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GREEN SUPPLY CHAIN MANAGEMENT

CHARISIOS ACHILLAS, DIMITRIOS AIDONIS, DIONYSIS BOCHTIS AND DIMITRIS FOLINAS

Green Supply Chain Management

Today, one of the top priorities of an organization's modern corporate strategy is to portray itself as socially responsible and environmentally sustainable. As a focal point of sustainability initiatives, green supply chain management has emerged as a key strategy that can provide competitive advantages with significant parallel gains for company profitability. In designing a green supply chain, the intent is the adoption of comprehensive and cross-business sustainability principles, from the product conception stage to the end-of-life stage. In this context, green initiatives relate to tangible and intangible corporate benefits. Sustainability reports from numerous companies reveal that greening their supply chains has helped reduce operating cost, thus boosting effectiveness and efficiency while increasing sustainability of the business.

Green Supply Chain Management provides a strategic overview of sustainable supply chain management, shedding light on the theoretical background and key principles of the topic. Specifically, this book covers various thematic areas including benefits and impact of green supply chain management; enablers and barriers on supply chain operations; inbound and outbound logistics considerations; and production, packaging and reverse logistics under the notion of "greening". The ultimate aim of this textbook is to highlight the challenges in the implementation of green supply chain management in modern companies and to provide a roadmap for decision-making in real-life cases.

Combining chapter summaries and discussion questions, this book provides an accessible and student-friendly introduction to green supply change management and will be of great interest to students, scholars and practitioners in the fields of sustainable business and supply chain management.

Charisios Achillas is a Professor at the Technical Educational Institute of Central Macedonia, Department of Logistics. His work primarily focuses on the areas of environmental engineering, reverse logistics and sustainable development.

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"The authors efficiently capture all the different aspects and latest trends in green supply chain management in a condensed, practical and reader-friendly way. A must-read guide for academics, students and entrepreneurs!"

Simon Pearson, Professor and Director of LIAT at Lincoln Institute for Agri-Food Technologies, UK

"In recent years, green supply chain management has become the focus among practitioners and researchers across the globe. This work provides an excellent synopsis of the current status, as well as the upcoming trends in the field. The authors clearly explain the different angles of green supply chain management and offer practical advice towards increasing the effectiveness and adaptability of supply chains in the modern business world."

Kyriakos Kouveliotis, Professor at International Telematic University UNINETTUNO, Italy

"One of the most critical issues in respect to competitiveness of enterprises in the modern business environment is balancing economic profits with environmental performance. The pressure from the community and the customers, the constantly increasing regulatory legislation, and the profit potential from energy savings or decreased waste management costs, put green supply chain management in the forefront of business efficiency. Connecting theory with practice, the authors offer a comprehensive overview of recent developments in the thematic area of green supply chain management."

Marinella Christoforou, Managing Director at TEAM CERT Certification & Inspection Services, Greece

"This book is definitely a great work full of important information on sustainability in supply chains, which is a top agenda issue worldwide. It is an easy-to-read book, useful for the business world and academia."

Claus Aage Grøn Sørensen, Professor in the Department of Engineering at Aarhus University, Denmark


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Acronyms

ANP	analytic network process
BSI	British Standards Institution
B2B	business-to-business
CBA	cost-benefit analysis
CDW	construction and demolition waste
CSR	corporate social responsibility
CVM	contingent valuation method
DTD	door to door
DW	data warehousing
ECDW	excavation, construction and demolition waste management
ECOEFA	eco-efficiency analysis
EEE	electrical and electronic equipment
EF	ecological footprint
EIA	environmental impact analysis
EMAS	environmental management and auditing scheme
EMS	environmental management system
EPD	environmental product declaration
ESPD	European single procurement document
GHG	greenhouse gases
GSC	green supply chain
GSCM	green supply chain management
HPM	hedonic pricing method
ICT	information and communication technologies
IoT	Internet of Things
IRR	internal rate of return
ISO	International Organization for Standardization
ITS	intelligent transportation systems
JIT	just in time
KEPI	key environmental performance indicator
LCA	life cycle analysis
LCC	life cycle costing
LCSD	life cycle sustainability dashboard

MCA	multi-criteria analysis
MIPS	material intensity per service unit
NPV	net present value
OLAP	online analytical processing
QASI	quantitative assessment of sustainability indices
RFI	request for information
RFID	radio frequency identification
RFP	request for proposal
RFQ	request for quote
R&D	research and development
SEA	strategic environmental assessments
SME	small and medium enterprise
SPP	sustainable public procurement
SRG	sustainability reporting guidelines
TCO	total cost of ownership
TQM	total quality management
VMI	vendor-managed inventory
VOC	volatile organic compounds
WEEE	waste electrical and electronic equipment
3PL	third-party logistics

1 Green supply chain framework

Discussion questions

- Why is a multidisciplinary approach critical for green supply chain management?
- Which are the key dimensions and disciplines of green supply chains?
- How are different research topics in green supply chain management interlinked within an integrated framework?

Green supply chain (GSC) includes policies, practices and tools that an organization can apply in the context of the sustainable environment. Even it being the case that the integration of environmental concerns within supply chain management has itself evolved into a separate research and business field, GSC can be considered as an interdisciplinary topic, involving different and multiple objectives of business, social, economic, technological and environmental sustainability issues. To assist the advancement of the multidisciplinary research field of GSC, a framework is provided in this first chapter to understand and appreciate the relationships of various research topics in this field. As numerous aspects of supply chain activities are examined, inevitably the multidisciplinary nature of the system will emerge. Each facet of the system is served by a combination of disciplines that come into focus as the particular subsystem is delineated. The proposed framework also acts as a roadmap for the chapters of the book, aiming to act as an integrated prism for the various research disciplines.

Appreciate the relationships of various research topics in the green supply chain

As a focal part of sustainability initiatives, green supply chain management (GSCM) has emerged as a key strategy that can provide competitive

advantage with significant gains for the company's bottom line.[1] In designing green supply chains, the intent is to adopt best practices comprehensively and across business boundaries, from product conception to the end-of-life recycling stage. In this context, green initiatives relate to tangible and intangible corporate benefits. Sustainability reports of many companies indicate that the greening of their supply chains has assisted them in reducing their operating costs, with increased sustainability of their business.

Greater importance of inter-organizational relationships has caused organizations to consider building competitive advantage via management of their supplier and customer partnerships and networks. This evolution in management and business focus resulted in development of the supply chain and supply management fields. In this introductory chapter, a conceptual framework and theoretical background is presented. Utilizing this framework, emergent research directions to advance the field are also presented. The structure of the textbook will be based on the proposed framework.

The integrated planning of the green supply chain requires the management of a business or organization to initially determine the inputs, drivers and enablers that must be processed for the production, transportation and distribution, packaging and recycling of green products (Figure 1.1).

The management of green supply includes the planning, execution, monitoring and control of practices, approaches and tools that assists organizations of their "greening" process to become socially responsible and sustainable through environmental protection.

Another critical issue is the identification of the key stakeholders within GSC initiatives. Sustainable supply chain management expands the concept of sustainability from a company to the supply chain level by providing companies with tools for improving their own and the sector's competitiveness, sustainability and responsibility towards meeting stakeholder expectations. Principles of accountability, transparency and stakeholder engagement are highly relevant to sustainable supply chain management. During recent decades, a number of innovative practices and technologies have emerged

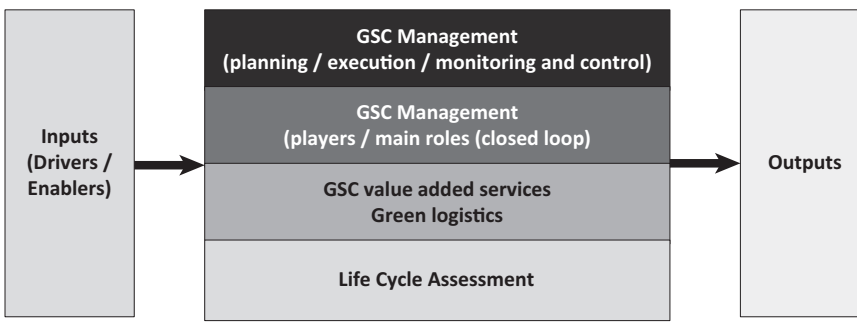

Figure 1.1 Green supply chain framework

to achieve the automation, simplification, optimization and redesign of GSCM processes. Specifically, the following initiatives have been promoted: (a) procurement-sourcing, manufacturing, re-manufacturing, warehousing, supply chain network design and waste management; (b) improving the communication and achieving the coordination, cooperation and integration of the supply chain partners of the supply chain; and (c) supporting the decision-making process in the three business levels (operational, tactical and strategic). Moreover, there is a need to identify the outputs and/or services, but also the social, financial and environmental benefits.

This conceptual framework acts as a roadmap for the topics of the book, aiming to provide an integrated prism instead of a self-directive and isolated study of the aforementioned key areas.

Green supply chain book roadmap

Green supply chain focuses not only on cost, efficiency and high customer service, but also on low environmental consequences. Chapter 2 provides the unique characteristics of green supply chain and discusses the main stages of the evolution from the traditional supply chain to the green supply chain. The identification and classification of the drivers and enablers to green and add sustainability in the supply chain, as well as the understanding of their mutual relationships, are the main objectives of Chapter 3.

In Chapter 4, the functional area of procurement in the context of green supply chain is examined. The chapter aims to define green procurement, as well as to identify the economic and environmental concerns that have contributed to increasing interest in green procurement. One of the key topics of the chapter is the description of the green procurement life cycle (green procurement cycle stages). Furthermore, a number of cases of green procurement initiatives and the barriers to its broader adoption are presented as examples.

Green production is the examined topic in Chapter 5. In this chapter, green production (manufacturing) processes and the corresponding production cycle are discussed. Sustainable materials, modern production techniques, technologies and applications are also presented, aiming first to assess the environmental impact of materials, manufacturing processes and product life cycles, and second to sketch the green production portfolio within a focused factory.

Chapter 6 describes the third functional area: transportation and distribution. Priorities and objectives of sustainable transportation, as well as policies, best practices and technologies for greening the transportation and distribution processes are presented and analyzed.

Green (sustainable) packaging is examined in Chapter 7. Packaging materials, policies and regulations are discussed. Case studies and new technologies, materials and processes are identified in order to better describe the eco-friendly packaging procedure.

Waste reduction is a critical success factor in green supply chain management, and specifically in the reverse logistics. In this context, the concepts of reverse logistics and closed loop are defined. Waste reduction strategies, best practices and example cases are also presented in Chapter 8.

Planning using sustainability criteria and multiple-criteria (cost-environment) planning in the three business levels is examined in Chapter 9. Drivers behind green supply chain strategies, as well as barriers and motivators are also presented. Moreover, performance measurement methods for green supply chain initiatives are discussed and key environmental performance indicators (KEPIs) are identified.

In Chapter 10, future trends, challenges and issues influencing green business decisions are presented. Moreover, the role of information and communication technologies (ICT) in the transition of a conventional supply chain to a green supply chain is estimated. Green information and communication technologies (GrICT), a term which refers to all the technological solutions that can be used to improve environmental performance throughout the economy and society, is presented. Case studies and best practices, as well as management of green technologies, are also discussed.

Chapter summary

In this chapter, we have provided a framework for green supply chain management, and presented the relationships between various research themes that are closely interlinked within the topic.

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