that operate internationally have to manage complicated rules and modify their plans as necessary. For enterprises, this raises expenses and administrative responsibilities.
- Limited Access to Sustainable Materials: Sourcing eco-friendly alternatives can be difficult and expensive. Many sustainable materials have limited availability or require specialized production methods. Companies must invest in research and supplier collaborations to overcome this challenge.
- Supply Chain Disruptions: Climate change, political instability, and natural disasters can disrupt sustainable sourcing. Businesses relying on specific regions for raw materials face heightened risks. Diversifying suppliers and investing in resilient strategies can help mitigate disruptions.

Due to all this limitations, companies are not able to answer to the environmental challenges so they use "greenwashing", whereby organizations invest more effort and resources in marketing

activities and building a public image of environmental responsibility than in actually implementing activities and measures that contribute to environmental protection.

Conclusion

Considering the need for environmental protection and rational use of resources, the implementation of green practices in the supply chain it's becoming more necessary. Green Supply Chain Management has a significant role for promoting sustainability and increasing operational efficiency. But implementation of GSCM practices also requires significant financial investments and faces economic constraints. In way to overcome financial and economic barriers in GSCM, companies must strategically allocate resources and seek external funding opportunities. Future research related to this topic should be focused on integration of technologies such as AI and machine learning, blockchain, IoT etc. for creating green supply chain because they can enhance operational efficiency, reduce costs, and minimize environmental impact.

References

- Ballou, H.R. (2007), "The evolution and future of logistics and supply chain management", *European Business Review*, Vol. 19, No. 4, pp. 332 - 348.
- Boskoska M., Gjorgjieska E., Risteska Jankuloska A., Odzaklieska D. (2026). *International Business*, Faculty of Economics – Prilep.
- Council of Supply Chain Management, https://cscmp.org/CSCMP/Certify/Fundamentals/What_is_Supply_Chain_Management.aspx%3FWebsiteKey%3D0b3f453d-bd90-4121-83cf-172a90b226a9?utm_source=chatgpt.com
- Dawei Lu. (2013). *Fundamentals of Supply Chain Management*. Publisher Bookboon
- Institute of Supply Chain Management, Whata are the benefits of green supply chain, 2024, [Green Supply Chains: What are they and what are their benefits](#)
- Gligorovski V., Risteska J. A., Dichovska A. M. (2023). RFID as an advanced technology designed to improve business processes in supply chain management, *KNOWLEDGE International Journal* Vol.60. 1.
- Institute of Supply Chain Mangement (2024), <https://www.io scm.com/blog/what-are-the-benefits-of-green-supply-chains/>
- Irshadullah Asim Mohammed, (2025), *Green Supply Chain Management: Strategies for Sustainability and Efficiency*, *European Economic Letters* ISSN 2323-5233 Vol 15, Issue 1 (2025), <http://eelet.org.uk>
- Jacobs, F. R., & Chase, R. B. (2018). *Operations and Supply Chain Management* (15th ed.). McGraw-Hill Education.
- Jaggernath R. (2015). *Green supply chain management*, *World Journal of Entrepreneurship Management and Sustainable Development*
- Jelena Bošković, Upravljanje lancima snabdevanja, 40 Nacionalna Konferencija o kvalitetu, FQ2013.
- Khusniya Dzhuraevna Mamamayusupova, *Green Supply Chain Management, International Scientific and Practical Conference "Emerging Trends in Green Economy"*, October 25, 2025. <https://doi.org/10.5281/zenodo.17435732>
- Kshitij Dashore, Dr. Nagendra Sohani, *Green Supply Chain Management - Barriers & Drivers: A Review*, *International Journal of Engineering Research & Technology (IJERT)*, Vol. 2 Issue 4, April - 2013
- Srivastava, S.K., (2007). *Green supply-chain management: a state-of-the-art literature review*, *International Journal of Management Reviews*, Vol. 9, No. 1

Suhong Li , Bhanu Ragu-Nathan , T.S Ragu Nathan, S. Subba Rao. (2006). The impact of supply chain management practices on competitive advantage and organizational performance, Omega Volume 34 Issue 2.

Vasanthi R. (2025). Sustainable Supply Chain Management: Trends, Challenges, and Future Prospects, Trends in Banking, Accounting and Business Vol: 4(1), 2025, [Sustainable Supply Chain Management: Trends, Challenges, and Future Prospects](#)

Wolfgang Albrecht. (2021). Scheduling in Green Supply Chain Management, A Mixed-Integer Approach, Springer

Zhu, Q. & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises”, Journal of Operations Management, Volume 22, Issue 3, p. 265-289