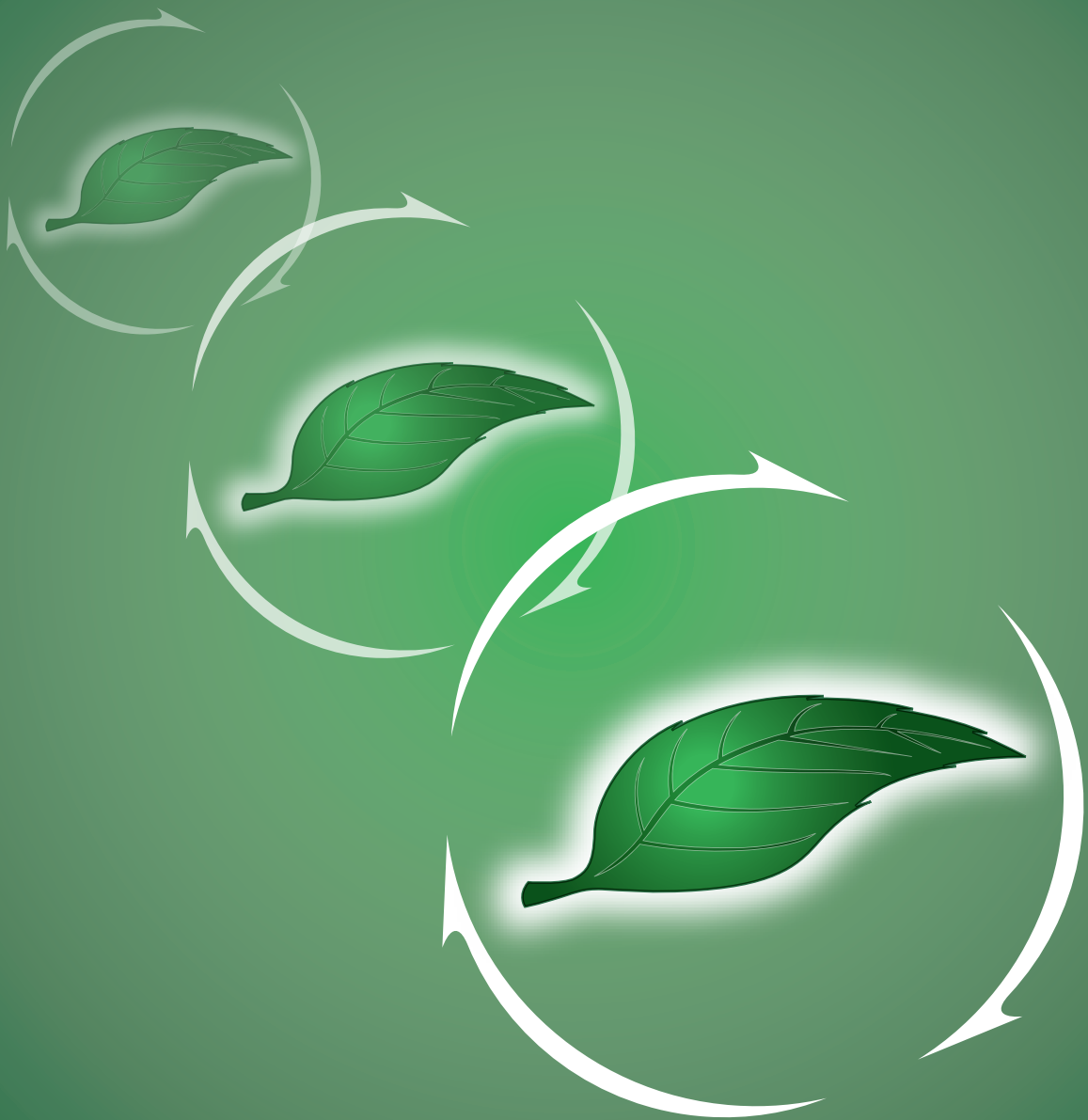
GREEN PRODUCTIVITY

Green Productivity and Green Supply Chain Manual



Asian Productivity Organization

Green Productivity and Green Supply Chain Manual

Asian Productivity Organization

Tokyo

2008

Acknowledgements

Green Productivity (GP) and Green Supply Chain (GSC) Manual: A guide to greening the supply chain applying GP principles, program, methodology, tools and techniques is based on the Asian Productivity Organization (APO)'s GP handbook and relevant GP materials, compiled with references to the GSC guides of the USA, Canada, the UK, New Zealand, Japan, the European Commission and the United Nations Environment Programme.

The Environment and Development Foundation (EDF), ROC, is commissioned by the APO to compile this manual as a user-friendly tool. Furthermore, EDF has taken all necessary care to see that no copyrights have been violated. Special thanks to the major references cited and many people that provided valuable resources and comments in the development of this guide.

Dr. Kun-Mo Lee, Republic of Korea, served as the volume editor.

ISBN: 92-833-7070-8

Contents

List of Boxes

List of Tables

List of Figures

Foreword

The APO has been promoting Green Productivity (GP) in the Asia-Pacific region since 1994. GP efforts have included numerous demonstration projects, international and regional forums, workshops, and seminars held in member countries over the past decade. As a result, GP is now widely accepted as a holistic approach to tackle environmental issues and problems while simultaneously enhancing productivity, the foundation of business competitiveness.

The APO has also introduced various GP tools such as pollution prevention, environmental management systems, eco-design, green procurement, etc., to assist small and medium enterprises in improving their productivity in a green, sustainable manner. “Greening supply chains” (GSC) refers to industries and enterprises requiring that suppliers and vendors take responsibility for meeting specific environmental requirements. GSC is part of the green procurement process, which is especially important for large and multinational enterprises that rely on many links in their supply chains for products and services. GSC not only strengthens customer-supplier relationships, but also reduces costs, leads to sustainable production and consumption, and provides potential opportunities to add value to businesses.

A published manual to provide guidelines on GSC was considered necessary to translate the concepts, practice, and tools involved into easily understood steps that enterprises can take to incorporate GSC into their procurement systems. The *Green Productivity and Green Supply Chain Manual* cites successful examples in many countries demonstrating the benefits of GSC and how it contributes to added business value. However, actual practice may differ from enterprise to enterprise and from country to country. This manual is written in a question, suggestion, and example format to assist enterprises to initiate a GSC campaign and stimulate discussion of the potential for GSC applications, along with the appropriate system, strategy, and tools to be adopted.

Many valuable references on GSC have been published by the United Nations Environment Programme and other organizations in the USA, Canada, New Zealand, Japan, UK, and EU. The present manual is compiled based on the experience developed in those countries and in the Asia-Pacific region. Special acknowledgement is due to all the references consulted during the writing of the APO’s *Green Productivity and Green Supply Manual*. Efforts were made to ensure that it is a stand-alone document covering all aspects related to GSC in a lucid, stepwise manner.

We hope that the *Green Productivity and Green Supply Chain Manual* will serve as another effective, easy-to-use reference for any enterprise desiring to adopt the GSC approach.

Tokyo
August 2008

Shigeo Takenaka
Secretary-General

Executive Summary

All businesses rely on their supply base and customers to survive. Increasingly our customers, our suppliers and we ourselves are becoming more mindful of our environmental and social responsibilities. More and more companies are driven by the media, non-governmental organizations, customer demand and regulatory frameworks to green their supply chain (GSC).

WHATEVER THE REASONS FOR EMBARKING ON THE JOURNEY, THE FOCUS AREAS ARE THE SAME:

- Improving the performance of the business's own operations
- Ensuring that the goods and services provided by suppliers are sustainable
- Working with suppliers to increase efficiency and competitiveness
- Working effectively with customers and sales channels to design sustainable products and services

It is a challenge and a real opportunity for organizations to work with their business partners to add business value, to use resources effectively, to enter new markets, and to show leadership. Each organization has its own way of managing its sustainability issues and greening its supply chain operations. The Green Productivity (GP) approach in setting up a GSC program is recommended, because the GP methodologies, tools, and techniques have been developed to enhance both productivity and environmental performance, thus ensuring sustainable development.

Following the examples of how the leaders are doing on GSC, an organization can identify GSC opportunities or options from its supply chain cycle. With commitment from the top management, an organization can start GSC measures or a GSC program using its existing management framework for quality, environmental management, or the supply chain.

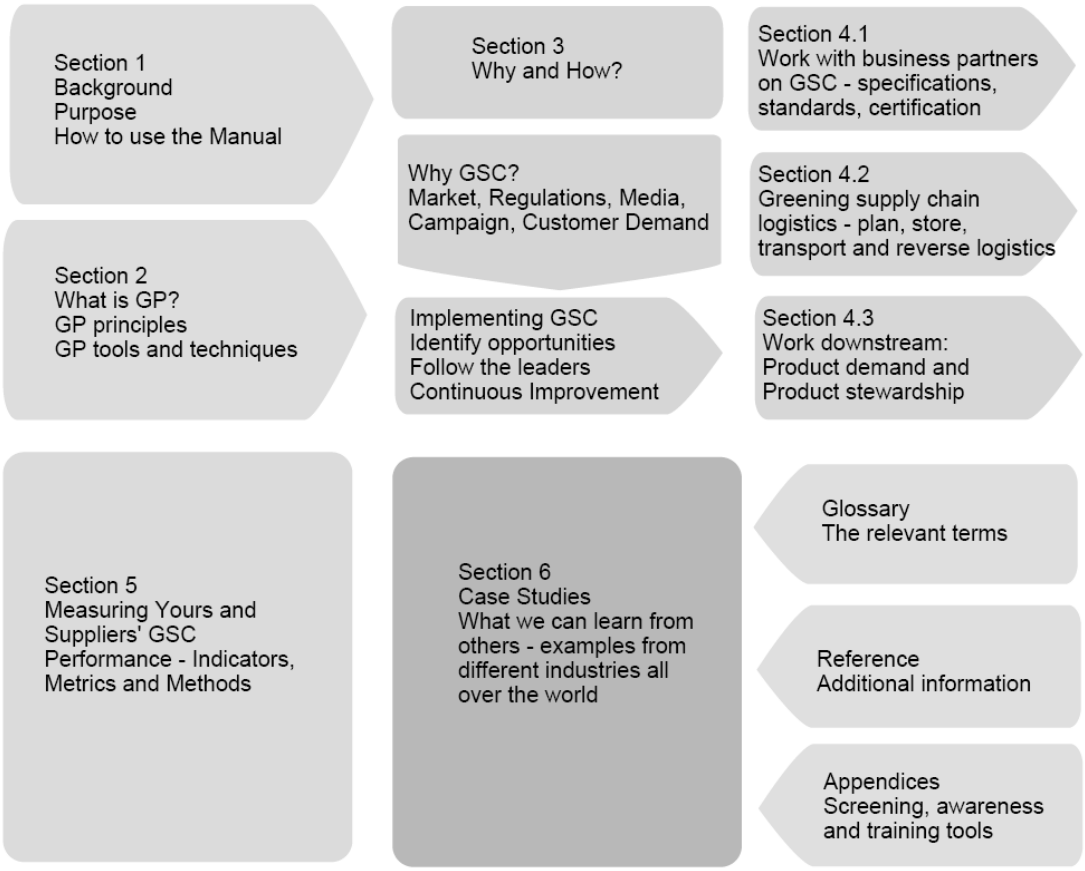
Right from the start, an organization can make progress in GSC by working with suppliers and service providers. Process collaboration with suppliers and customers in planning, forecasting, and replenishment has been shown to deliver improvements in manufacturing and logistics efficiency while reducing emissions and road congestion and improving employment stability.

Sustainable supply chain logistics (SCL) is important because it delivers goods and services to the right place, at the right time, and in the right conditions, while minimizing impacts on the natural and social environments. Measuring performance on GSC requires some relevant indicators and methodologies that can identify the hidden benefits and costs.

"The last book in the Harry Potter series is considered within the industry to be the most environmentally friendly in publishing history with 16 countries printing the book on eco-friendly paper up from one publisher in 2003…result[ing] in a savings of 197,685 trees (an area equivalent to 2.5 times the size of New York's Central Park) and 7.9 million kilograms of greenhouse gases (equivalent to taking 1,577 cars off the road)."

This manual is divided into several sections to assist organizations to implement GSC.

Box 1. The GP and GSC Manual at a Glance



1. Introduction

1.1 Background and Objectives

The Green Productivity (GP) concept, established by the Asian Productivity Organization (APO), aims for socioeconomic development with the ultimate objective of sustained improvement in the quality of human life. It also emphasizes environmental improvement combined with productivity enhancement and profitability. This concept ensures a structured and participatory approach to achieving goals, which can be utilized for a Green Supply Chain (GSC), which is an emerging concept for Asia and the Pacific region. Supply chain management is a very important factor that is directly related to productivity and business competitiveness.

In the last decade, APO has been promoting GP and its tools and techniques to the region, including cleaner production, eco-design and eco-products, green procurement and GSC. On 25–27 May 2000, APO sponsored a "Top Forum on GP – A Management Strategy to Enhance Competitiveness by Greening the Supply Chain" (Ref. 20) in Taipei, Republic of China. On 30 Oct – 2 November 2007, APO sponsored a "Study Meeting on Green Procurement and Green Supply Chains" in Taipei, Republic of China.

To achieve sustainable development in the region, the creation of sustainable consumption patterns, the development of eco-products, and the adoption of ISO 14000 standards would provide a framework for enterprises to practice green purchasing. GP is important in purchasing decisions, and developing new partnerships among enterprises will drive the green supply chain and enhance sustainable performance.

"Greening the supply chain" refers to buyer industries and organizations requiring environmental responsibility and certain environmental standards in their suppliers' and vendors' business management systems and practices. These requirements are expected to be coherent with the buyer industry's core environmental policies and vision. In some cases, the buyer industry also provides technical and/or financial assistance to suppliers/vendors to help them meet these requirements.

This manual on GP and GSC aims to bring the GP and GSC concepts together in a coherent and structured manner and will consider at length how the GP approach and principles can be applied to identify, evaluate, prioritize, and manage issues pertaining to GSC. The objectives of this manual include:

- To develop a hands-on, practice-oriented and comprehensive manual for integrating the GP concept and GSC best practices; and
- To make available a user-friendly manual with a step-wise approach, worksheets and detailed methodology to industries that wish to implement GSC.

1.2 The Review and Drafting Process

Supply chain environmental management (SCEM), or the green supply chain (GSC), is an emerging concept and practice, especially in Asia. It will be a prevalent development in the coming decade and green supply chain models could be developed based on further experience and case studies, especially with more input from small and medium enterprises (SMEs) in Asia.

The review of available and existing references and information revealed that most of the guides developed in this area so far are based on examples in large companies in North America, Europe, and Asia, and focus in particular on multinational conglomerates because they have a large number of business partners, both upstream and downstream. Furthermore, the level of sustainability and complexity in each country and organization varies; for example, the availability of eco-materials, eco-components, and eco-label products, suppliers' response to customers and buyers, and awareness of sustainable consumption and production all differ from country to country. The method of implementing GSC varies according to the nature of the products/services of the organization, and there are many approaches organizations can choose, depending on their available resources.

Therefore, it is not practical at this stage to develop a GSC manual in the form of a standard or a handbook for SMEs. Rather it needs to take the form of a guide compiled from existing experience and information. By providing questions, checklists, examples, and suggestions, each organization, no matter where it is located, can start working on GSC. Organizations may further develop their GSC program or system with the assistance of the available methodologies, tools, and techniques presented in this manual.

1.3 How to Use This Manual

The purpose of this manual is to develop a user-friendly, hands-on, practice-oriented, and comprehensive manual for integrating the GP concept and GSC best practices. It offers a step-wise approach with worksheets and detailed methodology to industries that wish to implement GSC. To achieve this goal, the manual is organized into sections, briefly described below. The user of this manual is encouraged to study the materials following the sequence of the sections, and to consult the additional references and study materials referred to in the manual if necessary.

The Executive Summary summarizes the Manual in a flow chart to give readers a quick overview and understanding of how to implement GSC.

Section 1: **Introduction** discusses the background and objectives, the format of the manual, and how to use the manual.

Section 2: Delineates the concepts, focuses, practices, guiding principles, steps and tasks, tools and techniques, and resources of **Green Productivity**.

Section 3: **Greening the Supply Chain** presents the market trends and business importance of GSC; defines the scope of GSC; and provides suggestions for applying the GP steps and tasks for setting up the GSC program.

Section 4: **Working with Business Partners** provides step-by-step examples of collaborative partnering with suppliers, greening the supply chain logistics, and product development/stewardship.

Section 5: **Measuring Performance on GSC** introduces the relevant indicators, metrics, and methodologies for evaluating internal and suppliers' performance on GSC.

Section 6: **Case Studies** presents greater detail on the different types of industries applying different ways to achieve GSC for organizations.

The **Glossary, References,** and **Appendices** explain important terms, provide additional sources of information, and supply some tools for screening GSC opportunities, training, and raising awareness.

2. Green Productivity (GP)

What is Green Productivity? What is the driving force for GP? What are its concepts, characteristics, principles, and practices? How can the GP program and its methodology, tools, and techniques be applied?

2.1 GP Concepts

Productivity is an umbrella concept covering a hierarchy of improvement opportunities for your business to meet or exceed the needs and expectations of the marketplace. These ever-changing expectations are now embracing good environmental management as a customer demand alongside quality, supply, delivery, technology, health and safety, and cost. When environmental needs and expectations are incorporated into productivity, it is then termed "Green Productivity" (GP).

GP attempts to answer society's needs for a better quality of life by increasing productivity through environmentally sound manufacturing practices and management activities. GP was conceived on the understanding that a healthy environment and a robust, competitive economy are mutually dependent. GP fosters "smart growth" by releasing the collective creative ingenuity of people. This is a move away from "mandate, regulate and litigate" towards encouraging people to act responsibly and take control of their actions to improve the quality of their own lives and to profit from it.

Green Productivity has already proven to be as effective in the boardroom as it is on the shop floor.

(Source: Ref. 1)

GP is a broad strategy for enhancing productivity and environmental performance (Figure 1). Used effectively it can lead to positive change in socioeconomic development. GP's array of productivity and environmental management tools, techniques, and technologies helps you to reduce the environmental impacts of your organization's activities, products, and services.

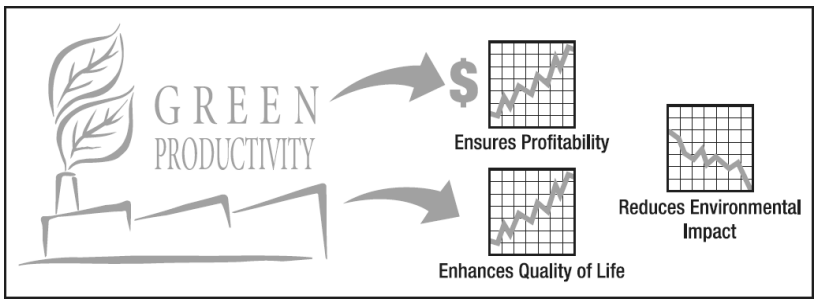


Figure 1. Green Productivity and Profitability, Quality of Life, and the Environment
(Source: Ref. 1)

GP's greatest attribute is its potential for integrating environmental protection into the operations of a business as a means of improving productivity. This can result in increased profitability, or simply better cash flow.

The concept of GP is drawn from the integration of two important developmental strategies (Figure 2):

- productivity enhancement, and
- environmental protection.

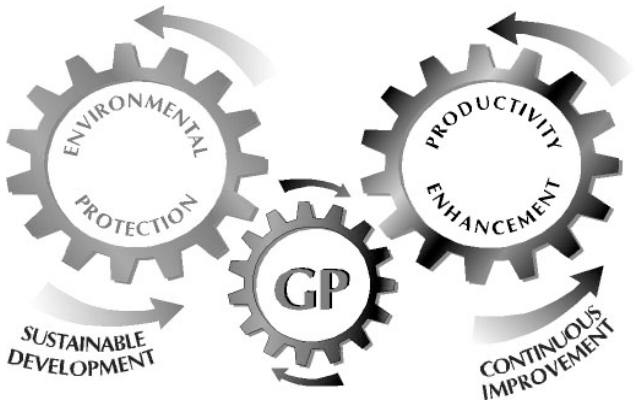


Figure 2. Green Productivity Enhances Sustainable Development and Continuous Productivity Improvement (Source: Ref. 2)

Productivity provides the framework for continuous improvement; *environmental protection* provides the foundation for sustainable development; *sustainability* is the vision or driving force for GP.

2.2 The Triple Focus of GP

GP ensures that environmental protection can occur while you make your business more profitable. Development without profit will not be sustainable, and neither environmental protection nor economic development can occur at the expense of the other. GP brings together three elements seen as part of a triple focus (Figure 3):

- environment, represented by sustainable development,
- profitability, defined by factor inputs, and
- quality, voiced by the customer.

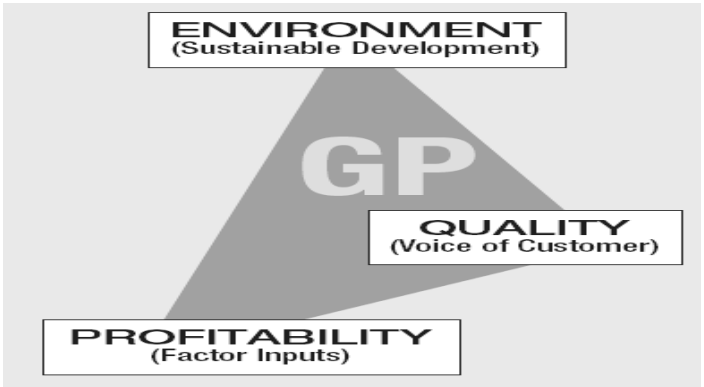


Figure 3. The Triple Focus of Green Productivity (Source: Ref. 1)

Quality plays an equally important role in the process of building wealth. For both goods and services, quality is dictated by the voice of the customer. It is therefore important not only to listen to what your customer is saying but also to understand why certain beliefs are held.

2.3 GP Practice

The practice of GP is characterized by four distinguishing criteria (Figure 4):

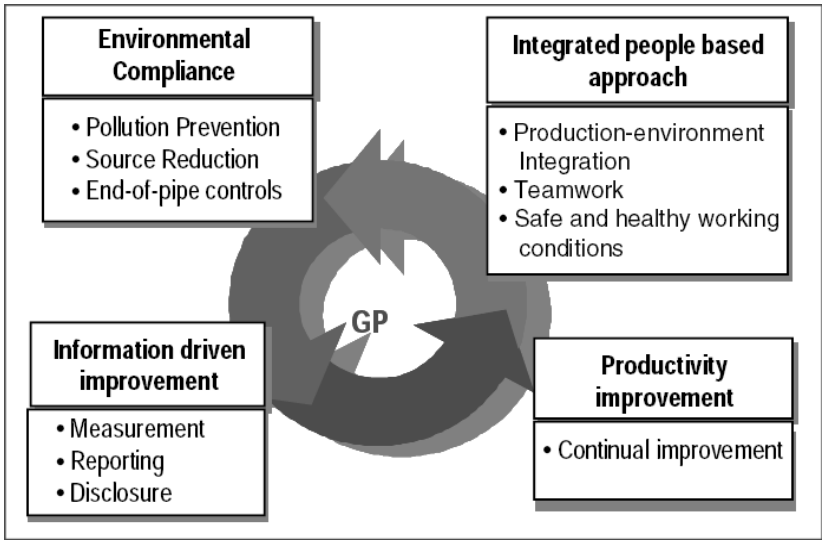


Figure 4. Distinguishing Characteristics of Green Productivity (Source: Ref. 3)

Integrated people-based approach. One of the strengths of GP is its worker-involvement and team-based approach. An improved working environment, better worker health and safety, non-discrimination, and related social welfare issues increase trust between workers and management. This enables a methodological step-by-step approach for the generation of options and solutions. Thus all members in an organization can contribute to the GP process. The involvement of people also promotes trust, simplicity, and accountability. It makes each person employed by your company a potential ambassador for your business.

Productivity improvement. The condition of continuous improvement achieved by KAIZEN or by adopting the premise that underlies the PDCA (Plan, Do, Check and Act) cycle is aimed at ensuring productivity improvement. However, unlike classic productivity improvement programs, GP includes environmental improvement. This is a dynamic and iterative process.

Information-driven improvement. Documentation and reporting under GP are drawn from management systems for quality and the environment (QMS and EMS, respectively). The adage "What gets measured gets done" embodies one of the driving forces of GP. After establishing a GP program, the performance of an organization will be continuously measured and evaluated using a set of defined GP performance indicators. The integration between what is conventionally termed "productivity improvement concepts" and "environmental protection concepts" is most evident here. Note that GP does not dictate how much documentation you require.

Your documentation needs may include:

- notes or minutes of a meeting
- data records, including graphs and charts
- results of customer surveys
- reports summarizing your team's progress and achievements, and areas where more attention is required

It is important that the form, style, and level of documentation meet your needs and suit your corporate culture. Too much documentation merely wastes paper, time, and money. Too little may result in errors, faults, or even failures.

Environmental compliance. Environmental protection, which is the object of legal instruments, traditionally positions compliance as the first step. Legal compliance is one of the most challenging tasks facing industry. The practice of GP assists through the use of tools and techniques in pollution prevention and source reduction. Residues still require management and can be addressed by using

end-of-pipe treatment measures. While environmental compliance can be achieved, it is the unique characteristic of GP that productivity too will improve.

2.4 GP Guiding Principles

The guiding principles of GP (Table 1) have been drawn from both productivity and traditional environmental domains. The principles incorporated in its conceptual development lead to a more positive image that will become apparent as you evolve your new strategy.

Table 1. The Guiding Principles of Green Productivity (Source: Ref. 1)

To meet the goal of environmental protection, three ecological principles were addressed:	The complementary productivity principles that guide Green Productivity include:
Accountability	Profitability
Polluter Pays[11]	Competitive Advantage
Precautionary Approach[12]	People-Building

Many of the principles used to initiate GP are guiding environmental management and productivity improvement practices today. However, they are being implemented in a compartmentalized or segregated manner. Productivity improvements are managed by one department and the environment in another. In the development of GP, care must be taken to select relevant principles that are complementary in nature and that will strengthen the integration of environmental protection and productivity improvement.

Ecological Principles

Ecological principles of accountability, polluter pays, and the precautionary approach bring in the element of responsibility. They place the onus for environmental restoration on the polluter, as do the laws of most nations. This generally reflects the position held by the public and increasingly by those controlling and influencing access to capital.

Accountability stresses the need for you to take responsibility for your actions and decisions. The principle prescribes the need for businesses to be accountable to various groups of people, and not just to traditional shareholders. Typically, law holds polluters accountable to the courts, and regulators decide when this level of scrutiny should occur. However, other business groups, such as suppliers, customers, consumers, and the public at large, are all increasingly seeking accountability for the actions and impacts of business activities. The way people are interpreting corporate responsibility is changing.

In practice, the principle of accountability has spawned voluntary initiatives such as Corporate Environmental Reporting and product stewardship programs, as well as voluntary producers' "Take Back" schemes for used products. When these voluntary actions are properly designed and implemented, they lead to environmental improvements, reduced costs, and lower risk. Businesses are increasingly subscribing to voluntary initiatives as proof of their willingness to be accountable. It improves their market image, increases credibility with regulators and consumers, and, perhaps most importantly, allows them to retain control of their business. The Responsible Care® program developed by the chemical industry is an early example of this kind of initiative. The principle of accountability is captured in part of the definition of GP, in the phrase "for overall socioeconomic development."

The concept of the *polluter pays* reflects responsibility by placing the onus on the polluter for the costs incurred in environmental clean-up. The entity creating the damage is made responsible for remediation of the damaged environment. This principle forms the basis of financial and other

penalties and of pollution taxation systems. The cost of clean-up may be in the form of end-of-pipe treatment systems or new technology to enable source reduction. Some people have difficulty in accepting the term “polluter pays” because it seems to attach the stigma of blame or the inference of wrongdoing. Yet every person does have an impact on the environment with every breath they draw and expel. However, not everything you do is bad. You can have a positive impact on the environment if you plant a tree, pick up litter, or stop a spill from occurring. As you implement GP, you can show leadership to others. Your actions can influence others to take responsibility and accentuate the positive, as well as focusing on opportunities to minimize negative environmental impacts.

How can you avoid negative consequences? The *precautionary* principle advocates a cautious, positive, and anticipatory approach. In terms of environmental protection, the precautionary principle usually means that, where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation. It is typically applied in situations where the impact of an event is long-term and difficult to reverse. Pollution prevention, cleaner production, and source reduction are all based on this precautionary approach to environmental protection.

Productivity Principles

The productivity principles that guide the practice of GP aim at cost effectiveness. Why?

Profitability is the cornerstone of any business. It stipulates the need to generate profits, whether through savings on raw materials by practicing resource efficiency, or through improved productivity, increased quality, or higher sales. GP recognizes that profitability is an essential ingredient for any form of economic activity to be sustainable.

Competitive advantage is essential for businesses to establish and maintain a market position. This also translates into profitability. This principle advocates competitiveness in pricing, in quality, and, in the case of GP, in “eco-friendliness.” As you practice GP, you will find that the integration of environmental and productivity improvements will create new business opportunities. It will provide competitive advantage in a market where “quality” has been the focus. Extending this concept to include environmental quality is not difficult; it is logical. As the history of the quality revolution has demonstrated, businesses eventually realized that quality could increase profitability in addition to reducing costs. Similarly, the advantages of integrating environmental protection into business strategies will be realized as you become more familiar with the practice of GP.

People are crucial at two levels. First, you need to motivate staff or build up people’s confidence (*people building*). Second, you need management’s commitment, which may require executive coaching. Top managers are responsible for setting priorities for the company, allocating resources, and motivating and encouraging employees. They need to understand the benefits and costs of moving forward with GP as well as the costs and risks of inaction. For GP to be successfully adopted in business, top management must commit to adopting “green” as a value-adding foundation. Just as crucial is worker involvement in the practice of GP. Without the involvement and commitment of the line workers, effective implementation of GP is not possible.

2.5 GP Steps and Tasks

The methodology for GP was originally developed to solve environmental and technical problems in manufacturing industry. In the early implementation of the APO GP demonstration projects from 1996 to 1998, the projects were mainly focused on small and medium enterprises (SMEs), such as those in the electroplating, textile, food processing, and papermaking industries. Consequently, there was a very strong emphasis on the manufacturing process in the methodology used. It became evident that GP methodology could be analytically broken down into three components:

- a step-by-step framework for problem solving
- a set of tools, techniques, and technologies used within the framework, and
- the social, economic, environmental, and cultural principles and values that govern the choice of tools, techniques, and technologies within the design of the GP process.

Table 2. The Steps and Tasks of Green Productivity (Source: Ref. 1)

Step I :	**Getting Started**
Task 1: GP Team formation Task 2: Walk-through survey and information collection	
Step II :	**Planning**
Task 3: Identification of problems and causes Task 4: Setting objectives and targets	
Step III :	**Generation, Evaluation and Prioritization of GP Options**
Task 5: Generation of GP Options Task 6: Screening, Evaluation and Prioritization of GP Options	
Step IV :	**Implementation of GP Options**
Task 7: Formulation of GP implementation plan Task 8: Implementation of selected options Task 9: Training, awareness building and developing competence	
Step V :	**Monitoring and Review**
Task 10: Monitoring and Evaluation of results Task 11: Management review	
Step VI :	**Sustaining GP**
Task 12: Incorporate changes into the organization's system of management Task 13: Identify new/additional problem areas for continual improvement	

After the implementation of a number of GP development programs, APO decided to adopt a six-step approach, with each step broken down into the tasks that will help you understand how to apply and implement GP methodology, tools, and techniques. The GP program shown in Table 2 has 6 major steps and 13 different tasks and is simple enough to be used by factories, farms, and communities practicing GP. Some flexibility is to be expected and one need not be dogmatic about the actual number of steps as the conditions in various situations can be very different

2.6 GP Tools and Techniques

The range of tools, techniques, and technologies available now is very extensive. They include management, engineering, environmental, economic, or other technical tools and techniques. The technologies that you need to employ to implement your GP program will depend on the issue or problem to be solved. Technologies tend to be more knowledge based and therefore the advice of resource persons skilled in the field will be essential.

Supporting the steps of the GP methodology is a set of GP tools that can be used to assist in drawing qualitative and quantitative conclusions from the data and observations. Table 3 lists the GP tools and techniques suggested for use with the GP methodology. A GP technique is a method of performance or work improvement, applicable to people, processes, equipment, materials/energy, products, and wastes. GP techniques are rather focused on the generation of GP options.

Table 3. Green Productivity Tools and Techniques (Source: Ref. 3)

Steps of GP Methodology \ GP Tools and Techniques	1 Brain Storming	2 Flowchart	3 Process Flow Diagram	4 Plant Layout	5 Eco-Map	6 Concentration Diagram	7 Material Balance	8 Energy Balance	9 Ishikawa Diagram	10 Cause-Effect Analysis	11 Pareto Chart	12 Cost Benefit Analysis	13 Decision Matrix	14 Source Reduction	15 Recycle, Reuse and Recovery	16 End-of-Pipe Treatment	17 Design for Environment	18 Life Cycle Assessment	19 7 Wastes of Production	20 5S Good Housekeeping
Step I: Getting Started																				
Task 1: Team formation	X																			
Task 2: Walk through survey and Data Collection	X	X	X	X	X	X	X	X			X	X								
Step II: Planning																				
Task 3: Identification of problems and causes	X	X	X	X	X	X	X	X	X	X	X	X								
Task 4: Setting objectives and targets											X	X	X							
Step III: Generation, Evaluation and Priortization of GP Options																				
Task 5: Generation of GP Options	X													X	X	X	X	X	X	X
Task 6: Screening, Evaluation and Priortization of GP Options											X	X	X							
Step IV: Implementation of GP Options																				
Task 7: Formulation of GP implementation plan	X																			
Task 8: Implementation of selected options														X	X	X	X	X	X	X
Task 9: Training, awareness building and developing competence		X	X	X	X	X	X	X	X	X										
Step V : Monitoring and Review																				
Task 10: Monitoring and Evaluation of results		X	X		X	X	X	X			X	X								
Task 11: Management review											X		X							
Step VI : Sustaining GP																				
Task 12: Incorporating changes into the organization's system of management		X	X	X																
Task 13: Identifying new / additional problem areas for continual improvement	X	X	X	X	X	X					X	X	X							

2.7 GP Resources

GP resources are a compilation of books, bulletins, periodicals, journals, newsletters, websites, videos, and CDs. The main criterion in the selection of those resources has been focused on the two areas that are integrated in GP, namely, environmental management and productivity improvement.

APO has so far developed three major references on GP, which describe the GP concepts, driving forces, characteristics, practices, principles, program, methodology, tools, and techniques in a comprehensive and user-friendly manner:

Handbook on Green Productivity, 2006
Greening on the Go: A Pocket Guide to Green Productivity, 2005
Green Productivity Training Manual, 2003

3. Greening Your Supply Chain

3.1 The Green Market Trends

Why Green Your Supply Chain?

General Motors (GM) sums it up well: "Working together with our business partners, we can accomplish much more to improve the environment than GM can alone." Customers (and other stakeholders) do not always differentiate between a company and its partners in the supply chain and hold the company accountable for environmental and social practices.

There is probably not a single enterprise that is not both a supplier and a customer. Whatever the reasons for greening the supply chain, the focus may be the same:

- improving the performance of the business's own operations
- ensuring that the goods and services provided by suppliers are sustainable
- working with suppliers to increase efficiency and competitiveness
- working effectively with customers and sales channels to design sustainable products and services

Box 2. Motivations for Undertaking GSC (Source: Ref. 8)

Primary Motivations	
Internal	**External**
Risk management • Supply interruption • Long-term risk to human health and the environment • Competitive disadvantage	**Enhanced brand image** • Corporate culture of forecasting trends and moving proactively • Potential for harm to public image due to environmental concerns
Regulatory stance • Desire to go beyond compliance • Suppliers knowingly or unwittingly provide materials containing problematic substances • Supplier non-compliance poses production risk	**International purchasing restrictions** • Eco-labeling and product takeback gaining momentum • May drive the creation of systems for collection, • Frequently focused on high-profile brands transport, and disassembly or recycling
	Customer pressure • Often appears in conjunction with a threat to brand image • Frequently focused on high-profile brands
Secondary Motivations	
Cost reduction as suppliers apply pollution prevention	**Increased innovation** • Can result from supplier participation in new product development
Enhanced quality	

What Are the Market Trends Leading to GSC?

- increased customer/consumer environmental awareness
- pressure from governments, suppliers, customers, and competitors
- better business efficiency achieved by organizations that emphasize environmentalism
- companies being held accountable
- consolidation of retail channels
- increasing recognition of environmental leaders and leadership
- greater knowledge transfer between organizations
- growing opportunities to secure environmental inputs
- the attractiveness of a proactive approach to supply chain issues and opportunities

The green market trends can be felt in varying degrees around the world and are expected to increase.

What Are the Trends and Motivations Forcing the Supply Chain Function to Pay More Attention to Sustainability?

A number of key drivers underlie the increased attention companies are paying to greening the supply chain:

- **Market campaigns by advocacy groups.** Businesses, households, and governments increasingly want to buy “green” products. Environmental groups are more and more using the tactic of "markets campaigns." Such campaigns are specifically designed to influence the sourcing policies of leading retailers and other companies in order to create a market demand for more *sustainable products* (for example through eco-labeling or Energy Star products) and to cut market demand for products they feel pose environmental concerns. Markets campaigns have been some of the highest-profile environmental campaigns against companies in recent years.

- **Shareholder interest.** Several social investment portfolios now screen companies' environmental efforts with suppliers as part of their research into companies' environmental performance. In addition, shareholder resolutions are increasingly being used to raise questions about companies' environmental initiatives with suppliers, ranging from recycled content to labeling genetically engineered food ingredients to examining the risks of water scarcity across the supply chain.

- **Supplier consolidation, strategic sourcing, and growing interest among purchasing professionals.** To better focus on their core competencies, companies are outsourcing the work of entire departments. On the other hand, by exerting corporate influence over facility-level purchasing decisions, and by developing strategic partnerships with suppliers, companies have radically reduced the number of suppliers. The issue of supplier environmental management (SEM) is beginning to attract coverage in the purchasing trade, indicating the growing recognition of SEM as a formal discipline.

- **Initiatives by business organizations.** A number of nonprofit organizations that focus on serving the business community have begun to address GSC issues affecting their members. Business-focused organizations such as the World Business Council for Sustainable Development (WBCSD), the Global Environmental Management Initiative (GEMI), and the Business Roundtable have all addressed the issue of greening the supply chain in recent years. Their initiatives have included convening conferences, facilitating networking and information exchange among companies, conducting benchmarking surveys, and sponsoring research reports.

- **Government activity and changes in the regulatory landscape.** Numerous countries have enacted *extended product responsibility* legislation that places the burden of products' final disposal on the manufacturer. In particular, European *take-back regulations* are an important external force driving companies toward GSC. As a result of these requirements, many companies are working closely with their suppliers to explore *design-for-disassembly* or *design-for-environment* principles (or, more recently, “environmentally conscious design”) to help eliminate or reduce the costs associated with the disposal of their products or packaging. Product or packaging take-back is becoming mandatory in many countries and governments support the principle of shared product responsibility. This principle acknowledges that, although manufacturers have considerable ability to reduce the impacts of their products, reducing those impacts often requires the cooperation of others in the product chain. In addition, governments at the central and local levels have adopted *green procurement* policies that have had strong influences on the marketplace.

- **Demands by commercial customers and expanding liabilities and risks.** Companies are increasingly seeking to extend their supply chain management across multiple tiers of their supply chain. Liability is also being pushed back up the supply chain. As a result,

supplier environmental management programs are cascading up the supply chain. For instance, new purchasing requirements on restricted materials imposed by many automobile and electronics manufacturers necessitate that their suppliers collect environmental information or restrict the use of substances by their own suppliers further up the supply chain.

What Are the External Standards That Are Influencing GSC?

External standards are a strong driving force for GSC and we provide a few examples here. In the US, the Institute for Supply Management, an association of 45,000 purchasing and supply chain management professionals, is developing strategies, protocols, and tools to encourage companies to address environmental issues emanating from customers and external standards.

CERES

CERES, the Coalition for Environmentally Responsible Economies, is a US national network of investors, environmental organizations, and other public interest groups working with companies and investors to address sustainability challenges such as global climate change, with the goal of getting companies to endorse the ten CERES principles. CERES signatories are expected to publish publicly available annual statements disclosing their progress on meeting these principles. Although the CERES principles do not contain explicit GSC standards, the CERES annual report form includes an entire section on the supplier relationship, in which companies are asked to disclose information about their supply chain environmental management practices. The report includes questions such as whether the company has a policy to incorporate environmental criteria into its selection of suppliers; whether the company's suppliers have environmental management systems in place; and whether the company works cooperatively with suppliers and contractors to develop environmentally preferable materials, products, and processes. (www.ceres.org)

EuP

On 6 July 2005, the European Parliament issued a Directive establishing a framework for setting eco-design requirements for energy-using products (EuPs), which aims to improve the environmental performance of products throughout the lifecycle. It is part of the EU's Integrated Product Policy (IPP) and voluntary. Implementation was originally set at July 2007, then postponed to 2008. It has two main requirements applicable to all energy-using products: energy efficiency and eco-design. In particular, the eco-design requirement requires manufacturers to consider greening their supply chain by purchasing green materials. Suppliers must meet all their clients' product-related environmental regulations and requests. It is the single most influential legal framework for transforming conventional suppliers into green suppliers.
(www.ec.europa.eu/enterprise/eco_design/index_en.htm)

Global Reporting Initiative

The Global Reporting Initiative (GRI) is a multi-stakeholder process and independent institution whose mission is to develop and disseminate globally applicable "Sustainability Reporting Guidelines." One of the core indicators required for companies that seek to report "in accordance" with the GRI relates to suppliers' environmental performance. It suggests that companies report on the performance of suppliers relative to the environmental components of programs and procedures described in response to Governance Structure and Management Systems section (www.globalreporting.org).

International Organization for Standardization (ISO) 14001 Environmental Management System (EMS) Standard

ISO is a nonprofit global network of national standard-setting agencies that coordinates global standards on a range of issues. The ISO 14001 EMS standard is a process-based standard for environmental management that many companies use as a guide for their environmental management programs. A growing number of companies include some level of supply chain issues within this scope of analysis. In addition, it is becoming more common for companies to include ISO 14001 compliance as a minimum standard in their procurement policies. Several multinational companies such as Ford now require that all suppliers with manufacturing facilities become ISO 14001 certified. (www.iso.ch)

REACH
The European Community Regulation on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) was adopted in December 2006 and entered into force on 1 June 2007. It requires the chemical industry to put health-and-safety information on approximately 30,000 chemical substances used in the European Union (EU) market. While much of the Regulation targets the chemical industry, manufacturers and importers too are required to provide information about the chemicals in the products they sell. The data are entered into a database managed by the European Chemicals Agency, which coordinates in-depth evaluations of potentially dangerous chemicals. All findings will be made available to consumers. (http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm)

RoHS
The Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (commonly referred to as the Restriction of Hazardous Substances Directive or RoHS) was adopted in February 2003 by the EU. This Directive bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE) flame retardants. Manufacturers need to understand the requirements of the RoHS Directive to ensure that their products, and their components, comply. The RoHS Directive and the UK RoHS regulations came into force on 1 July 2006. (www.rohs.gov.uk)

WEEE
The EC Directive on Waste Electrical and Electronic Equipment (WEEE) is closely related to RoHS. The Directive required EU member states to enact local legislation and implement the law by 13 August 2005. In essence, WEEE makes the free recycling of electrical and electronic equipment mandatory throughout the EU. The consumer pays nothing at the point of collection. The manufacturer pays for all costs associated with collection, transportation, and recycling. In addition, recyclers must be informed of the material content of many items. The producer must also mark all affected products with the WEEE symbol, defined in Annex IV of the Directive. Even Asian countries such as China and Thailand are setting up their own WEEE requirements. (www.weeenetwork.com)

3.2 Green Supply Chain Adds Business Value

Now that we know the reasons for implementing GSC, we can ask what it is, how it differs from supply chain environmental management or a sustainable supply chain, and how it is related to purchasing and green procurement.

What Is a Green Supply Chain?

"Greening the supply chain (GSC)" refers to buyer companies requiring a certain level of environmental responsibility in the core business practices of their suppliers and vendors.

What Is Supply Chain Environmental Management?

Supply chain environmental management (SCEM) is a broad term that refers to a variety of approaches through which companies work with their suppliers to improve the environmental performance of the products or manufacturing processes of the supplier, the customer or both.

What Is a Sustainable Supply Chain?

A Sustainable Supply Chain (SSC) entails the management of raw materials and services from suppliers to manufacturer/service provider to customer and back with improvement of the social and environmental impacts explicitly considered.

Basically GSC is equivalent to SCEM (or ESCM or GSCM – related terms whose definitions can be found in the *Glossary* of this manual) and SSC considers environmental, economic, and social aspects when working with business partners. GSC is part of the purchasing function and of achieving green procurement by working with suppliers, contractors, and service providers. SCEM or

GSC approaches may address an “upstream” supply chain, one that provides goods and services to an organization; or they may be directed “downstream” towards the completed manufacture or delivery of products to the end user. Suppliers provide not only raw materials and finished products, but also transportation, energy, packaging, and waste management services – perhaps “supply web” would be a more accurate description. To add to the complexity, some supply chains contain thousands of individual suppliers, each with a slightly different impact on the environment and each with a slightly different potential for improved environmental performance.

How Does the Greening Process Start?

> “Greening the supply chain begins at the root source, or the supplier of raw materials. If a customer’s supplier uses raw materials from an outside source, the supplier could investigate to see if the practices of those root material suppliers could be improved. In many cases there are several materials suppliers that provide goods to the supplier a customer works with.
>
> “After the raw material sources have been assessed, it’s up to the supplier to determine what improvements can be made. Internally, suppliers can do anything from creating a green purchasing plan to improving the manufacturing process in order to reduce harmful emissions or conserve energy.
>
> “There is also room for improvement in the distribution stage by shipping bulk quantities, opening up more small manufacturing plants across the country, or asking shipping partnerships to reduce the number of trucks, boats, or planes carrying goods.
>
> “At this point, the customer receives the product from the supplier. In some cases the customer might take the product and put it through another manufacturing process of their own – like in the car or electronics industry. In other situations, the product shipped in from the supplier can be sold directly to the consumer.
>
> “Products purchased by consumers represent the end of the supply chain, since consumers are the final user. In today’s world, consumers are increasingly aware of the purchases they are making and the effect those purchases have on the environment. Consumers can be anything from a distributor, to an office, to a household.” (Source: Ref. 10)

What Are the Targets of GSC/SCEM/SSC?

The targets of GSC or SCEM may vary widely, but generally include:

- a focus on reducing or eliminating restricted or hazardous materials used in manufacturing processes or products
- a focus on the environmental compliance status and practices of supplier operations
- joint development of new materials and processes, or other solutions to environmental issues

What Is the Business Importance of GSC?

A growing number of companies realize that, to achieve their environmental goals and satisfy stakeholders' expectations, they need to look beyond their own facilities and to involve their business partners in environmental initiatives. Supply chain management goes both downstream to customers and sales, and upstream to suppliers, contractors, and service providers. A supply chain can be complex, with environmental issues occurring at the second- and third-tier supplier levels. Some companies may also attempt to work the opposite end of the supply chain, by educating their customers on the environmental benefits of their products.

In addition, many companies are working to streamline their supply base and develop more cooperative, long-term relationships with key suppliers, a practice that has fostered greater opportunities to work together on environmental issues. According to several studies, many companies have received requests from their corporate customers to address environmental issues.

Working with business partners on environmental issues generates not only significant environmental benefits but also opportunities for cost containment, improved risk management, enhanced quality and brand image, greater operational efficiency, enhanced value to customers, increased sales, positive media attention, and positive ratings from socially responsible investment groups. Companies cite a range of business reasons for implementing GSC programs:

- **Reduce costs.** GSC initiatives that prevent pollution or that decrease energy and materials use throughout the supply chain can significantly reduce companies' procurement costs. Researchers at management consulting firm A.T. Kearney estimate that inefficiencies in the supply chain can waste up to 25% of a company's operating costs, and that even a 5% reduction in waste throughout the supply chain can double a typical company's profit margins. In recognition of this, General Motors and a number of other leading companies offer suppliers technical assistance to implement energy and material use efficiency improvements that help them cut their costs and avoid price increases.

- **Improve risk management.** GSC programs can protect companies from potential supply chain interruptions or delays associated with their suppliers' environmental problems. Some companies are relying on GSC programs to ensure that international suppliers can handle anticipated strengthening of environmental regulations and to reduce any potential future liability associated with their suppliers' environmental performance.

- **Enhance quality.** In many instances, companies' work with suppliers on environmental issues has resulted in enhanced product quality as well as environmental gains. For example, furniture manufacturer Herman Miller's efforts with suppliers to develop new processes to reduce the environmental effects of paint and other finishing helped enhance the quality of many of its office furniture products.

- **Increase innovation and new product development.** Companies have fostered innovation by working collaboratively with suppliers to address environmental issues. Such initiatives have added new features and performance characteristics to existing products or even generated new products.

- **Protect reputation and brand image.** A number of companies have implemented stronger environmental standards for their suppliers to address controversies over the environmental impacts of the products they sell and to deal with or preclude campaigns by environmental activists.

We can provide several examples of the benefits gained by famous multinational brands or companies in greening their supply chain through either recycling of materials, removing toxic substances from the design, or saving energy through supply chain logistics.

Hewlett-Packard
In 2007, USD92 billion computer maker HP reported it would eliminate 30,000 cubic feet of polystyrene computer packaging and more than 6 million pounds of PVC packaging from its inkjet printer business. The company will also reduce its carbon footprint by 20% by 2010.

Nike
USD15 billion footwear manufacturer Nike decided to remove a toxic compound from its core “Air” shock absorption technology. The company says the environmental innovation did more than reduce waste. It was fundamental to a breakthrough alternative that allowed designers to insert full-sole-length Air in its new shoe, the AirMax 360.

Wal-Mart
Through its Zero Waste initiative, USD312 billion retailer Wal-Mart has so far saved 478.1 million gallons of water, 20.7 million gallons of diesel fuel, and millions of pounds of solid waste. Through its 100% Renewable Energy program, the company expects to reduce energy consumption by 30% at all of its new stores in seven years.

Examples of improvements at various stages of the supply chain from other US leaders are given in Table 4.

Table 4. Examples of GSC Improvements from US Leaders (Source: Ref. 5)

INNOVATION	RESULTS
Purchasing Several electronics companies, including Nortel and Intel, have moved away from purchasing *materials* toward receiving chemical *services* via chemical management programs. These services can include procurement, inventory management, data tracking, and waste management.	By providing incentives for suppliers to reduce material quantities and by leveraging the suppliers' expertise, these companies have achieved substantial savings and reduced wastes. Chemical management providers are no longer compensated based on the volume of chemicals they sell to their customers, but on value-added services instead. With appropriate incentives, providers are rewarded for reducing chemical usage (and costs), increasing productivity, or decreasing waste.
Materials Handling A number of companies are switching to reusable packaging systems. 3M recently launched an Eco-Efficient packaging business, and GM has a well-established reusable pallets and containers program.	By working closely with suppliers, GM successfully switched to reusable packaging systems and reduced its disposal costs by $12 million between 1987 and 1992. Additionally, reusable containers can reduce solid waste, decrease product damage during shipping, and eliminate ergonomic and safety problems (e.g., cuts while slicing open boxes).
Storage Several companies have changed their inventory storage procedures for maintenance, repair, and operating (MRO) materials by consolidating storage areas and requiring suppliers to adhere to stringent material return policies.	Public Service Electric and Gas Company streamlined its purchasing and storage processes and saved more than $2 million in 1997. The changes significantly decreased the disposal of obsolete paint and other materials, reduced storage space requirements, and lowered carrying costs. Previously, these costs had been hidden in overhead accounts.

Box 3. What are the Benefits to SMEs, Customers, and Consumers? (Source: Ref. 10)

SMEs	Customer (Corporation) Benefits:	Consumer Benefits:
-Cost reductions through increased resource and process efficiency -Enhanced customer value through environmentally friendly image -Increased competitiveness over other companies without environmental mandates -Reduced environmental impact, as well as an improvement to health and safety risk management -Potential for increased attractiveness in Europe and Japan where green products are more aggressively sought out	-Enhanced communications and relationships with suppliers -Ability to complete requirements of an EMS relating to addressing suppliers -Positive media attention & ratings from socially responsible investment groups -Decreased waste disposal costs -Mentorship of small businesses to improve environmental management	-Ability to have an impact on the way businesses conduct themselves -Assurance they are reducing their impact on the environment by using a particular product or service -Easier access to eco-friendly products

Examples of GSC Leaders

The following "leadership" practices have been chosen as illustrative examples (and we shall introduce more examples and case studies of the benefits they have achieved when implementing GSC). They are intended to represent innovation, higher-than-average commitment, unusual industry practice, or a comprehensive approach to this issue.

Agilent Technologies

Agilent Technologies has a Supplier Environmental Management Program that "monitors and aims to improve the management of environmental issues within our supply chain." The company shares its own environment and sustainability policy with its suppliers and encourages them to implement sound environmental management practices. Suppliers that provide components used in Agilent's products must meet environmental specifications restricting the use of hazardous and environmentally sensitive materials. Agilent periodically reviews the environment, health, and safety practices at selected suppliers. Based on these reviews, Agilent creates a development plan to help improve performance at suppliers that do not meet Agilent's environmental expectations.

Boeing

Boeing takes a very collaborative, capacity-building approach to its engagement with suppliers on environmental issues. The company sponsors Supplier Technical Exchange forums every 18 months to collaborate on common environmental challenges. During these week-long events, Boeing brings together 40–50 people from Boeing and representatives from the company's key suppliers to exchange ideas and work jointly to address environmental issues, such as lifecycle assessment. The company has also worked one-on-one with suppliers to help them find environmentally preferable substitutes for hazardous materials. In some cases, the company has reworked parts drawings to allow suppliers to undertake design-for-environment projects and to use substitutes for materials that pose environmental concerns.

Ford Motor Company

Ford Motor Company is requiring ISO 14001 certification from all of its suppliers with manufacturing facilities. ISO 14001 is the environmental management standard under which independent auditors evaluate an organization's environmental performance in a systematic way. Specifically, Ford required suppliers to certify at least one manufacturing site to ISO 14001 by the end of 2001 and all manufacturing sites shipping products to Ford by 1 July 2003. The requirement affects about 5,000 of Ford's production and non-production suppliers with manufacturing facilities. To help suppliers meet these goals, Ford developed and provided ISO 14001 Awareness Training to allow suppliers to

benefit from Ford's experience in achieving ISO 14001 certification at its plants. The company also has a supplier-owned reusable container program in place to reduce packaging waste for its North American plants. As part of its World Excellence Award process, Ford Motor Company has created Environmental Recognition awards that recognize suppliers for outstanding environmental achievement and innovation. The company also established an internal Global Supply Environmental Management Forum to develop global supply initiatives across all its brands and regions to provide suppliers with a unified set of environmental requirements, tools, and training.

McDonald's

McDonald's is not a manufacturer but it is driving good environmental management upstream into its supply chain. Recently it has instituted a sustainable fisheries program and works with its packaging supplier. In 2002, McDonald's partnered with five key suppliers that process agricultural raw materials into food products that are important for its menus – beef, pork, chicken, potatoes, and bakery items. Together, they developed a scorecard tool that allows them to monitor their most significant direct environmental impacts: solid waste, energy use, and their impacts on water supplies and air quality.

The scorecard was piloted in 12 plants in five countries. The results indicate that this helped them control and, in many cases, substantially reduce their impacts. McDonald's is now rolling out the scorecard to all of its suppliers of the five food product types, beginning with those in the UK and Australia. One of the supplier experts who worked with McDonald's on the scorecard – Tom Kazas of McCain Foods – makes a point about environmental management that is directly related: "The gains we make...generally have a positive effect on the economics of our operations in the long term. Green behavior pays dividends." This is true about a lot of corporate social responsibility efforts.

Starbucks

Starbucks developed a Preferred Supplier Program in 2002 to encourage more sustainable production of coffee beans. The company worked with the non-profit group Conservation International's Center for Environmental Leadership in Business to develop a set of Coffee Sourcing Guidelines that include performance criteria on quality, environment, and social conditions. In order to participate in the program, suppliers submit applications documenting their sustainability measures that meet the guidelines. Starbucks provides participants with financial incentives as well as preferred supplier status. Starbucks requires that an independent third party verify the information in applications. More than 50 growers applied to the program in its first year.

Unilever

Unilever launched a Sustainable Agriculture Initiative to foster more sustainable practices among farmers, because agricultural commodities comprise more than two-thirds of the inputs to Unilever's branded products. The company created a Sustainable Agriculture Advisory Board of outside experts from leading environmental groups, universities, and research institutions to help provide independent advice and evaluation of the Initiative. With their input, the company created 10 broad indicators of sustainability in agriculture. The company is pilot testing these indicators with five key crops. These pilot tests apply to Unilever's owned and operated tea and palm oil plantations, and to contract farmers who produce spinach, tomatoes, and peas for Unilever. Pilot projects under the Initiative have helped farmers decrease their use of chemical pesticides and fertilizers and reduced water use. Unilever is now working to enroll more of its contract farmers in the program, share its findings with other agricultural companies, and encourage its contract farmers to extend more sustainable practices to all crops they grow.

Samples of GSC Policies

The following sample policies are taken directly from company materials to illustrate how they implement GSC within their corporations.

Hewlett-Packard

HP's website describes its policies around Supply Chain Social and Environmental Responsibility as follows:

> "Today, more than 80% of our products are manufactured for HP through alliances and partnerships and the expectations we set for our major product material suppliers, suppliers that

manufacture HP's parts, components and products, are a key aspect of our social and environmental performance.

"HP has had a long-standing commitment to social and environmental leadership around the world. Our global and corporate citizenship commitment is not only limited to what goes on inside our company walls but also extends to our suppliers. We expect our suppliers to act as responsible corporate citizens and take a positive, proactive stance regarding environmental, occupational health and safety and labor issues.

"To ensure that we minimize the environmental and social impact of our worldwide design, manufacturing and operational practices we have:

- Expanded our supplier environmental expectations to formally include health, safety, labor and human rights practices;
- Obtained upper-level management's support for a new Supply Chain Social and Environmental Policy and Supplier Code of Conduct;
- Strengthened our supplier contract and purchasing agreements to reflect our new expectations;
- Formalized and widely communicated our compliance monitoring process; and
- Developed requirements for supplier performance reporting and corrective actions for non-compliance.

"We acknowledge the external demand for higher levels of transparency on our supplier metrics, performance and results and we are working aggressively to improve our ability to measure, track and report our environmental and social impacts globally.

"At HP we are dedicated to working closely with our suppliers to continually improve our processes and results around social and environmental responsibility."

Sony

Sony's report on the highlights of its social and environmental programs for fiscal year 2001 notes:

"Sony designates suppliers that cooperate in the production of environmentally sensitive products as Green Partners. Sony established the Sony Green Partner Standards in July 2001 with the aim of encouraging suppliers to introduce Green Partner environmental management systems. In March 2002, Sony established a set of 'Management regulations for environment-related substances to be controlled which are included in parts and materials.' Environment-related substances to be immediately banned or reduced were identified, as well as their applications. The regulations were enforced the following July. Together with this action, items required of suppliers under the Sony Green Partner Standards were further clarified by introducing the 'Green Partner Environmental Quality Approval Program.'

"Under this program, Sony auditors visit suppliers to check environmental management activities. If suppliers meet Sony's standards, they qualify as Green Partners.

"From April 2003, Sony will procure parts and materials for its products solely from suppliers that have qualified as Green Partners. This qualification will be one requirement for suppliers wishing to both start and continue doing business with Sony. Furthermore, Green Partner suppliers are required to work continuously to maintain and upgrade their environmental management systems. Specifically, suppliers are required to reduce and eliminate environment-related substances as prescribed in the management levels listed by substance and application in Sony's 'Management regulations for environment-related substances to be controlled, which are included in parts and materials.' Suppliers must renew their Green Partner approval every two years."

Kinko's

The following is a portion of Kinko's Forest-Based Products Procurement Policy, released in April 2003:

"Kinko’s will:

- Not knowingly purchase any paper or wood products that are derived from the harvesting of old-growth, endangered or high conservation value forests (as mapped by World Resources Institute, Conservation International). Suppliers must be able to document compliance.
- Actively manage and engage forest-based products suppliers to ensure the company does not align itself with organizations that operate outside Kinko's guidelines.
- Continue working with organizations, other large consumers of forest-based products, and external stakeholders to assist in identifying suppliers that meet our requirements.
- Require that suppliers must have audited procurement system or conduct audits to ensure certifiable chain-of-custody procedures for third-party raw material by the end of 2003.
- Only purchase forest-based products from suppliers that have independently third-party certified, well-managed forests by the end of 2004."

Kaiser Permanente

A Kaiser Permanente press release on environmental initiatives reported on the company's Environmentally Preferable Purchasing initiative:

> "Kaiser Permanente incorporates environmental considerations into targeted national contracts. These considerations include:
>
> - Reducing the toxicity and volume of waste.
> - Increasing post-consumer recycled content.
> - Selecting reusable and durable products.
> - Eliminating mercury content.
> - Selecting products free from polyvinyl chloride (PVC) and di-2-ethylhexyl phthalate (DEHP).
>
> "Recent successes include replacing three DEHP-containing medical products in the neonatal intensive care units with alternatives, ensuring the continued elimination of mercury containing medical equipment from standards, and negotiating a national recycling contract. Kaiser Permanente purchasing standards include 30 percent post-consumer content office paper, mercury free and latex free products."

Fujitsu

Fujitsu's website includes a form for suppliers to notify the company of environmentally preferable products. The form states:

> "Fujitsu decides the company from which to procure a product based on a comprehensive list of economic factors, such as the specifications, quality, delivery date, and price of the product. However, Fujitsu also gives careful consideration to the product's impact on the environment. Fujitsu is actively engaged in Green Procurement (procurement of materials, parts, products, and production equipment in which environmental impact is given careful consideration) and widely solicits proposals for enhancing this approach from our trading partners."
>
> "Fujitsu defines superior environmental performance as those products or services that avoid toxic substances, conserve resources and energy, promote recycling, and/or are easy to process and dispose."

J. Sainsbury plc

The company's 2002 Environmental Report includes the following statement:

> "Goal: Influence our suppliers to reduce their direct environmental impacts and improve the environmental quality of own-brand products through more sustainable sourcing.
>
> "Every product we sell has some impact on the environment as part of its lifecycle; in the way it is grown, transported, used or disposed of, or in the way it is manufactured.
> "Through our integrated product policy we aim to influence our suppliers to reduce their direct environmental impacts and improve the environmental quality and performance of own brand

products through more sustainable sourcing.

"Supplier Program -- 'Raising the Standard'

"Sainsbury's Supermarkets has the largest number of suppliers of own-brand products for resale in the Group. It has developed Guidelines called 'Raising the Standard' and issued them to all own-brand suppliers, after piloting them with a number of suppliers. The Guidelines cover:

- Meeting legal requirements.
- Being aware of and managing current and future environmental issues.
- Managing environmental effects of production.
- Reducing environmental impacts of product lifecycle.
- Adopting Environmental Management Systems (EMS) wherever possible."

3.3 Implementing the GSC Program

Where and How You Can Apply GSC?

Companies need to recognize that they have to identify, understand, and manage issues within their own organization before they start working with other organizations in their supply chain to ensure that these issues are successfully managed throughout. A supply chain can be rather complex: commodities represent a significant part of the export market, manufacturers and logistics companies, and retailers and the public or service sector.

SUGGESTION: Once an organization decides to implement GSC, it should identify environmental issues (and impacts) along the supply chain and investigate opportunities for improvement.

Box 4: Product and Service Characteristics (Source: Ref. 4)

Physical Supply Chain	Raw Materials	Manufacturing Plant	Warehouse	Transport	Distribution Centre
Physical aspects of Supply Chain	Crops and Commodities Imports Manufactured Internal Transfers	Assembly Processing Manufacture	Temperature Regime In house or Third Party Storage: Pallet & packaging: pallet configurations	Road, rail, sea, air In house: Third Party: Customer collect on store-returning vehicles	Automated versus manual: Design and layout Picking optimisation Vehicle choice and utilisation
Sustainability issues/ Opportunities	Raw Material Waste Dependence of local economy on traditional agriculture Local jobs Fuel use Internal resources	Waste created Energy use Water pollution Emissions Safety Health impacts eg reduce manual handling: noise levels Productivity	Energy use Reduce packaging waste Social impact of long/unsocial hours Repetitive handling Pay and conditions Inventory management	Fuel usage Emissions Noise Impact on transport infrastructure Full loads in both directions where feasible Work life balance Road accidents	Scheduling: Improve traffic flows Reusable tays and pallets Reverse logistics Unsocial hours – round the clock shifts Economies of scale from buying direct from supplier

From your supply chain, a simplified method would be to look at product or service characteristics with an eye to identifying issues such as pollution prevention, resource efficiency, and lifecycle perspectives before purchasing (as suggested in Table 5).

Table 5. General Environmental Impacts along the Supply Chain

Product/service characteristics	Pollution prevention	Lifecycle	Resource efficiency
Material composition	Non-toxic, biodegradable, bio-based	Recycled, reusable, renewable resource	Consumes less water or energy, recycled content
Transport	Produced locally, non-petroleum-fueled transport	Administrative or logistical costs	Fewer shipments, shipped by rail or boat, larger quantities, backhaul
Manufacturing	Utilizes best practices, continuous improvement	Environmental management system, improved compliance	Reduced material waste
Packaging	None or reusable	Requires no special handling	Thinner packaging, recycled content
Product use	Repairable, reusable, upgradeable, safe, non-polluting	Long life, durable, reusable	Low energy demand, easy to use efficiently
End of life	Reusable, fewer incidents	Disposal without long-term liability	Fuel blend, less to be disposed of

GSC programs will vary according to a company's product lines, customers, supply base, structure, and culture. Nevertheless, successful GSC programs generally involve the same characteristics as *GP programs*, as shown in Table 2. We now apply the GP approach of 6 steps and 13 tasks to implementing a GSC program.

Step 1: Getting Started on a GSC Program

Box 5. An SCEM Program Applied to Clothing (Source: Ref. 8)

> A clothing manufacturer marketing to a high-end customer base thought of itself as “one big supply chain”. Therefore this company set about modifying that supply chain to meet the demands of sustainability. From the plant fibers used to make their textiles to the dyes used in their coloring to the kind of materials used to make display racks and packaging, the company sought the most benign materials available. Where not available, this company embarked on joint ventures to create new materials. Over time, the information gathered was redeployed in an educational program to inform consumers and others about what had been learned about environmental impacts and alternatives.

Task 1: Team Formation

Who should be a team member?

Successful GSC programs often involve all the different areas within a company that can gain value from interacting with business partners. These areas frequently include procurement, environment, health and safety (EH&S), manufacturing, marketing, research & development, and distribution. In addition, leadership companies often include EH&S staff on design and/or procurement teams to help

achieve the company's environmental objectives. Identifying a leader establishes accountability. This may be difficult for companies with particularly complex supply chains. A coordinator can research products and work with users. Companies may find that appointing a supply chain manager with overall responsibility for purchasing and supply chain logistics will provide the necessary focus.

Task 2: Information Collection

What types of information are required and are there cost-effective methods of collecting the information?

The two main types of information that will need to be collected in order to start a GSC program are (1) information relating to the environmental impacts or sustainability issues of the products/services of the organization, and (2) information about its business partners. Each company imposes constraints on the types of information it can request from its business partners. These must be relevant to the contract and care should also be taken not to put an undue burden on suppliers.

Table 6. Pros and Cons of Data Collection Methods (Source: Ref. 9)

Method	When	Pros	Cons
Meetings and Structured Seminars	From the Beginning and Throughout	Informal Opportunity for clarification Opportunity for feedback Key to partnership style Builds commitment and understanding	Hard to make and systematic Resource intensive Information collection less detailed
Questionnaires	Contract Monitoring Vendor Rating Preliminary Supplier Evaluation (selectively)	Consistency Resource efficient Large quantities of information Flexible Useful where purpose is clear (with training)	Open to misinterpretation Do not build commitment and understanding Mixed quality of information May require validation
Site Visit	Supplier Evaluation Vendor Rating	Best quality of information Useful for collecting large volumes of information Opportunity for suppliers to share benefits/value Build commitment and understanding Can be independent Can be systematic/structured Opportunity for detailed examination and problem solving	Resource intensive Can be intrusive unless handled correctly

Once suppliers are contracted, however, a buyer can ask for any information covered by the contract conditions. It can enforce specified requirements and contract conditions, for example by spot checks and the provision of documentary evidence of compliance. It can choose also between regular monitoring meetings with its suppliers, site visits, supplier seminars, and questionnaires. Time and resource constraints will determine which is the most suitable. The advantages and disadvantages of different data collection methods are presented in Table 6. Sections 3.1 and 3.2 have already provided information on the reasons for greening the supply chain, the key drivers of GSC, the definition and scope of GSC, its business value and benefits, and the leaders' examples. All this information will assist your organization to proceed with implementing GSC.

Views and suggestions from business partners

Business partners' views, perspectives, and suggestions are also important sources of information that should be collected in planning a GSC program:

- Motivated by requests not to supply products with restricted substances
- Need more collaboration across the supply chain
- Customers will truly integrate environmental expectations into purchasing decisions
- Customers can help bear costs of change
- Customers and suppliers can work together
- Address supply chain through their own suppliers

- Ability to tap emerging market suppliers for less sophisticated products as well as manage associative risks
- Supplier audits on environmental issues require a cross-functional initiative involving employees from quality assurance, environmental affairs, and purchasing

Further information and resources

Further information and resources may include case studies, references, and promoting organizations. The case studies in Section 6 and the references listed at the end of this Manual provide additional information to assist your GSC program. The following list of promoting organizations is not comprehensive. It is illustrative of the many national and international, nonprofit, public sector, and/or academic organizations working with the private sector in the area of supplier environmental management (SEM). The resources identified below have been included because they provide information or support that is relevant to companies and they are national or international in scope. Working with trade associations can raise awareness to develop frameworks for improving the environmental performance of suppliers.

The Institute for Supply Management

The Institute for Supply Management (ISM), formerly called the National Association of Purchasing Management Inc. (NAPM), is the key professional trade association for purchasers, serving more than 40,000 members through a network of over 180 affiliated organizations. The Center for Advanced Purchasing Studies (CAPS) is the organization's research affiliate. ISM's website provides a large amount of detailed product and membership information; links to regional offices, CAPS, and purchasing resources; and access to the latest national *Report on Business*, a monthly survey of purchasing trends. (www.ism.ws)

Box 6. Chemical Services Industry Models (Source: Ref. 9)

Model	What is for Sale?	How is it Priced? Net Result for Cost Savings and Environmental Opportunities
$/lb.	Chemical is sold by volume	Suppliers have no incentive to help customers use their products efficiently - in fact, just the opposite.
$/lb. + Services	Chemical is sold by volume Higher price includes some consulting services	Services associated with the proper use/handling of the chemicals are a more prominent component of the relationship. These services might involve logistics, ESH/compliance, and applications. This strategy is an initial market differentiator for the supplier.
Chemical Management	Chemical is sold by volume Management services sold on itemized basis	Supplier brings greater expertise to performing chemical management activities previously handled by customer. Management fee reduces incentive to increase chemical sales for higher revenues. This model is good first step towards increased collaboration.
Shared Savings	Supplier is paid a fixed fee to meet the "chemical performance needs" of the customer.	Supplier and customer's goals to reduce waste and save money are financially aligned. Both parties make money by reducing chemical use over time.

Chemical Strategies Partnership

The Chemical Strategies Partnership (CSP) promotes the reduction of chemical use through a new model in customer–supplier relationships in which chemical suppliers are rewarded for chemical service instead of chemical sales. The CSP Program helps a manufacturer evaluate the efficiency and costs of its current chemical management system. CSP is expanding the website to include a step-by-step CSP Manual, which helps companies assess whether they want to implement a chemical services program, how to recruit a chemical service provider, and how to develop financial incentives. (www.chemicalstrategies.org)

International Green Purchasing Network

The International Green Purchasing Network (IGPN) promotes green purchasing around the globe by coordinating those who take the initiative in implementing green purchasing toward sustainable consumption and production. The network consists of international organizations, local authorities, and non-governmental organizations (NGOs). (www.igpn.org)

Supply Chain Working Group

Business for Social Responsibility (BSR) serves as a convener for the Supply Chain Working Group, a group of companies interested in sharing ideas on how to improve economic and environmental performance in their supply chains. The group is working with BSR to identify leadership company practices in supplier environmental management and to create new and better tools for implementing and measuring the results of supply chain management programs. (www.bsr.org)

ICLEI – International Council for Local Environmental Initiatives

ICLEI was founded in 1990 when more than 200 local governments from 43 countries convened at its inaugural conference, the World Congress of Local Governments for a Sustainable Future, at the United Nations in New York. ICLEI—Local Governments for Sustainability is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. More than 550 cities, towns, counties, and their associations worldwide comprise ICLEI's growing membership. ICLEI works with these and hundreds of other local governments through international performance-based, results-oriented campaigns and programs. (www.iclei.org)

Global Environmental Management Initiative

The Global Environmental Management Initiative (GEMI) is based in Washington, DC and is a nonprofit organization of leading companies dedicated to fostering environmental, health, and safety excellence and corporate citizenship worldwide through the sharing of tools and information between businesses. In 2001, GEMI published a guidance document (Ref. 9) designed to address the business value of managing Environment, Health and Safety (EHS) in Procurement. It includes useful tools and case studies. (www.gemi.org)

The Pacific Northwest Pollution Prevention Resource Center

The Pacific Northwest Pollution Prevention Resource Center (PPRC) is a nonprofit organization based in Seattle, Washington, that works collaboratively with business, government, NGOs, and other sectors to promote environmental protection through pollution prevention in the Pacific Northwest of the US. The organization’s website includes a useful set of case studies and resources on greening the supply chain. (www.pprc.org)

Suppliers Partnership for the Environment

The Suppliers Partnership for the Environment is a nonprofit trade association that represents an innovative partnership between automobile original equipment manufacturers and their suppliers and the US Environmental Protection Agency (EPA). The Suppliers Partnership provides a forum for companies to work together to share best practices and jointly address specific environmental issues and offers facility-specific technical assistance workshops. (www.supplierspartnership.org) on greening the supply chain. (www.pprc.org)

United Nations Environment Programme’s Division of Technology, Industry, and Economics

The United Nations Environment Programme’s Division of Technology, Industry, and Economics (UNEP DTIE), based in Paris, works to help decision-makers in government, local authorities, and industry to develop and adopt policies, strategies, and practices that are cleaner and safer, make efficient use of natural resources, ensure environmentally sound management of chemicals, reduce pollution and risks for humans and the environment, enable implementation of conventions and international agreements, and incorporate environmental costs in decision-making. The DTIE also has some information on greening the supply chain on its website. (www.uneptie.org)

United States-Asia Environmental Partnership

The United States-Asia Environmental Partnership (US-AEP) is a public–private initiative based in Washington, DC, that promotes environmentally sustainable development in Asia. US-AEP is jointly implemented by several US government agencies, under the leadership of the US Agency for International Development. US-AEP's Industry Program works in areas such as ISO 14000 & EMS, Greening the Supply Chain, and Environmental Due Diligence. (www.usaep.org)

US EPA's Environmentally Preferable Purchasing Program

The US EPA's Environmentally Preferable Purchasing (EPP) program serves as a clearinghouse of information and tools to help executive agencies purchase environmentally preferable products and services. However, EPP's audience is not limited to federal agencies, because it also includes many helpful resources that relate to corporate purchasing. (www.epa.gov/opptintr/epp)

Step 2: Planning

Task 3: Identification of GSC Opportunities

GSC opportunities exist along the whole supply chain. Identify alternatives that meet your business needs, and determine which changes will produce significant cost savings and reduce environmental impacts.

Box 7. Sample GSC Initiatives Currently in Use (Source: Ref. 11)

■ Product content requirements that specify that products must have certain environmentally preferable attributes	■ Product content restrictions that specify the avoidance of certain environmentally undesirable substances
■ Product content labeling or disclosure, from information on product contents to "eco-labels" based on assessments against environmental standards	■ Supplier questionnaires about environmental aspects, activities and/or management systems
■ Requirements to implement, and sometimes certify, an "environmental management system"(EMS)	■ Audits of supplier compliance with regulatory requirements and/or with the requirements of an EMS
■ "Product stewardship" for managing products and materials "from cradle to grave", including product takeback, which requires manufacturers to take responsibility for product disposal	■ Supplier education on SCEM in general, and specific approaches such as pollution prevention, life cycle analysis and Design for the Environment
■ Direct consulting with suppliers on processes targeted for environmental improvement	■ Collaboration with suppliers during product and process design to reduce or eliminate environmental impacts

Suggestion 1: Identify potential issues affecting your supply chain

Use Table 7 to identify potential issues affecting your supply chain and where they might occur in the process.

Suggestion 2: Map your risks

Select your potential risks from Table 8 and assess their level of importance to your supply chain. Those to which you have given a significant rating, e.g. 4 or 5, are potential options where you can start.

Suggestion 3: Evaluate the items you are going to purchase

GSC is part of the purchasing function. Appendix 3 of this Manual describes a Green Procurement Decision Making Tool (http://www.pwgsc.gc.ca/greening/text/proc/decision-e.html), which is simple to use because it is built on an Excel spreadsheet. You use scores to weight the products or services you purchase, and these can help to identify opportunities for greening the supply chain. Of course, you have to collect the relevant information and set up the scoring scale based on your company's situation before you can apply the software. Select a few commodities and add up the scores for each

commodity, then the results will be automatically plotted for you on a chart. From the chart, select the commodities that are located closest to the upper right-hand corner. These have the highest opportunity for environmental improvement because, according to your assessment, they have the highest environmental impacts and the highest degree of feasibility. The example provided here shows the calculation of the environmental impacts of using a computer; from this one can identify opportunities for environmental improvement. The environmental attributes are scored on a scale from 1 to 10, and the operational requirements are scored on a scale from 1 to 20.

Table 7. Potential Issues Affecting Your Supply Chain (Source: Ref. 4)

	SUPPLIER (1st tier / 2nd tier / 3rd tier etc)			**RETAILER**		**CONSUMER / USER**		
Issues to Consider **(relating to sustainable development issues)**	Material Acquisition from primary source	Manufacture / Process	Despatch / Transport	Operations including warehousing	Product design & development	Sales & Market development	Product / Service in use	End of life
General								
Changing customer expectations								
Adverse media coverage								
Threat to brand or corporate reputation								
Government procurement requirement								
Losing alignment with corporate/employee								
No appeal to ethical investors								
Specific Issues								
Long-term supply of raw materials:								
Use of chemicals/hazardous substances								
Animal husbandry								
Short term access to supply								
Waste and packaging used								
Labor standards and practices including unsocial hours								
Local supply or overseas								
Water, air or soil pollution/emissions								
Transport; fuel; congestion								
Increase in transport costs								
Energy utilization								
Increased operating costs, eg. energy, fuel, waste disposal								
Regulatory requirements								

Box 8. Environmental Impacts of Using a Computer

Environmental attributes (Y-axis)	Use	Disposal	Operational requirements (X-axis)	Overall
Greenhouse gas emissions and air contaminants	10	10	Volume and frequency of purchase	12
Energy and water efficiency	10	5	Costs related to the environmental impacts	20
Ozone depleting substances	1	10	Usability and effectiveness of alternatives	20
Waste and supporting reuse and recycling	5	10	Feasibility and accessibility of alternatives	20
Hazardous waste	1	10	Minimal risk of liability (corporate and personal)	20
Toxic and hazardous chemicals and substances	1	7	Costs and level of effort related to green procurement are reasonable	20
Other			Other	
Total	28	52	Total	112
Grand total		80		

Table 8. Mapping Your Risks in Your Supply Chain (Source: Ref. 4)

Risk Monitor

Environment | Social | Economic | 5 is highest risk

Supply Chain	Issue	Risk	Examples	Rating 1-5
Procurement	Sustainable source of raw materials including all components	Chain of custody is uncertain. May result in consumer concern/NGO activity; Ineligibility for public/private tenders	Retailers request GM-free – foods and non-foods; NGO activity relating to deforestation; UK Govt procuring doors & desks for Whitehall from endangered species	
	Use of chemicals/hazardous substances.	Product safety scare. Precautionary Principle might be applied in certain countries. Product recall	Pesticides in produce. Marks & Spencer ban PVC.	
	Animal husbandry: Breeding; Feeding; Food supply	Loss of business because chain of custody cannot be proved	See Richmond case study – need to demonstrate animal husbandry.	
	Long-term supply	Source drying up will threaten economic viability	Fears for long term-fish supply prompted development of MSC; Maui gas supply; Toyota developed hybrid vehicle recognizing diversifying energy supply.	
	Short-term supply	Insufficient product to fulfill demand	NZ police not able to source enough LPG vehicles.	
	Waste and packaging	Insufficient use of resources. Cost to business	Cost of landfill – levies and charges	
	Labour standards and practices. Conditions do not conform to ILO standards	Media scrutiny; boycotts; Loss of business, eg., ineligible for public/private tenders	Overseas labor conditions, eg., Nike; Gap.	
	Supplier dependence and viability	Eliminating a supplier from supply base might close their business and cause public outcry	Marks & Spencer's decision to move some of its supply base from UK to overseas.	
	Fair pay for suppliers	Sustainability of supply base and potential adverse publicity	Coffee supply; Fair Trade products	
	Inventory levels	Negative impact on cash flow	Companies left with seasonal stock due to inefficient procurement	
	local supply or overseas	Buying local may be more expensive and problems with continuous supply	Sainsbury prefer local produce supply – selling $6bn worth per year	
	Escalating cost of supply	Economic viability of product or services	Increase in fuel costs; Energy costs which cannot be passed on to end consumer	
Internal Operations	Water; air or soil pollution/ Contamination	Effect on reputation in local and wider community. Cost of remediation and risk of lawsuits	*Prestige* oil spill; Potential effect of any phosphate/nitrates land pollution to "clean, green NZ" image.	
	Perceived health impacts from local emissions	Effect on reputation in local and wider community. Cost of remediation and lawsuits	PCBs; Mobile phone masts; Incinerators	
	Waste management	Increased costs of disposal to landfill	Potential taxation	
	Work/Life balance of employees; unsocial hours	Retention of staff. Additional costs of recruitment. Potentially punitive costs for stress in the workplace or lawsuits	Impact of Occupational Health & Safety Amendment 2003	
	Labor standards and practices; Pay & conditions	Staff retention; Strikes; Absenteeism; Claims	Wal-Mart challenged about trade unions; Strikes	
	Increased cost of fuel; Energy; Delivery method	Economic viability of product or services	Plant closures on temporary basis because of high power costs	
	Increased delivery times due to congestion	Increased resource costs; Service delays to customer; Impact on drivers; Road accidents	See Progressve case study	
	Inefficient operations/Poor productivity/Cost of overhead	Economic viability of product or services; Higher direct and indirect costs; Effect on competitiveness	Companies outsourcing or setting up lower-cost operations overseas.	
Product Development & Stewardship	Impact and efficiency of product in use	Adverse publicity; Product boycott; Reduction in market share	Major recall of Firestone tires because of product fault	
	Cost or suitability of raw materials increases. Need to find substitutes	Financial impact	Search for alternatives to materials such as PVC	
	End-of-life collection and disposal	Loss of market share; Non-compliance with potential legistlation in home or overseas market	Mobile phones; Car parts; White goods	
	Product traceability; Bar codes and labels	Costly recall if unable to pinpoint batches of product	Pan Health products recall	
	Packaging and materials: need to match packaging to product requirements	Increased costs from overpackaging; Legislation in some markets relating to takeback systems, eg., bottles, cans	Returnable levies on bottles in some countries	
	Customer demand	Loss of market share	First mover gains: Shell, Nike	
	Increased cost of product/service because of increases in raw materials; Energy; Advertising	Market viability; Loss of market share	Pulp prices effect on the paper industry – can increase the price differential between sustainable and non-sustainable pulp supplies	
	Investor appeal	Exclusion from ethical indices	DJSI, FTSE4Good	

Task 4: Setting Targets

Once the opportunities have been identified, it is necessary to set targets. These should be specific, measurable, and attainable.

Table 9 shows the GSC targets of the GSC leaders. You need to define how purchasing can support your department's strategy for greening its operation and set your own targets.

Table 9. GSC Targets of the Leaders

GSC leaders	Examples of GSC targets
Sony	30% reduction in power consumption and 20% reduction in resource input in 2005
Ford Motor Company	Requiring ISO 14001 certification from all of its suppliers with manufacturing facilities by 2003
Samsung	All main products obtained Korean type3 Eco-labeling in 2006
HP	Recycle 1 billion pounds of IT products by 2006 and another 1 billion pounds by 2010

Step 3: Generation, Evaluation, and Prioritization of Options

Task 5: Generation of GSC Options

You need to generate GSC options related to both your business partners (external options) and your own company (internal options).

Options related to business partners
There are many GSC options enterprises can choose from, a lot of them related to suppliers, contractors, and service providers. The details are presented step by step in Section 4 of this Manual. Below is a general review and discussion of the options available.

- **Processes for approving and evaluating suppliers.**
  GSC programs typically establish a formal process for approving potential suppliers and evaluating the environmental performance of ongoing suppliers. These programs set specific environmental criteria that some or all suppliers must meet, and companies may include these environmental criteria in their supplier contracts. Some leadership companies focus their efforts on first-tier suppliers and on suppliers that handle significant quantities of hazardous materials. Environmental performance reviews, including a combination of supplier questionnaires, onsite visits, and formal environmental assessments, are often used to evaluate suppliers' progress in meeting environmental goals and continually improving their environmental performance. Some companies require that suppliers' environmental programs be certified by an independent organization.
- **Purchasing guidelines.**
  Direct purchasing professionals need to minimize any adverse environmental impacts directly associated with goods and services purchased by the company. At a minimum, purchasing decisions must consider source reduction, availability of recycled materials, recyclability/reusability, renewable resources, hazard reduction, process waste reduction, handling and disposal, environmental technology, energy efficiency, and suppliers' environmental commitment.
- **Joint problem-solving.**
  By engaging suppliers in joint problem-solving, companies can leverage the expertise of suppliers to address their common environmental and business goals. Many companies have indicated that they learnt useful best practices from their suppliers, including some that are much smaller than they are. Companies with GSC programs often encourage their suppliers to take an active role in problem-solving, and even to act as a consultant to the company. The early integration of suppliers into all decisions affecting them is critical to environmental effectiveness. Collaborative efforts might include developing cleaner technologies, building environmental considerations into product design, and performing lifecycle analysis of products and materials.

Box 9. A Collection of Environmentally Related Suppliers' Initiatives (Source: 13)

Prequalification of suppliers

- Require or encourage environmental criteria for approved suppliers
- Require or encourage suppliers to undertake independent environmental certification

Environmental requirements at the purchasing phase

- Build environmental criteria into supplier contract conditions
- Incorporate EHS staff on sourcing teams

Supply base environmental performance management

- Supplier environmental questionnaires
- Supplier environmental audits and assessments

Build environmental considerations into product design

- Jointly develop cleaner technology with suppliers
- Conduct life cycle analysis in cooperation with suppliers
- Engage suppliers in design for environment (DFE) product innovation
- Coordinate minimization of environmental impact in the extended supply chain
- Develop tools that assist in the DFE effort

Cooperate with suppliers to deal with end-of-pipe environmental issues

- Reduce packaging waste at the customer/supplier interface
- Reuse/recycle materials in cooperation with the supplier
- Launch reuse initiatives (including buy backs and leasing)

Reverse logistics

- Give supplier an incentive to reduce the customer's environmental load

Influence legislation to facilitate better SCEM policies

- In cooperation with suppliers, lobby to strengthen environmental regulation
- Lobby on behalf of SCEM initiatives

Work with industry peers to standardize requirements

- Create interfirm procurement group to collaborate on environmental issues
- Standardize supplier questionnaires

Inform suppliers of corporate environmental concerns

- Issue statements of EHS priorities to suppliers
- Draft and distribute comprehensive SCEM policy

Promote exchange of information and ideas

- Sponsor events to facilitate discussions between customers and suppliers on environmental issues
- Host training and mentoring programs.

Internal GSC options

These are some options on internal policy, decision-making, strategy, and practice that enterprises can consider in greening their supply chain.

- **Resource conservation and eco-efficiency**
  Evaluate all the materials purchased worldwide.
- **Purchasing policy**
  Review your purchasing policy to buy products and services that will generate fewer environmental impacts, and review your purchase specifications and contracts to include environmental performance standards or requirements.
- **Awards/recognition**
  Some companies have instituted awards to recognize environmental achievements by their internal staff and suppliers, and these could be extended to cover supply chain environmental management programs.
- **Perform a product lifecycle cost analysis**
  Look beyond purchase price when making purchasing decisions. Consider the costs of operations and maintenance, worker exposure, and waste disposal. These extended costs are often hidden, and can reveal previously unrecognized savings.

Box 10. Procurement Roles and Value Opportunity (Source: Ref. 9)

	Value Opportunity in Product Life Cycle	Procurement Role
1	Redesign of company's product or service	Describe available supply options, facilitate collaboration with expert suppliers, and help craft accurate purchasing specifications.
2	Redesign for process improvement	Describe available supply options and facilitate collaboration with expert suppliers, and help craft accurate purchasing specifications.
3	Decision to subcontract process	Conduct a make or buy analysis.
4	Streamline materials management (integrated procurement or inventory minimization)	Facilitate collaboration with other departments and suppliers to optimize whole-system supply chain performance.
5	Obtain better products and services	Identify and propose superior alternatives. Select new suppliers and/or work with current suppliers to improve supplier quality and process. Perform quality assurance checks.
6	Improve in-coming transportation and logistics	Assess total costs of logistics system and develop appropriate control mechanisms.
7	Improve supplier processes	Monitor process, provide education and suggestions, and facilitate expert-to-expert collaboration.
8	Improve supplier organizational strengths (financial soundness, reliability)	Evaluate supplier management systems, screen out weak organizations, and help suppliers improve management systems.

Box 11. Greening Office Supplies (Source: Ref. 12)

Goods/ Products		Targets
Electronic Products	Computers	An institution jointly replacing more than 10% of its computers or undertaking purchases to a corresponding extent should take care that the computers purchased belong to the 10% of the least environmentally damaging brands in terms of production and that they operate at the lowest energy consumption standard available. Finally, it should be possible to dismantle the computers after use in order to recycle them / their materials.
	Printers	All printers are required to perform double-sided printing and should fulfil the state-of-the-art minimum performance demands for printers.
	Photocopiers	All photocopiers are required to use 100% recycled paper and should fulfil the state-of-the-art minimum performance demands for photocopiers.
Office supplies	In general	All office supplies have to be PVC-free. No organic solvents in office supplies.
	Paper	Paper and stationery should be unbleached and consist of 100% recycled paper. Paper for photocopiers unable to use 100% recycled paper has to contain at least 50% recycled fibres.
	Ring binders and magazine cassetes	At least 50% of ring binders and magazine cassettes have to be made of recycled cardboard.
	Toner	All toner cassettes have to be reused. All inkjet cassettes have to be reused.
Cables/ Pipes		All cables purchased have to be PVC-free. Purchasing PVC-free cables, however, should not considerably reduce the competitive power of the institution and may not lead to significant additional expenses. After January 1, 2005, however, all cables purchased have to be PVC-free. All pipes purchased have to be PVC-free under the precondition that less environmentally damaging substitutes exist. Purchasing PVC-free pipes, however, should not considerably reduce the competitive power of the institution and may not lead to significant additional expenses. After January 1, 2005, however, all pipes purchased have to be PVC-free.

- **Contracting for services**
  Service agreements with no written environmental performance standards allow a contractor flexibility to operate under its own environmental management system. Contract agreements provide a strong leverage point for requiring improved environmental performance standards. Purchasing professionals have tremendous buying power. Suppliers in a competitive relationship with other suppliers and suppliers seeking to gain a preferred position have the motivation to respond to your customer needs.
- **Leasing equipment or consumables**
  Evaluate whether the equipment or consumable you are currently buying could be more cost effective if the supplier "leases" or provides a "service." Under a leasing system, customers pay for the use and maintenance of a product, and actual ownership of the product remains with the manufacturer. At the end of the product's useful life, the manufacturer is responsible for disposal. The lessee thus obtains use of high-quality equipment that is regularly upgraded. In addition, the lessee can avoid disposal costs. The lessee also can retain high-value equipment that delivers more revenue over its life.
- **Increased communication among purchasing operations**
  If you have a fragmented purchasing system (each department responsible for purchasing its own materials), then develop a coordinated purchasing system. This allows for purchasers to apply standard criteria for evaluating and purchasing products. Coordinated purchases can better leverage volume with a supplier. This system also provides better inventory control so products are not "over purchased," which causes many products to expire on the shelf. Once expired, these products then need to be disposed of properly.
- **Buying energy**
  Restructuring of the electric utility industry has allowed purchasing departments to choose among power supplies. Renewable sources of energy can now be purchased instead of power from coal or other fossil fuels.
- **Buying office supplies**
  A tremendous number of office products are now available that are made from recycled content and are energy efficient. Buying these products helps conserve natural resources.
- **Buying or receiving "demo" products**
  "Demo" products used for testing purposes become waste products once the tests are complete. Often these products need to be disposed of as a hazardous waste. Do not accept products for trial runs if the manufacturer or manufacturer's representative will not take back the product or provide you with disposal options.
- **Consider products certified by third parties**
  A product designed around a single attribute such as recycled content, energy efficiency, or bio-based materials may not "make the grade" as a green purchase. To do so, an evaluation based on multiple, diverse attributes such as chemical composition, toxicity, and biodegradability needs to occur. Third-party certifiers such as Green Seal (www.greenseal.org) or Scientific Certification Systems (www.scscertified.com) can make your purchasing decisions easier because of their work on verifying environmental performance, or else look for eco-label products such as those certified under Blue Angel or Energy Star. Those are American or European examples. In Japan, there is Eco Mark  ; in China, there is  ; in the Republic of Korea, there is  ; in India, there is  ; in Singapore, there is  ; in Thailand, there is  ; in the Republic of China, there is  ; and in Indonesia, there is  .

- **Greening your meetings**
  Bringing people together for meetings, often for several days at a time, can create a "host" of environmental impacts – from the smog and greenhouse gas emissions associated with air and ground travel to the paper, plastic, and food waste associated with feeding attendees. Marketing of the event and registration, travel to the event, hotel stays, food services, exhibition hall, and local transportation associated with meetings and conferences are major sources of waste and pollution. Review the available resources that

your organization can use to reduce the environmental impacts of meetings.

- **Greening your company travel**
  Business travel is not particularly environmentally friendly. The impacts come principally from the fuel used by planes, trains, and automobiles, and from the solid waste and other emissions associated with the billion-dollar business travel industry. Of course, transportation is not the only environmental impact of travel. Hotels, restaurants, and conference centers all require a variety of resources to operate and they produce a myriad of waste streams. Collect information from the hotels where your staff will stay during business travel to reduce the environmental and social impacts.

Task 6: Screening and Assessment of GSC Options

Evaluate criteria and resolve barriers to change

Criteria to evaluate changes and take into account your available resources may include potential cost improvements, types of environmental impact, and the barriers to change. Common barriers in implementing GSC and some suggested potential solutions to these barriers are shown in Table 10.

Other obstacles might include:

- inadequate internal knowledge and resources
- few substitute vendors
- extreme supply chain complexity
- fragmented nature of many supply chains
- behavioral changes
- lack of clarity about who should drive innovation and change

Table 10. Common Barriers to Effective Supply Chain Environmental Management and Suggested Potential Solutions (Source: Ref. 6)

Barriers or obstacles	Suggested potential solutions
Cost of environmental requirements	- "Ownership" of true cost of environmental demands; willingness to share the costs (e.g., pay a premium, help fund joint research and development) - Accurately measure and integrate savings due to waste, energy, materials conservation, and efficiency - Full cost accounting
Burdensome reporting requirements; lack of lead time	- Harmonized, streamlined surveys - Adequate preparation time - Improved data management - Web-based reporting
Lack of environmental awareness/values	- Integrate customer and supplier environmental staff into decision-making process - Improve internal education at the customer and supplier level - Collaborate or affiliate with knowledgeable NGOs
Technological barriers	- Understand processes involved before making a change in processes or materials - Be willing to pay for new technologies - Allow adequate time for R&D - Involve engineers and designers in the decision-making process - Devise equitable system for sharing innovations
Conflicting communication	- Identify the right people within divisions or departments -Create cross-sectoral teams (marketing, environmental, purchasing, accounting, engineering, design, etc.)

Compare the benefits of alternatives with the processes already in place. Use qualitative analysis or observations to consider the material and organizational impacts in your organization. A preliminary list of impacts includes: landfill space, hazardous materials, total costs, labor, and employee satisfaction.

Build criteria into your assessment system and prioritize business partners

Where possible, build any relevant environmental factors into your system for assessing products and services by: (a) providing relevant user information; (b) requiring that buyers assess relevant environmental issues as part of the procurement process; (c) holding regular meetings with suppliers and users to improve their environmental performance; and (d) constantly reviewing product specifications (e.g., can recycled materials be specified?). In addition, decide which key business partners to concentrate on: who contributes to your major environmental impacts or poses the greatest environmental risks to your own performance?

Step 4: Implementation of GSC

Task 7: GSC Implementation Plan

Secure top management support

Before formulating a GSC implementation plan, analyze the current situation and secure approval from senior management to make changes. Top-level leadership support is critical to the success of GSC programs. This type of support typically reflects a company's strong, high-level corporate commitment to environmental stewardship and a demonstrated commitment to environmental goals relating to resource conservation, waste minimization, and pollution prevention.

Integrate GSC plan into existing system

Leaders in supplier environmental management typically *merge their environmental policies and programs with their existing supply chain management activities*, including their design, procurement, and distribution processes. For example, companies can integrate environmental audits of suppliers into their existing quality assurance or supplier certification programs. Integrating GSC initiatives into existing supply chain management programs typically reduces the resources needed to implement these programs. Decide what are the most important impacts and which key suppliers to address.

Decision-making

Make a decision and implement it. Design specific initiatives around desired benefits. At first use a pilot study. Have a group committed to the implementation process. Train staff and analyze the costs and the reduced environmental impacts.

EXAMPLE OF DECISION-MAKING MODEL: Figure 5 is a suggested decision model from the New Zealand Business Council for Sustainable Development on sustaining the supply chain.

Formulate implementation plan

Examples of specific actions in a GSC implementation plan to achieve the sustainable improvements include:

- Reduce consumption (re-think the purchase) – make sure that the volume requested is really the volume required.
- Alter specification/contract terms to detail measures or product attributes that will reduce the impact of the purchase during use.
- Seek alternative goods or raw materials (always based on a cost/benefit analysis).
- Incorporate environmental criteria into supplier selection processes.
- Incorporate environmental design issues into specifications.
- Specify eco-labeled (or equivalent) goods and services, if feasible.
- Request evidence of the supplier's environmental management system during the supplier selection/appraisal.
- Engage suppliers and create awareness of environmental performance issues.
- Include environmental criteria in supplier auditing.
- Include environmental clauses in conditions of contract.

- Require suppliers to detail their proposed measures for reducing environmental impacts at end of life or on disposal as part of the specification/invitation to tender.
- Include environmental performance criteria in contract monitoring requirements.
- Exercise caution regarding "green" marketing from suppliers.

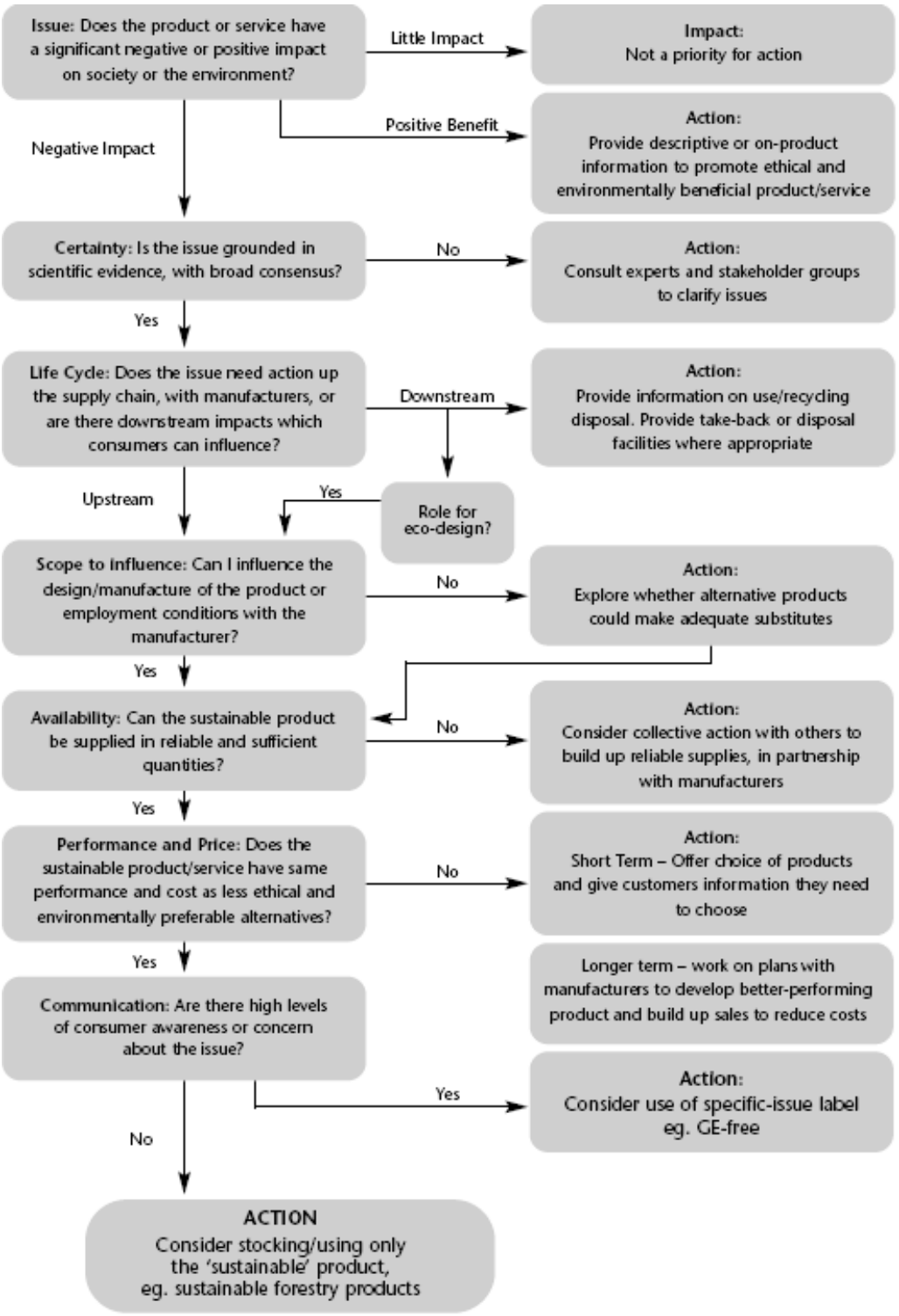


Figure 5. Sustaining the Supply Chain: Suggested Decision-Making Model (Source: Ref. 4)

Task 8: Implementation of GSC Options

Communicate effectively

Successful GSC programs typically include clear, consistent, frequent, and two-way communication with business partners about environmental issues and performance expectations. To be effective, this communication should articulate both the company's environmental goals and its expectations for supplier environmental performance. Communication strategies might include providing business partners with the company's environmental mission statement and environmental codes of conduct, holding workshops to explain to vendors the company's environmental performance expectations, and asking suppliers to complete an environmental questionnaire. Companies also need to communicate effectively within their organization to help employees understand how the SEM program relates to their individual responsibilities. Internal communication methods might include employee training, using the corporate Intranet to convey environmental information, and incorporating environmental messages in daily company communications.

Work with departments (and business partners) one-on-one

This approach engages experts in the work that they know best. Change takes time – you cannot just say "buy green" and expect it to happen. You have to expect mistakes, and need to learn from them. End users know what they need. Environmental purchasing coordinators can help find products that fulfill those needs. Seek out and work with the internal champion. When you have changed the buying habits of one person, build on that and go on to the next person, until you have a team.

Task 9: Training, Awareness, and Developing Competence

Assess training needs and the training of trainers

Training is an ongoing activity, both short term and long term, required for the successful implementation of any programs. Training is necessary at all levels of the organization, but is especially important for business partners in implementing GSC programs. Assessing training needs, scheduling a training program, and the training of trainers are the major starting activities of a training program.
EXAMPLE: Samples of GSC training slides and train-the-trainer slides are provided in Appendix 1 and Appendix 2, respectively, of this Manual for reference.

Make a statement of intent

A statement of intent establishes management support and sets priorities. If publicized, it informs and raises awareness among suppliers and employees about the objectives and conditions of the change and about their roles. This can be done with a revised business policy, mission statement, or declaration. Terminology is important! The purpose can be promoted as a cost or quality program.
EXAMPLE: A sample GSC awareness brochure is provided in Appendix 4 of this Manual for reference.

Collect information, network, publicize, and share information

Learn from others and share your successes, even though they may seem small. Many enterprises use their websites and distribute email bulletins to keep in touch with other departments and their business partners. Encourage program staff to subscribe to list serves and to join GSC or green purchasing associations and national organizations. Publishing information that demonstrates reduced costs, improved efficiency, increased market response, or enhanced environmental performance promotes accountability and information sharing.

Step 5: Monitoring and Review

Task 10: Monitoring and Assessment

Establish GSC indicators

Establish suitable monitoring indicators – the “achievement” indicators and the “working indicators” –

to monitor and assess your performance and that of your business partners on GSC. You can manage only what you measure and the metrics are important for your review and evaluation. Section 5 provides the details of appropriate methods for setting up GSC indicators and examples.

Look for further and future opportunities

Monitor progress on a regular basis to identify opportunities to reduce costs, reduce environmental impacts, and improve the supply chain management in place. Feed any improvements back into the system to take account of: (a) changes both inside and outside the organization; (b) changes in environmental and procurement regulations; and (c) improvements in business partners' performance.

Task 11: Management Review

Management review involves checking whether the overall GSC program is working, the effectiveness of the GSC options, whether the GSC methodologies are applied in the right direction, the benefits obtained, the savings achieved, the difficulties and barriers, and areas for future improvement. Management review should assess the effectiveness and adequacy of the GSC program, as well as how changing circumstances may influence the implementation of the GSC program.

Step 6: Continuous Improvement in GSC

Task 12: Incorporation and Updating of GSC Changes

In the management of GSC programs, there will be a need to incorporate corrective actions based on the monitoring results, and to update changes in relevant departments, targets, objectives, and actions.

Task 13: Identifying New Opportunities for Continuous Improvement

New opportunities and existing difficulties may arise because of changing markets, the availability of resources, new regulations, technical improvements, etc., and an enterprise can always look into new options and re-enter the loop to go back to the different steps and tasks of the GSC program.

3.4 Summary

Table 11 shows all 13 tasks, and their corresponding key points, that are required for the implementation of GSC.

Table 11. Tasks Required for the Implementation of GSC

Tasks	Key points
Team formation	Form a cross-functional team
Information collection	Seek views and suggestions from business partners
Identification of GSC opportunities	Map your risks and evaluate items that you plan to purchase
Setting targets	Specific, measurable, and attainable targets should be set
Generation of GSC options	Generate options related to business partners (external) and to your own company (internal)
Screening and assessment of GSC options	Evaluate criteria and resolve barriers to change; integrate these criteria into your assessment system and prioritize business partners
GSC implementation plan	Integrate GSC plan into existing system, formulation of implementation plan, and decision-making
Implementation of GSC options	Communicate effectively and work with departments and business partners one-on-one
Training, awareness, and developing competence	Assess training needs and train trainers; make a statement of intent; collect and share information
Monitoring and assessment	Establish GSC indicators and look for further and future opportunities
Management review	Assess the effectiveness and adequacy of the GSC program, and how changing circumstances may influence the implementation
Incorporate and update	Incorporate corrective actions and update changes in targets, objectives, and actions
Identifying new opportunities for continuous improvement	Look into new options and re-enter the loop to go back to different GSC tasks

4. Working with Business Partners

GSC or SCEM approaches may address an "upstream" supply chain, one that provides goods and services to an organization; or they may be directed "downstream" towards the completed manufacture or delivery of products to the end user. Suppliers provide not only raw materials and finished products, but also transportation, energy, packaging and waste management services.

Having explained the background, principles, and rationale for GSC and GP in previous sections, we now introduce approaches that organizations may adopt to work with business partners in implementing GSC. This section covers how to work with partners on GSC through specification, standards, and certification, how to achieve the greening of supply chain logistics, and how to work downstream through product demand and stewardship.

4.1 Collaborative Partnering with Suppliers and Contractors/Service Providers

Both customers and their supply chains stand to gain by collaborating on environmental and efficiency improvements. The benefits of partnering are:

- the supplier knows the product better than the buyer and can maximize efficiencies and minimize associated wastes;
- two or more perspectives (or different expertise areas) are better than one when it comes to designing greener products and processes;
- working together strengthens the customer–supplier relationship; and
- shared savings and mutual benefits make such efforts even more worthwhile.

Box 12. Four Levels of Suppliers (Source Ref. 9)

Level 1: Spot Purchasing	There is little or no relationship with or knowledge of the supplier. Price is the key determinant of purchase. To the extent that quality is important, it is assessed based on predictable product characteristics or supplier reputation alone. Each transaction is its own business contract. Commodity items such as coal, sand, mops, and pencils are often purchased on the spot market. To control EHS impacts, change products or product specs. For example, Intel prohibits the purchase of pencils and other wood products made from old growth forest resources.
Level 2: Competitively Based Incumbent Relationships (CBIR)	Suppliers have a long-term business relationship, typically an annual contract against which purchase orders are issued. Contracts are renewed annually. Your business is theirs to lose. Relatively little technical cooperation is invested in these short-term relationships, because a better supplier may be located the next year. To contol EHS impacts, change specs for the annual bid, and let the world know you are always looking for suppliers who can better meet these specs.
Level 3: Preferred Supplier	The intention is for a long-term relationship, that requires and benefits from fairly frequent communication and collaboration to improve or adjust supplier inputs over time. To control EHS impacts, include EHS issues in the periodic visits and meetings where progress and quality are discussed, and targets may be set.
Level 4: Strategic Partnerships or Alliances	Relationships involve an even deeper level of commitment. Typically, there is an explicit or implicit understanding that supplier and buyer will share the business benefits of effective collaboration. To influence EHS impacts, add EHS to the agenda of problems the partnership must address. Write contracts so that the business value of better EHS performance is shared among the partners.

Suppliers can typically be classified at one of four levels based on the intimacy and mutual dependence of the relationship. This hierarchy of relationships often corresponds to the procurement activities that take place at different levels of the company. Purchasing decisions made locally by individual plants are likely to be price focused, whereas alliances and partnerships are often directed by corporate staff who consider many factors in addition to price. Suggestions for the implementation of options related to business partners, under Task 5 (in section 3.3), are presented below.

Examples of partnering between supplier and customer include:

- Collaborating on green design and manufacturing projects.
- Sharing tools used for environmental improvement.
- Researching alternative materials, products, equipment, and processes that have lower lifecycle impacts.
- Managing of inventories by the supplier (e.g., chemicals, cleaning supplies, lab supplies, office supplies).
- Devising ways to take back and recycle or refurbish end-of-life items and packaging.
- Service provided or managed by suppliers.

Suggestions for Partnering with Suppliers or Contractors/Service Providers

- *Involve suppliers early*

  Why? Long lead times necessitate early sourcing and early supplier involvement in green product development.

- *Identify opportunities for improvement that suppliers may be able to help resolve*

  Examples:
  - Gather a cross-functional team of staff to brainstorm on product and process improvements; include office, design, manufacturing, procurement, waste handling, and other staff.
  - Evaluate your current products and supplier products for lifecycle impacts.
  - Evaluate manufacturing, office, maintenance, inventory, and other operations against environmental policies, goals, management systems, etc. to determine areas that need improvement.
  - Ask all your suppliers for suggestions.

- *Prioritize the opportunities identified in the previous exercise and determine a set of action items to implement the top opportunities*

  Examples of prioritization criteria:
  - Start with the "lowest hanging apples on a tree."
  - Focus on products or processes that generate the most pollution or the highest-volume waste stream.
  - Focus on operations that your staff may not have the sole expertise or time to address, such as chemical inventory management, just-in-time inventory, reusable packaging, process improvements, alternative solvents, energy reduction, scrap recovery.
  - Start the effort with one or two supplier(s) known to provide quality products and service, exhibit some environmental initiatives and interest, or have a longstanding business relationship with your company.

- *Identify existing and new suppliers that go beyond simply providing a product or basic service and are willing to help their customers meet environmental goals*

  Example:
  - Anheuser-Busch Companies, Inc., a beverage producer, worked with aluminum can manufacturers to decrease wall thickness and lid diameter, achieving a 30% weight reduction in aluminum cans and changing beverage can design industry-wide.

- *If applicable, establish terms and agreements for the partnership*

  Examples:
  - Will shared savings be adequate compensation for each party?
  - Will you need to pay for the supplier's additional services or participation?
  - Is the agreement informal or does it need to be an official business document?

- *Consider becoming an environmental mentor, or find an environmental mentor to assist you*

  Example:
  - General Motors (GM) Lean Implementation Program mentors suppliers on environmental

and other key business issues. GM's Supplier Environmental Advisory Team provides feedback from key suppliers to help shape GM's environmental initiatives.

- *Influence up and down the supply chain by providing customers with waste-saving ideas, proposals, and initiatives*
  Example:
  - See "Green Supply Chain Adds Business Value" (section 3.2) and "Product Stewardship" (section 4.3).

4.1.1 Procurement Policy and Product Specifications

How Can Environmental Procurement and Product Specifications Impact Supply Chains?

Buyers can use their purchasing power to influence suppliers and help create a more reliable market for greener products. By specifying purchasing preferences for products that have lesser environmental impacts, companies can spur manufacturers to: use clean manufacturing processes and materials, design for the environment (DfE), consume less energy or water, minimize waste, or create less toxic products or emissions.

There is no cookie-cutter approach. A policy may be as simple as restricting certain substances used in manufacturing or contained in any products purchased, or as complex as a comprehensive procurement policy and product specifications that cover every supplier and product.

Suggestions for Greening Suppliers through Environmental Procurement and Product Specifications

- *Define requirements in the contracts and use specifications in the tendering process*
  Examples:
  - Define the requirements of the contracts, e.g., disposal volume, amount of materials to be recycled.
  - Draw up the technical specifications in the contract so that tenders can be evaluated.
  - Use performance-based approach contracts that allow more scope for market creativity and, in some cases, develop into innovative solutions.

- *Develop procurement policy and product purchasing specifications*
  Examples:
  - While developing a procurement policy or product specifications to be used in the purchasing process, decide whether to adopt existing industry standards or to develop your own standards and criteria. Your procurement policy can be developed by benchmarking existing industry procurement policies. Product specifications for green procurement can be found in the eco-labeling criteria of existing eco-label programs. These include the US Green Seal, the European Union EU flower, Germany's Blue Angel, the US EPA's Energy Star, and certified wood per the Forest Stewardship Council. Eco-labels are classified into (1) international and regional, (2) national, and (3) private. Typical international and regional programs are TCO from Sweden, Energy Star from the US, the EU Flower and the Nordic Swan; national programs include Eco-labeling in the Republic of Korea, Green Mark in the Republic of China, Environmental Choice in Canada, and Blue Angel in Germany; and an example of a private classification is Green Seal in the US.
  - Determine if the criteria will apply to supplier's practices and operations as well as to their products.
  - Decide whether criteria will apply to all products and all suppliers:
    - Will you differentiate standards for various classes of products? For example, will office supplies have different specifications than raw materials or equipment?
    - Will you give preference to certain products?
    - Will you stop purchasing certain substances or products made using those substances?
    - Will you purchase only products with low lifecycle impacts?

- *Carefully, clearly, and consistently introduce the information to suppliers and contractors*
  Example:
  - The Green Business Letter article "How Supply Chain Management Practices are Greening Procurement" (on the GreenBiz website) says not to expect immediate acceptance from all suppliers. “It’s certainly not a matter of merely handing down an edict,” and some suppliers may tell you to take your business elsewhere. "It's not that suppliers don't want to reduce the environmental impact[s] ... It's just that many find themselves facing a bewildering array of corporate environmental ... criteria.”

- *Offer assistance and education to suppliers and contractors in meeting the established requirements*
  Example: See “Outreach and Assistance” (section 4.1.4).

- *Decide how to finalize the agreement*
  Example:
  - Will the environmental specifications be included in contract language, verbal discussion, or some intermediate level of formality?

- *Establish strong, two-way communication channels*
  Examples:
  - Be accessible for interaction as needed.
  - Ask suppliers/contractors for information.
  - Offer assistance and education.
  - Learn and understand their operations and capabilities.

- *Where applicable, establish an evaluation or rating system*
  Example:
  - DaimlerChrysler uses an environmental rating system for its suppliers to make its final purchasing decisions (also see section 4.1.3 on “Evaluation and Certification”).

- *Work to establish long-term relationships and commitments with your qualified, green suppliers*
  Example:
  - According to a study conducted by Business for Social Responsibility (BSR), many suppliers have responded to requests from their corporate customers to address environmental issues in their products and practices. Several suppliers in this study "expressed frustration with customers who have issued environmental ... expectations which are not reflected in actual purchasing decisions” (Ref. 6).

- *Educate your customers with environmental information on products they purchase from your company*
  Example:
  - Volvo provides customers with environmental information on its products.

4.1.2 Supplier Standards and Criteria

In efforts to green their supply chain, some customers may expect suppliers to meet standards equivalent to their internal standards. Others may request that their suppliers implement an environmental management system or become certified to other industry standards. Many environmental standards and models are available, from national certification to international standards. One of the well-known environmental standards developed by the International Organization for Standardization (ISO) is ISO 14001. It is becoming more common for companies to include ISO 14001 compliance as a minimum standard in their procurement policies."

Suggestions for Setting Supplier Standards and Evaluation Protocols

- *Develop and/or adopt existing criteria, standards, or management systems*
  Examples:
  - Will you develop your own standards and criteria?
  - Will the criteria apply to suppliers' practices and operations as well as to their products?
  - Will you adopt existing industry standards?
  - eco-label products certification such as the US Green Seal or Germany's Blue Angel
    - certification from industry standards such as ISO 14001
    - CERES Principles for environmentally sound business practices
    - the Global Reporting Initiative (GRI)
    - the Balanced Scorecard (www.balancedscorecard.org)
    - Management Systems Verification by Responsible Care™ (American Chemistry Council)

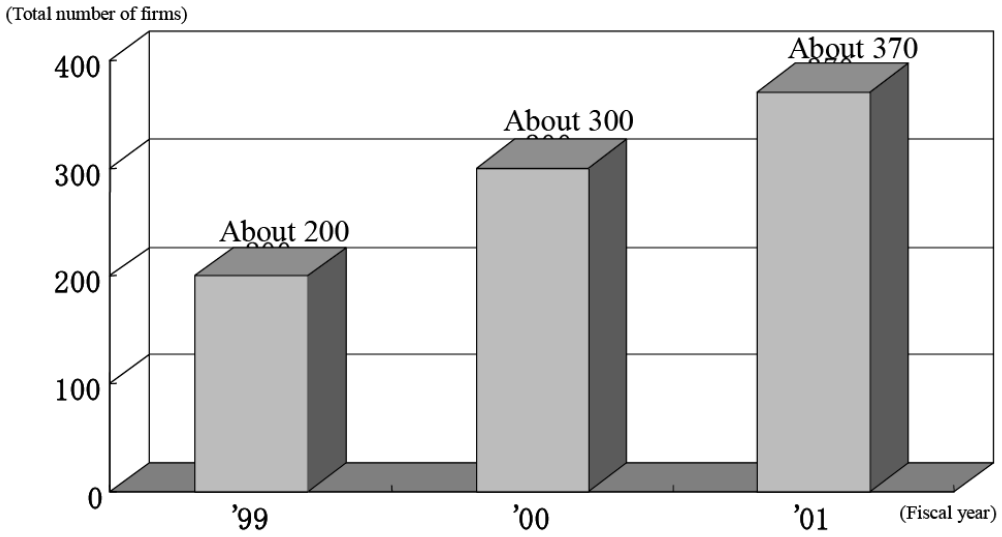


Figure 6. Acquisition of ISO 14001 Certifications by Suppliers of Toyota (Source: Ref. 4)

- *Decide what environmental criteria, standards, management systems, etc. will apply to which suppliers*
  Example:
  - Will you use more rigorous standards for certain suppliers?

- *Develop an evaluation or certification plan and schedule*
  Example: See "Evaluation and Certification" (section 4.1.3)

- *To make it easier for suppliers, notify them well in advance, tell them why, and offer assistance, incentives, and flexibility*
  Examples:
  - Tell suppliers why it is important to meet your criteria.
  - Notify suppliers of evaluation protocols and schedules, including milestone dates for partial and/or full compliance.
  - Educate and assist suppliers in how to meet the requirements (see "Outreach and Assistance", section 4.1.4)
  - Provide incentives, such as a long-term procurement commitment or shared savings
  - If a supplier's other customers are stipulating environmental requirements, offer to cooperate with the other customers to minimize duplication of efforts by the supplier

- *Develop a policy for suppliers and contractors that cannot meet your criteria*
  Examples:
  - Will you offer assistance to help them meet your standards? (See "Outreach and

Assistance", section 4.1.4)
- Will you seek out new suppliers or contractors?

4.1.3 Evaluation and Certification

Some customers may require key suppliers, or all suppliers, to meet certain standards in their operations and practices. Once standards and requirements are in place, there are different mechanisms for establishing whether the supplier is meeting those requirements. In some cases, completed questionnaires from the supplier, or other written documentation, are proof enough for the customer. Other evaluation methods may include inspection of goods received, onsite evaluations or assessments of suppliers, certification to an eco-labeling program, auditing per ISO standards 14010 and 14011, or other protocols for monitoring and validating supplier operations.

Example:

Box 13. Criteria for Evaluation of Suppliers (Source: Ref. 4)

Principle	Grading & criteria (1–5 with 1 best practice)		
	1	2	3
Good Employee Practices	Remuneration and work practices exceed norm	Positive employee relations including provision of reasonable living wage	Provides minimum wage. Commits to program of objectives
Health & Safety	Active commitment to H&S with investment in physical/mental well being, injury prevention and rehabilitation. Companies with ACC tertiary scheme	Demonstrates commitment to H&S which exceeds legal requirements. Complies with ACC secondary scheme	Demonstrates commitment to H&S which complies with ACC primary scheme
Working conditions for factories in development countries	Supplier is involved in supply chains where clear and obvious welfare benefits are provided to workers, their families and the community. This may include health care, education and housing.	The supplier makes regular visits to the factories and has provided sufficient evidence that the working conditions and H&S are good (in comparison to country norm). Meets ILO standards. "When in Rome do as the best Romans do."	Supplier has an understanding of the issues and knows the sources of the products but has little awareness of the actual working conditions because they have not been audited.
Governance	History of transparent reporting on social, environmental and economic impacts & performance. Commitment demonstrated at Board level.	Transparent report of social, environmental and economic impacts with future commitments. Inclusion of sustainable development targets in management performance reviews.	Commits to balancing social, environmental, and economic impacts
Environmental Responsibility: Awareness of the environmental issues associated with products and operations	Supplier's environmental policy shows advanced understanding of their operations and products' entire lifecycle and a systematic environmental management system such as ISO14001.	Supplier has a thorough understanding of the key impacts of their products' lifecycle and a systematic program to address them plus an action plan with specific targets.	Supplier has identified the key issues and has a framework policy in place with commitment to specific objectives
Environmental Responsibility: Eco Efficiency. Packaging & Environmental Claims	Supplier is actively involved in innovative initiatives to reduce the amount of packaging used. Packaging is totally recyclable. Use of post consumer recycled material is standard. Reusable trays and pallets are used for shipment.	Where possible only one material is used, if two are used they are separable. If plastic is used it is marked with the relevant SPI code. Labels can be removed. Packaging material contains some post-consumer recycled material. Any environmental claims are informative, relevant and substantiated. Inks, paints, dyes and adhensives are water-based.	No over-packaging occurs. Packaging is deemed to be essential, ie., for fragile items or small separable parts. Packaging should be recycled. Despite the availability of post consumer waste, a high percentage of virgin material is used. All plastics marked SPI code 3, 6 or 7 should be avoided including polystyrene
Hazardous Substances/ Chemicals & GMOs	Supplier is well ahead of any legislation and has developed appropriate ways to deal with concerns about chemicals and GMOs	Has a radar that identifies concerns and the products it sells or has sold. Complies with all existing and pending legislation	Complies with existing legislation, eg., product ingredients, product labelling, product disposal and any chemicals used in the business
Supplier Management: Local Supply base – raw materials supply	Demonstrates commitment to local economies and reduced transport costs. Carried out review of supply base taking into account sourcing of product	Has identified and selected those suppliers which meet requirements from local supply base. Supports economic sustainability of suppliers.	Considers geography in supplier decision-making.

4	5
Provides minimum wage	No commitment to socially responsible business
Meets legal requirements	Does not meet legal requirements
Supplier demostrates insufficient understanding of the supply chain to be confident there are no ethical concerns	There is a poor understanding of the supply chain and sources of supplier, and the supplier shows no inclination to improve its knowledge base
No obvious transparency	No commitment to monitoring social or environmental impacts
Supplier has failed to provide a policy statement which includes a proper assessment of the environmental issues	Supplier shows no inclination to make any meaningful commitment to environmental issues
Products are over-packaged and difficult to recycle. There is no use of recycled material. There are environmental claims on the packaging which are inaccurate or may mislead.	Products are excessively packaged and the packaging is extremely difficult to recycle. The packaging has misleading claims. The supplier has not acted to address these problems.
Supplier unable to provide adequate details relating to all chemicals and GMOs used in product	Supplier unable to provide details of chemicals and GMOs in use and shows no concern relating to chemicals in use
Does not consider location – price is principal driver	No clear picture of supplier base

Box 14. Code of Conduct for Suppliers (Source: Ref. 4)

Principle	Criteria	Examples	Performance Indicators
1. Employee Practices	Comply with Local and International Labor Standards	• 48 hour max. normal work week • Wage is above legal minimum • Freedom of Association • Security of Contacts • Equal Opportunities: Race & Culture; Age; Gender & Sexuality; Disability • Training & Development Program	Staff Retention; Reputation as "good employer" Pays in the median/upper quartile; Diversity of employees % against the industry/local norm HR Policy/ Company Benefits reflect work/life balance, eg. childcare; tele-working; leave of absence policy
2. Health & Safety	Commitment to Health and Safety which meets minimum legal requirements	• Health & Safety Policy • Active participation of employees • Employee health monitoring • Training • Contractor Management Policy	Number of Lost Time Incidents or Medically Reportable Incidents; ACC accreditation; NZS4801 accreditation; Records demonstrate safe workplace
3. Working Conditions for factories in developing countries	Comply with International Labor Standards and, where local standards are higher, to local standards	• No children under 15 in full-time labor • No use of forced or compulsory labor • Does not engage in discriminatory practices • Freedom of Association and right to collective bargaining • Health care & Safety at work • Normal work week is 48 hours or less • No wage is lower than the applicable legal minimum	Employees are provided with drinking water, clean toilets in adequate numbers; adequate ventilation and emegency exits; Employees receive pay slip; Accreditation to SA8000; Supplier has been audited by external body or customer
4. Governance	Demonstrates commitment at Board level	• Corporate Policy • Inclusion of sustainable development targets in CEO's performance review and remuneration • Whistle Blower Policy	Corporate Policy; Transparent KPIs; Sustainable Development Report; No public record of fraudulent activity
5. Environmental Responsibility: Energy efficiency	Company complies with existing and pending national and international legislation on the energy efficiency of products and the energy use of buildings it operates	• Emissions & Energy Reporting • Reduce energy by x% p.a. • Reduce vehicle emissions by x% p.a. • Energy effifient design of products and buildings • Consider viability of renewable energies	Carbon Footprint reported as tons of CO_2 net emissions; ISO14001; Enviro-Mark Labelling showing energy efficient Environmental Choice
6. Environmental Responsibility: Eco-efficiency	Products and production procedures which maximize eco-efficiency	• Recyclable content of product is reviewed and audited • No over-packaging; Use of reusable trays/shippers • Recover x% waste for recycling • Increase timber products sourced from sustainably certified forests by x% p.a. • Consider sustainable sourcing of raw materials • Reduce water consumption by x%	Reduction in waster to landfill year on year Packaging Policy Product Life Cycle analysis Profit from waste to energy system Set target for waste management FSC or other external accreditation, eg., MSC, or other accreditation Water usage by person
7. Hazardous Substances/ chemicals/GMOs	Comply with existing and pending chemicals-related legislation. This might include legislation on product ingredients, product labelling, and product disposal	• Measures environmental impact of materials and processes • Identifies and acts on potential areas of concern	Hazardous Chemicals register Validate any adverse public concern by NGOs or other stakeholder Transparent Labelling Environmental Choice
8. Supplier Management	Commitment to local economies and reduced transport costs; Supplier relationships	• Conduct review of supply base taking into account product source • Support economic sustainability of suppliers.	Program to monitor local sourcing; Reduced transport costs Work with key suppliers to ensure procurement policy does not unreasonably threaten supplier viability

Suggestions for Evaluating Suppliers for Environmental Management and Environmental Business Practices

- *Determine how to verify that suppliers and contractors are meeting your environmental requirements*

  Examples:
  - Documented confirmation from suppliers, such as a license or certificate of compliance to an eco-labeling program, ISO, CERES Principles, or other environmental standards.
  - Self-assessment results or environmental questionnaires from suppliers.
  - Onsite audits or assessments conducted by your staff (see below for auditing/assessment tools)
  - Onsite audits conducted by third-party auditors.

Box 15. Environmental Questionnaire (Source: Ref. 17)

E.1	Do you have an environmental policy and/or an environmental purchasing policy? If yes, please provide a copy	☐ Yes ☐ No
E.2	What environmental management systems do you have in place in line with ISO 14001?	
E.3	What actions have been taken over the last three years to improve the environment? By your company By other companies with whom you deal	
E.4	Do you adhere to any relevant Industry Codes of Practice? If yes, please give details	☐ Yes ☐ No

- *If you (or third-party auditors) evaluate suppliers, develop or adopt evaluation procedures and methods based on the established criteria*

  Examples:
  - ISO 14010 or 14011 procedures, or auditing tools such as a high-level GAP analysis.
  - The Global Environmental Management Initiative **self-assessment tools** can be adapted for evaluating suppliers, including the "Environmental Self-Assessment Program" and the ISO 14001 "Environmental Management System Self-Assessment Checklist" (both at www.gemi.org/docs/PubTools.htm)
  - Environmental management, audit and reporting software such as Greenware.

- *Determine level of evaluation for different suppliers*

  Example:
  - Only evaluate strategic suppliers or sole source suppliers, or develop other criteria to trigger evaluation of a supplier. Bristol-Myers Squibb determines when and whether an evaluation is warranted depending on the extent of involvement in the operations of the contractor or supplier and the nature of the supplier's operations.

Box 16. Typical Procurement Tools by Stage in Process and Level of Supplier (Source: Ref. 9)

Level of Supplier: 1	2	3	4	TOOL	COMMENTS AND EXAMPLES
Stage 1: Pre-Screening Communications					
	✓	✓	✓	Policy Statements (EHS and Procurement Policies)	These can communicate buyer goals and set the tone for collaboration. Georgia Power has an Extranet web page that provides suppliers with key EHS information.
	✓	✓	✓	Code of Conduct for Suppliers	These communicate how business will be done with suppliers, and often warn suppliers of standards and sanctions that may be applied if they fail.
	✓	✓	✓	Minimum EHS Performance Standards	Most companies have contract language requiring suppliers to self-certify themselves in compliance with local requirements or supplier requirements.
✓	✓	✓	✓	Product Specifications	Product constituents and performance characteristics can be specified.
	✓	✓	✓	List of Chemicals to Avoid	Kodak, Canon, Sony, Toyota, Ford, and Volvo are among companies circulating lists of chemicals for their suppliers to eliminate or reduce.
Stage 2: Qualifying and Negotiating					
✓	✓	✓	✓	List of Pre-Approved Materials	Many companies screen materials onto pre-approved lists to speed purchasing decisions.
	✓	✓	✓	Requests for Proposal	Requests for Proposal can include explicit evaluation criteria for the supplied product or service, and for the supplying organization. Many ask for safety performance statistics and evidence of continuous improvement.
	✓	✓	✓	Surveys and Questionnaires	Companies require suppliers to complete self-assessment forms that vary widely in detail.
	✓	✓	✓	Required Standards of EHS Performance	Standards are referenced in contract documents, and may be customized for level 3 and 4 suppliers, or suppliers of EHS-sensitive services such as waste disposal, construction, and remediation.
		✓	✓	Supplier Selection Criteria/Ranking	Anheuser-Busch includes EHS management systems as part of its existing supplier selection and certification program. Texas Instruments goes beyond incident rates in assessing the safety performance of suppliers of key services, and considers corporate culture and top management commitment. Volvo uses Environmental Priority Strategies tool to assess the energy and resource consumption, air, land, and water emissions of materials it purchases. Canon uses Green Procurement Standards to rate supplier corporate environmental structure and product-specific impacts.
✓	✓	✓	✓	Pre-Approved Supplier Lists	The EHS department may screen suppliers and prepare lists for Procurement to use.
		✓	✓	Contract Negotiations	Haliburton has found it essential to include EHS professionals from both their own company AND contractor companies during contract negotiations.
Stage 3: Monitoring and Continuous Improvement					
		✓	✓	Audits	On-site audits are typically conducted for toll manufacturers, critical suppliers, and suppliers that dispose of waste. *See Ashiland Case Study* on page 41.
		✓	✓	Regular Supplier Visits	Anheuser-Busch regularly visits packaging suppliers to review continuous improvement efforts and environmental management systems.
	✓	✓	✓	Performance Reviews	These typically involve quarterly, six-month, or annual progress and performance reports in formats developed by procurement, possibly with supplier participation.
		✓	✓	Collaboration to Solve EHS Problems	To increase recycling, Anheuser-Busch worked with a packaging supplier to develop standards for plastic binding on shipments. Motorola safety staff worked with a chair manufacturer to redesign chairs for better ergonomic performance. Collins & Aikman (carpet manufacturers) reduced volume of volatile organic compounds (VOCs) by collaborating with a supplier to reformulate products and modify manufacturing processes.
		✓	✓	Supplier Training and Seminars	Herman Miller holds semi-annual conferences for all employees and suppliers on waste minimization, pollution prevention, lifecycle analysis, and environmental design.
			✓	Collaboration on R&D and New Product Development	Intel works with suppliers and cross-functional teams to design new semiconductor manufacturing tools that will operate with minimum EHS impacts.

- *Develop evaluation or certification schedules*

  Examples:

  How often will you evaluate suppliers/contractors?
  - One initial evaluation
  - Annual evaluation
  - As needed, based on risk
  - Each time a new or upgraded product line starts up

- *Determine a policy and plan for suppliers and contractors that do not meet the criteria*
  Examples:
  - Will you offer assistance to help them meet your standards? (See "Outreach and Assistance", section 4.1.4)
  - Will your evaluation team make recommendations and develop and track corrective actions?
  - Will you seek out new suppliers or contractors?

4.1.4 Outreach and Assistance

Many suppliers and contractors are willing to work with customers to meet their environmental standards or requirements. After all, good environmental practices increase efficiency and competitiveness and save money. Furthermore, meeting customer requirements usually means continued business. On the other hand, rigorous environmental requirements, or a different set of requirements from each major customer, may prove unattractive or overwhelming to suppliers and contractors. Some smaller suppliers may not be able to devote the necessary resources on their own in order to implement necessary changes.

As a customer interested in greening your supply chain, be ready to participate actively in the supplier's efforts by investing time, resources, and other assistance. Examples of assistance to suppliers include providing access to tools, information, or programs that your company has had success with, offering training and mentorship from your staff or through third-party consultants, and being an available resource to key suppliers when needed.

Suggestions on Outreach and Assistance to Suppliers

- *Make suppliers or contractors aware of your requirements, and well in advance of the effective date*
  Examples:
  - Develop and publish your environmental criteria.
  - Put yourself in your supplier's shoes to help you understand how they will accept and meet the new requirements.
  - Send advance notification explaining expectations for their level of participation and commitment, timelines, benefits, and compensation (if applicable).

- *Offer education, assistance, and/or training to suppliers on how to meet your environmental standards*
  Examples:
  - Recognition phases.
  - Establish a **mentoring** relationship.

- *Offer to help bear the transitional costs*
  Examples to consider:
  - Interact directly with the pertinent supplier contacts.
  - Offer training seminars or workshops.
  - Share tools you have successfully employed.
  - Offer assistance in the startup or transition phases.
  - Establish a mentoring relationship.
  - Offer to help bear the transitional costs.

- *Conduct assessments and provide recommendations*
  Examples:
  - Review supplier and contractor facilities, operations, and policies; provide recommendations on improvement opportunities and ways to help meet your environmental requirements.

  - Assess the products or services you purchase from the supplier or contractor. In the case of product assessments, additional information from second- or third-tier suppliers may be

necessary.
- Provide recommendations for greening suppliers' products or processes used to manufacture the product.

- *Offer technical support services and effective means of communication*
  Examples:
  Set up one (or all) of the following to provide needed support and answer supplier questions on meeting your environmental requirements:
  - Supplier environmental advisory council
  - Web help screens
  - Email, hotline. and/or other direct methods of communication

Box 17. Communication Channels in Retailing (Source: Ref. 15)

- ✓ Advertising campaigns
- ✓ Publications (Brochures, Leaflets, Posters)
- ✓ Websites, CD-ROMs
- ✓ Eco-labels
- ✓ Take-back schemes in store (e.g. glass bottles, empty containers, used books, batteries etc. for reuse / recycling)
- ✓ Recycling booths in store to facilitate recycling of certain products
- ✓ Promotional events (Green week, organic products' day, etc.)
- ✓ Concerts, speeches in the store on sustainability themes
- ✓ Competitions, lucky draws/lotteries for consumers participating in sustainability initiatives
- ✓ Exhibitions
- ✓ Special membership clubs for consumers who purchase eco-friendly products
- ✓ Loyalty / recognition programs for consumers who select green products and services

- *Educate your customers and encourage them to support your efforts*
  Example:
  Marks and Spencer (see section 4.3.2) links customers with farmers to provide information on their products.

4.1.5 Service Supply Chain Strategies

Giving a supplier or contractor responsibility for management of an inventory, material stream, waste stream, or onsite service engages the supplier or contractor in greening that area of a customer's business. Usually, the supplier knows this part of the business better than the customer and can handle and manage the product(s) or service(s) more efficiently. This allows the customer to redeploy staff to core operations. A few examples of supplier services include:

- Onsite management of chemicals and other supplies, including delivery, stocking, tracking, and managing data
- Handling scrap, used packaging, or recyclables associated with the supplier's products
- Responsibility for equipment or goods at the end of their useful life
- Management of energy services, including energy efficiency efforts
- Leasing and servicing of office equipment or furnishings

Suggestions for the Customer on Implementing Supplier Service Strategies

- *Assess areas of your business that might be more effectively managed by a supplier*

Examples:
- Chemicals and other lab supplies
- Office supplies
- Fleets and fleet maintenance
- Cleaning and facility maintenance supplies
- Raw material inventories
- Scrap, packaging, or recyclables associated with a supplier's products
- Energy management
- Electronic office equipment and maintenance
- Office furnishing
- Document services and related equipment

- *Prioritize the opportunity list from the above assessment*
  Example criteria for prioritizing:
  - Biggest economic benefit
  - Well-established supplier/customer relationship(s)
  - Greatest potential for environmental or efficiency improvement
  - Simplest implementation (especially for the first few agreements)

- *Flesh out an initial objective list and draft plan*
  Examples:
  - Define proposed responsibilities for each party.
  - Define the requirements, e.g., communications, training, safety.
  - Estimate and document benefits, e.g., environmental benefits, shared savings from reduced waste or inefficiencies, competitive advantage, added business for the supplier.

- *Involve the supplier*
  Examples:
  - Introduce your objectives and initial plan.
  - Assess the supplier's acceptance and willingness to evolve the program with you.
  - Involve the supplier in final planning and negotiating terms, e.g.:
  - Will shared savings be adequate compensation for each party?
  - Will you need to pay for the supplier's additional services or participation?
  - Is the agreement informal or does it need to be official?

- *Complete and implement the agreement with the supplier*
  Examples:
  - Be flexible – Xerox's leasing program for office equipment was initially developed as a marketing tool, but is now a full-blown DfE program that maximizes recovery and reuse of materials and components from their copiers, including powdered toner.
  - Re-evaluate – evolve the working agreement as you and the supplier develop even more efficient practices.

Suggestions for the Supplier on Implementing Supplier Service Strategies

- *Assess potential service(s) that could supplement products currently sold to your customers*
  Examples:
  - Offer cleaning/maintenance services and cleaning supplies maintenance.
  - Manage scheduling, delivery, stocking, and tracking of inventories for customers (at their facility or yours).
  - Take back scrap, packaging, recyclables, and wastes associated with your products.
  - Offer energy management/efficiency services.
  - Provide servicing of electronic office equipment, computers, office furniture, or other goods
  - Offer document services instead of just offering copiers, printers, etc.

- *Assess the advantages for your organization and the customer*
  Examples:
  - Interface, LLC began managing Delta Airlines' chemical inventory in 1994. Delta has

attained a 30% reduction in overall chemical costs and use, and also dramatically improved delivery success, inventory practices, environmental reporting, and compliance.
- Environmental and cost savings accrue without much effort on the customer's part.
- Potential gain-sharing between supplier and customer can provide the incentive for both customer and supplier to further reduce, reuse, and recycle.
- Additional business opportunities arise for the supplier.
- Customer staff can be redeployed to core activities.
- Maintenance and/or ultimate disposal become the responsibility of the supplier.
- Product(s) are managed and maintained by the supplier, who best knows the product and waste reduction opportunities.

- *Assess the profitability and cost benefits of adding these services*
  Examples:
  - Conduct an economic analysis to see if implementation and operation of the program would be profitable; consider gain-sharing in the analysis.
  - Calculate potential savings for the customer from improved efficiency and reduced environmental costs, and potentially gain-sharing.
  - Determine the cost to the customer for the service; will the customer be willing to pay this cost?

- *Build the program incrementally*
  Example:
  - Often a service model evolves from existing lines of business and historical relationships with customers. A successful program will require careful planning and procedures, and significant interaction with the customer to ensure you are providing a service they will want and use.

- *Develop a draft operational plan and terms of agreement*
  Examples:
  - Define your proposed services and responsibilities for the customer.
  - Define the requirements, e.g., communications, training, safety.
  - Include benefits, e.g., environmental benefits, shared savings from reduced waste or inefficiencies, competitive advantage, added business for the supplier.
  - Request the customer's participation in developing and evolving the program; their input will give them more responsibility, interest, and ownership.

- *If your program is geared toward taking back scrap, recyclables, or end-of-life products, etc., optimize product design and manufacturing activities to facilitate recovery*
  Example:
  - See the DfE/Lifecycle Checklist or section 4.3.2 on “Product Stewardship” for more specific opportunities.

- *Complete and implement the agreement*
  Examples:
  - Be flexible – Xerox's leasing program for office equipment was initially developed as a marketing tool, but is now a full-blown DfE program that maximizes recovery and reuse of materials and components from their copiers, including powdered toner.
  - Continually evaluate and redesign – evolve the working agreement as you and the customer develop even more efficient practices.

Box 18. Environmental Criteria for Office Furniture (Source: Ref. 12)

Kolding environmental criteria for office furniture

In this context, office furniture are desks, bookshelves, conference tables, chairs, swivel chairs, computer tables and other items to be used in an office.

To assess the environmental impact of the product the following questions are asked. Questions must be answered with yes or no, and positive answers must be detailed.

Preliminary questions

1. Which country of origin does the wood come from?
2. Which kind of primary energy sources are used for electricity and heating?
3. Can the product in question, or part of it, comply with demands similar to the environmental demands of the Nordic Ecolabelling "Svanen" (Swan) or the EU eco-labelling? YES NO

Questions No. 1 to 3 must be answered. If 3 is answered with yes, no further questions.
If 3 is answered with No, please answer the following questions:

1. General questions

1. Does the business have a policy of transport in the intention of reducing the impact of CO2 (e.g. by increasing load per truck, less transports, using alternative energy sources or forms of transportation)? YES NO
2. Is the business certified according to ISO 14001 or EMAS? YES NO
3. Does the business prepare a yearly green account? YES NO
4. Does the business have a waste policy as to waste sorting, increased use of recycled materials, and reducing waste amounts? YES NO
5. Does the business comply with the environmental demands of the local authority? YES NO

2. Questions regarding the environmental impact

1. Is the product made of renewable resources? YES NO
2. Are recycled materials part of the product? YES NO
3. Can the product be repaired, and will spare parts be available for a long time? YES NO
4. Can the product, or part of it, be recycled? YES NO
5. Can the product be separated into its single components? YES NO
6. Does the product have a long lifespan in comparison with similar products? YES NO
7. Can the product be cleaned easily with water and ordinary soap? YES NO
8. Does the wood used come from sustainable forestry complying with FSC guidelines (Forest Stewardship Council)? YES NO
9. Is the product produced without any use of organic solvents? YES NO
10. Is the product produced without the use of heavy metal containing compounds? YES NO
11. Is the product produced without adding chemicals from the "List of Undesirable Substances" from the Danish Environmental Protection Agency? YES NO
12. Is the product produced without the use of PVC containing plastics? YES NO
13. Are screws, plates and other metallic parts made without aluminium? YES NO
14. Are screws, plates and other metallic parts made without chrome? YES NO
15. Are screws, plates and other metallic parts made without nickel? YES NO

3. Questions regarding the packaging of the product

1. Is the packaging without chemicals from the "List of Undesirable Substances" from the Danish Environmental Protection Agency? YES NO
2. The packaging is produced without the use of PVC containing plastics? YES NO
3. The product is delivered unpacked or with only minimal packing means? YES NO
4. The packaging is made of recycled or recyclable materials? YES NO

4. Assessing the environmental impact (only for purchasers' use)

The more questions answered with yes, the more environmentally friendly the product. Minimum requirements for a product to be regarded as environmentally compatible are answering the following questions with YES:

1. General questions: No. 4,
2. Questions on environmental impact: No. 6, 8, 10, 11 and 12
3. Questions as to package: No. 1 and 2

Box 19. DfE/Lifecycle Checklist (Source: Ref. 14)

Premanufacture Design Considerations

✓ Minimize soil and ecological disturbance related to all process and product inputs
✓ Design for disassembly, remanufacture, reuse, and recycle:
- Minimize dissimilar materials and number of components
- Use interchangeable parts; Identify materials;
- Do not use incompatible inks or surface treatments
- Make hazardous parts components easily detachable
- Make disassembly easy and efficient; Minimize disposable components

✓ Minimize volume and weight
✓ Incorporate recovered materials
✓ Use low-energy materials and processes
✓ Avoid hazardous or toxic materials and constituents
✓ Consider transport implications of supplies, raw materials, the product and packaging
- lightweighting
- volume reduction
- local purchase

✓ Product use & maintenance features such as enhanced durability, operation without oil, battery, chemicals or other consumables, and minimizing energy and water consumption

Product Manufacture

✓ Minimize chemical usage and associated waste or emissions (Of special concern are heavy metals, toxic chemicals and those linked to global warming and ozone depletion)
✓ Minimize surface treatments; use low-VOC, or water or vegetable based coatings, inks, etc.
✓ Minimize energy- and water-intensive manufacturing processes
✓ Maximize energy and water recovery
✓ Minimize and/or reclaim effluent and process discharge
✓ Minimize and/or reuse scrap
✓ Follow spill prevention and secondary containment procedures

Distribution & Packaging

✓ Utilize environmental packaging and materials, including reusable, bulk and non-hazardous
✓ Ask suppliers to minimize packaging
✓ Minimize volume, weight, and different material types
✓ Identify different types of packaging material
✓ Organize and use efficient (means of) transportation
✓ Prevent hazardous spills during transport

End of Life

✓ Maximize material and part recovery opportunities
✓ Avoid gaseous, liquid, or leachable releases from any portion of the product that requires disposal

4.1.6 Summary

Table 12 presents a summary of the suggestions related to partnering with suppliers, contractors, or service providers introduced in this section.

Table 12. Summary of the Suggestions Related to Partnering with Suppliers, Contractors, or Service Providers

Approaches	Suggestions
Partnering with suppliers or contractors/service providers	Involve suppliers early Identify opportunities for environmental improvement that suppliers may be able to help resolve Prioritize the opportunities identified in the previous exercise and determine a set of action items to implement the top priorities Identify existing and new supplies that go beyond simply providing a product If applicable, establish terms and agreements for the partnership Consider becoming an environmental mentor Influence up and down the supply chain by providing customers with waste-saving ideas

Greening suppliers through environmental procurement and product specifications	Define environmental requirements in the contract and use specifications in the tendering process Develop a procurement policy and product specifications Introduce the information to suppliers and contractors Offer assistance and education to suppliers and contractors in meeting the established requirements Decide how to finalize the agreement with the supplier Establish a two-way communication channel between company and suppliers If applicable, establish an evaluation or rating system for the suppliers Work to establish long-term relationships with your suppliers Educate customers with environmental information on products they purchase from your company
Setting supplier standards and evaluation protocols	Develop and/or adopt existing environmental criteria, standards, or management systems Decide what environmental criteria, standards, or management systems will apply to which suppliers Develop an evaluation or certification plan and schedule Notify suppliers well in advance, tell them why, and offer assistance, incentives, and flexibility
Evaluating suppliers for environmental management and environmental business practices	Determine how to verify suppliers are meeting your environmental requirements Develop or adopt evaluation procedures and methods Determine level of evaluation for different suppliers Develop evaluation or certification schedules Determine a policy and plan for suppliers that do not meet the criteria
Outreach and assistance to suppliers	Make suppliers aware of your requirements well in advance of the effective date Offer education, assistance, and/or training to suppliers on how to meet your environmental requirements Offer to bear the transitional cost Conduct assessment and provide recommendations Offer a technical support service and effective means of communication Educate your customers and encourage them to support your efforts
Implementing service supplier strategies (customer)	Assess areas of your business that might be more effectively managed by a supplier Prioritize opportunities Involve the service supplier Complete and implement the agreement with the service supplier
Implementing service supplier strategies (supplier)	Assess potential services

4.2 Supply Chain Logistics

Supply chain logistics (SCL) activities are integral to the effective and efficient movement and storage of goods between the origin and destination or back again, especially for manufacturers and wholesale or retail distributors. Sustainable supply chain logistics concern the planning, storage, transportation, and reverse logistics processes involved in getting goods and services to the right place, at the right time, and in the right condition, while minimizing the impacts on our natural and social environments.

4.2.1 Definitions, Business Trends, and Benefits

What Is Supply Chain Logistics?

Supply chain logistics (SCL) is better understood within the context of end-to-end supply chain management (depicted in Figure 7). End-to-end supply chain management emphasizes communication, collaboration, and coordination between a company's supply chain functions and those of its suppliers, customers, and service providers. SCL functions – the darker-shaded areas labeled plan, store, transport, and reverse logistics – are integral to a high-performing supply chain.

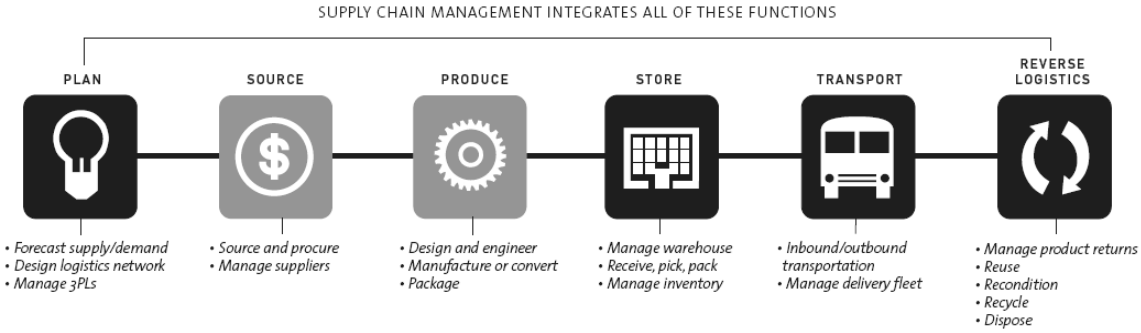


Figure 7. Supply Chain Logistics Functions within an End-to-End Supply Chain (Source: Ref. 7)

What Is Sustainable SCL?

Sustainable SCL explicitly manages the environmental and social impacts of SCL activities; i.e., the effective and efficient movement and storage of goods between the points of origin and destination or back again. Typical environmental and social impacts of SCL activities are shown in Figure 8.

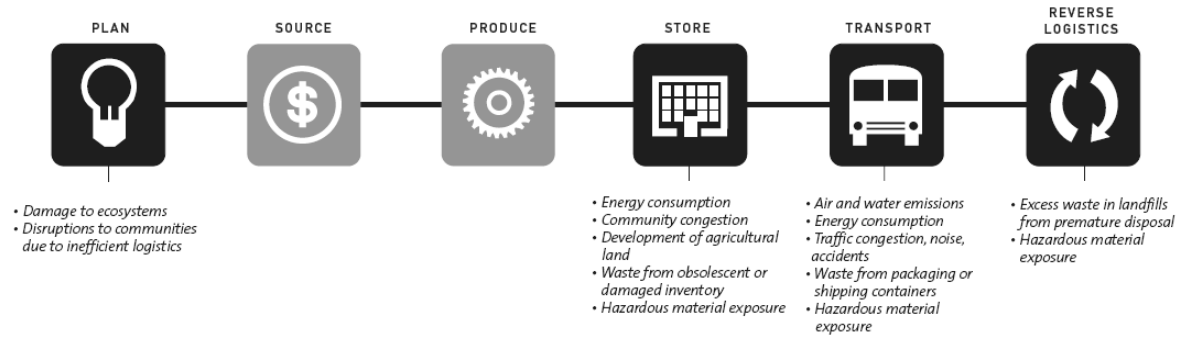


Figure 8. Typical Environmental and Social Impacts of SCL Activities (Source: Ref. 7)

Beyond these environmental and social impacts, the financial implications for businesses of congested transportation infrastructure, high fuel and energy costs, and logistics-related health and safety incidents are significant.

Business Trends and Implications for Sustainable SCL

The motivation to lower costs through SCL efficiency provides built-in business incentives to pursue sustainable SCL, since many SCL efficiencies also produce environmental and social benefits. In addition, the following business trends suggest a growing need for companies to consider the environmental and social impacts of their SCL activities:

- Increasingly, corporate purchasers are adopting sustainable purchasing policies.
- The evolving role of third-party logistics companies.
- Corporate social responsibility statements are increasingly prevalent.
- Government regulations and incentives.
- Just-in-time manufacturing and direct-to-consumer business models, e.g. online shopping.
- Diminishing supply and increasing costs of fossil fuels.

Table 13. Examples of Financial and Sustainability Benefits in Sustainable SCL Practices

(Source: Ref. 7)

Financial Benefits	Environmental Benefits	Social Benefits
Increased revenue	Reduced fossil fuel consumption	Reduced community impacts (noise, traffic congestion, health and safety, etc.)
Reduced costs	Reduced air and water emissions	
Increased asset utilization	Increased energy efficiency	
Enhanced customer service	Reduced waste	

4.2.2 Planning

The “Plan” link in the supply chain includes activities performed at the strategic level. These activities drive the efficiency and effectiveness of SCL practices later performed at the tactical level. Best sustainable SCL practices and benefits associated with the “Plan” link are:

- Increase forecast accuracy
- Consider SCL in product lifecycle management
- Optimize SCL network design

Plan 1: Increase Forecast Accuracy

Increasing the accuracy of supply and demand forecasts can reduce waste and inventory along the supply chain, increase supply chain visibility and responsiveness, and enhance customer service. An advanced supply chain management practice aimed at improving forecast accuracy is collaborative planning and forecasting. Greater collaboration can take place between a company’s internal functions, as well as between a company and its customers and suppliers. Successful collaboration is based on trust and long-term relationships and can take many forms, including the sharing of information, materials, assets, capital, risks, technology, or other resources.

Suggestions: Best practices to increase forecast accuracy:
- Involve sales and marketing, operations, and logistics departments in developing integrated sales and operational plans.
- Conduct a collaborative planning initiative with external supply chain partners (customers, suppliers, and third-party logistics companies) to exchange forecast information.
- Use technology to facilitate real-time sharing of point-of-sales data, inventory levels, reorder status, and production and delivery schedules. Improved information visibility can reduce speculative orders, excess production, unnecessary shipments, and waste.

Plan 2: Consider SCL in Product Lifecycle Management

Lifecycle management takes the view that products need to be managed throughout design, production, operation, maintenance, and end-of-life reuse or disposal. Product and packaging design affect the efficiency and effectiveness of a company’s SCL practices and, thus, logistics costs, waste, emissions, and energy consumption.

Suggestions: Best practices to incorporate SCL into product lifecycle management:
- **Design for logistics** – a lean manufacturing principle that uses product design to address logistics efficiency – addresses package weights and dimensions and product standardization for efficient warehousing and transport, and product suitability for efficient take-back, reuse, or recycling.
- **Use lifecycle cost analysis** to reduce the total cost of design, production, logistics, operation, and disposal over a product’s lifecycle. Lifecycle costing allocates total costs – including those traditionally grouped as “overheads”, such as waste disposal, training, environmental permitting,

and waste and water treatment – to the products and processes responsible for generating the costs. This allows decisions about product design, purchasing, and manufacturing to be based on a truer picture of costs over a product's lifecycle.

Plan 3: Optimize SCL Network Design

Merger activities, customer demands, pressures to reduce inventory and free up capital, and rising energy and fuel costs are common incentives for a company to examine its logistics network – that is, the number, type, and location of manufacturing and distribution facilities and the transportation channels and modes used to service customers. Network design also considers whether a company should manage its SCL in-house, or whether SCL activities should be outsourced to one or more third-party logistics providers (3PLs).

Suggestions: Best practices to optimize the efficiency of your SCL network:

- **Use supply chain optimization software** that considers distance, weight and cube volume, asset mix, location, and customer service variables. New tools (such as Schenker's online emission calculator) also consider fuel and energy consumption and emissions in SCL network design. These tools can support decisions to change the number or type of sites, distribution channels, or transportation modes; to use capacity more efficiently; or to extend the life of existing assets.
- **Assess the costs and benefits** of outsourcing some or all SCL activities to one or more 3PLs, particularly those aspects that are non-core to your business. Not only will this enhance your company's supply chain agility; but consolidating warehousing and transportation activities with other companies, through a 3PL, typically uses warehouse and transport space more efficiently, thus reducing costs, greenhouse gas emissions, and energy consumption. In addition, reduced traffic and higher levels of training for 3PL truck drivers versus private fleet drivers have been found to result in fewer traffic fatalities.

Box 20. Example: Nature's Path (Source: Ref. 7)

NATURE'S PATH

Optimizing supply chain logistics network efficiency

With the help of a modeling tool that analyzed shipments and customer ordering patterns for a year, Richmond-based Nature's Path found the optimal location for a new distribution centre (DC).

The new DC will be strategically located within 150 miles of Chicago, where it will serve as a hub for the Midwest, home to the majority of Nature's Path's customers. These customers were previously serviced by truck from Nature's Path's Richmond DC. Distributing from the new Chicago hub will enable Nature's Path to send efficient inventory shipments from Richmond to Chicago by rail. Also, warehousing product closer to the core market will allow Nature's Path to cut delivery lead-time in half.

Many of Nature's Path's customers already pick up products from the Chicago DC, further reducing their ecological footprints through consolidated pickups.

- Customer service levels up: delivery lead-time reduced from three–five days to one and a half days
- Emissions and fuel consumption down; 625 truckloads transferred to more fuel-efficient rail
- Per unit freight costs down
- Reduced traffic congestion

4.2.3 Storage

The "Store" link in the supply chain concerns the selection, design, and configuration of warehouse space; management of inventory receiving, picking, and packing functions; and management of raw materials or finished goods inventory. There are significant opportunities to improve the energy

efficiency and reduce the environmental and social footprints of warehouse facilities. Best practices associated with the “Store” link are:

- Incorporate sustainability factors in new warehouse development
- Optimize warehouse layout and workflow
- Increase the energy efficiency of warehouse operations
- Reduce inventory obsolescence or degradation
- Handle and store hazardous materials safely
- Automate inventory handling and management processes

Store 1: Incorporate Sustainability Factors in New Warehouse Development

When developing a new warehouse, incorporating objectives of sustainability, security, productivity, accessibility, functionality, and cost-effectiveness early on can result in a more secure, healthier working environment than when focusing too narrowly on any single objective.

Suggestions: Best practices to minimize the environmental and social impacts of a new warehouse:

- **Reuse** existing buildings and sites where possible.
- Select the site and situate the building to **minimize traffic and noise impacts** on the community.
- **Implement measures to avoid erosion of soil** that could destroy vegetation, degrade property, cause sedimentation of local water bodies, destabilize building foundations, or impact structural integrity, all of which have liability and insurance cost implications.
- **Implement water efficiency measures**, such as integrated rainwater collection and storage systems, to reduce the municipal water supply and wastewater treatment requirements.
- **Design or reconfigure facilities to be energy efficient.** For example, a light-colored roof reflects solar radiation and will reduce HVAC (heating, ventilating and air conditioning) loads, energy consumption, and operating costs. For large roof areas, the effect can be significant, especially for temperature-controlled warehouses. Greater heat reflection can also increase worker productivity in the summer.
- **Minimize the amount of building materials used and waste produced**, and use building products and materials with recycled content or other environmentally preferable characteristics.
- **Establish good indoor air quality** and eliminate sources of indoor air pollution.

Store 2: Optimize Warehouse Layout and Workflow

Warehouse layout and operations impact energy efficiency and worker productivity. Inefficient use of space results in excess utility and labor costs, slower customer service, lower asset utilization, higher capital requirements, and a bigger physical footprint on the environment.

Suggestions: Best practices to optimize the efficiency of warehouse layout and workflow:

- Where possible, **share** warehouse space with other users.
- **Organize warehouse layout** for safe and efficient circulation and inventory picking and put-away, and to minimize repetitive handling.
- **Relate interior and exterior receiving and shipping operations** to the flow of goods through the warehouse.
- **Configure cartons, pallets, and racking** to make full use of available height. **Example:** reusable shipping containers are typically standardized and designed for more efficient stacking.
- **Optimize picking methodology** for energy efficiency and productivity (e.g., order pick – one picker, one order; batch pick – one picker, multi order; zone pick – multi pickers, one or multi orders but passed zone to zone; or wave pick – multi picker, multi order).
- **Train employees** on efficient workflow processes and procedures.

Store 3: Increase the Energy Efficiency of Warehouse Operations

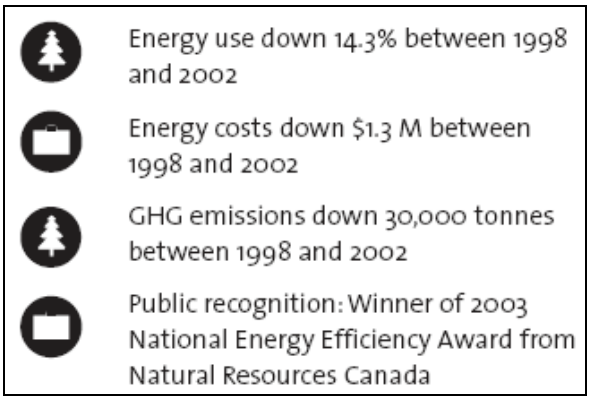
Common warehouse systems (e.g., HVAC, lighting, and security) and equipment (e.g., conveyors and forklifts) consume significant amounts of energy and contribute to high operating costs.

Implementing energy efficiency measures related to warehouse operations can result in cost savings of 20% or more and reduce the draw on energy resources.

Suggestions: Best practices to make your warehouse operations more energy efficient:

- **Designate an energy manager** and conduct an energy audit to identify opportunities to be more efficient.
- **Use a formal building commissioning process** for new buildings or a regular recommissioning process for existing buildings to ensure and document that all building systems perform according to specification and design intent. A formal commissioning process can improve new building energy performance by 8–30%.
- **Plan loading dock space** to reduce energy consumption in colder months and provide more tolerable working conditions for dock workers. For example, loading berths should be covered at least 4 feet beyond the platforms of open loading docks; dock seals could be used at each loading bay; or, for very cold climates, the entire loading bay could be enclosed.
- **Install rapid action loading doors** that minimize the time doors are open for the approach or departure of delivery vehicles, thus controlling exposure to weather and reducing energy costs.
- **Use energy-efficient lighting fixtures**, such as motion-sensor or timed lighting systems. Use natural light where feasible.
- **Turn off lights and HVAC** when not in use.
- **Use direct digital control systems** and link HVAC systems with the warehouse operating schedule.
- **Use natural ventilation** rather than energy-intensive mechanical ventilation. Natural ventilation can provide acceptable indoor air quality and use less energy, though precautions must be taken to protect against outside contaminants.
- **Use ceiling-mounted fans** to reduce heat stratification and provide air circulation.
- **Recover waste heat generated by refrigerated storage systems** to heat water, provide space heat, or power other processes.
- **Maximize the energy efficiency of materials handling equipment** such as conveyors, palletizers, and automated storage systems.

Box 21. Example: VERSACOLD (Source: Ref. 7)



Store 4: Reduce Inventory Obsolescence or Degradation

Excess inventory and low inventory turnover can result from poor management of reorder points, order quantities, storage locations, or data. Improving inventory management will increase turnover and reduce obsolescence or degradation, leading to less waste, improved warehouse utilization, and lower capital, labor, and utility costs.

Suggestions: Best practices to improve inventory management and reduce obsolescence and degradation:

- **Analyze purchasing patterns** to detect and implement opportunities for vendor consolidation or standardization that will result in fewer stock-keeping units.
- **Include risk of obsolescence** in calculating economic order quantities.
- **Implement vendor-managed inventory programs** or require suppliers to adhere to material

return policies that reduce incentives to stock excess inventory.
- **Consolidate storage of inventory** within controlled locations to avoid wasting storage space or hidden build-up of inventory that may become obsolete and eventually require disposal.

Store 5: Handle and Store Hazardous Materials Safely

Manufacturers store a variety of paints, fuels, solvents, and other chemicals for use in operations or asset maintenance. Where the use of non-hazardous alternatives is not an option, safe handling and storage of hazardous materials (hazmat) is essential to prevent worker health and safety issues, operational downtime, environmental contamination from spills or leaks, higher insurance premiums, and higher environmental permitting costs – not to mention damage to a company's brand equity.

Suggestions: Best practices to handle and store hazmat safely and to minimize waste and pollution:
- **Where possible**, **replace hazmat** with non-hazardous alternatives.
- **Train warehouse workers** on safe handling, proper storage techniques, and spill and leak prevention.
- **Inspect tanks or containers** used to store hazmat to detect and correct the potential for liquid or vapor leaks.
- **Segregate containers** used to store hazmat from those used to store non-hazardous supplies, and ensure proper cleaning procedures are used prior to reuse or disposal.
- **Schedule regular hazmat waste removal and disposal** to comply with regulations regarding how long hazmat may be stored on site.

Store 6: Automate Inventory Handling and Management Processes to Improve Efficiency

Automating paper- or labor-intensive inventory processes can provide financial and sustainability benefits. Automated warehouse operations can be run in darkness or non-heated environments, resulting in energy savings. Automated inventory systems also enhance product traceability in the event of a recall.

Suggestions: Best practices to automate inventory handling and management processes to improve efficiency:
- **Use bar coding, radio frequency identification (RFID), or material requirements planning (MRP)** technology to track inventory levels and locations with high precision. Improved inventory visibility can increase service levels and customer satisfaction, reduce obsolescence and waste, reduce the number of expedited shipments by fuel-intensive modes such as air freight, and reduce safety stock along the supply chain. Bar coding and RFID technologies can also reduce paper consumption in manual inventory processes.
- **Implement automated storage and handling systems** that sort, direct, and retrieve inventory with less repetitive handling and lower energy consumption for lighting and HVAC than manual labor.
- **Use mechanical handling equipmen**t powered by alternative energy sources.

Box 22. Example: General Hydrogen (Source: Ref. 7)

GENERAL HYDROGEN

Alternative energy solutions for warehouse performance improvement

The first sale of Hydricity packs, the name of Richmond-based General Hydrogen's fuel cell system, has just been made to Bridgestone to power its warehouse forklifts.

Although the initial cost of General Hydrogen's technology is greater than the lead acid battery technology it replaces, there are multiple operational benefits to using Hydricity packs:

BATTERY	FUEL CELL
Takes up to 8 hours to be recharged	Refuelling takes only a few minutes
Expected life is 1.5 years	Current life is 4–5 years; industry targeting 10-year lifetime
Hazardous waste is stored in the battery and disposed of at end of life	Only by-product is pure water

4.2.4 Transportation

The “Transport” link in the supply chain involves fleet vehicle management and the inbound and outbound transportation of goods. The following best practices apply to in-house or outsourced transportation:

- Manage the lifecycle performance of delivery fleet
- Shift to modes or equipment that use less fossil fuel
- Optimize transportation loads and routes
- Use reusable or recyclable shipping materials
- Transport hazardous materials safely

Transport 1: Manage the Lifecycle Performance of Delivery Fleet

Whether operated in-house or by third parties, the way that a delivery fleet is managed contributes significantly to the cost and environmental impacts of transporting goods. Fleet management encompasses sourcing, maintenance, operation, and disposal of fleet vehicles. Effective fleet management can reduce fuel use and vehicle emissions, reduce maintenance costs, increase vehicle reliability and customer service, increase vehicle life and salvage value, and improve the safety of equipment operators and the public.

Suggestions: Best practices to manage the lifecycle performance of your delivery fleet:

- **Specify fuel-efficient fleet technologies** and design improvements when sourcing new fleet vehicles, such as better aerodynamics, vehicle weight reductions, improved engine and transmission designs, improved rolling efficiency of tires, and more efficient accessories.
- **Perform regular preventive fleet maintenance and inspections**, including items such as tire pressure, which should be checked frequently. Proper tire inflation is essential for fuel economy, safe vehicle handling, and long tire life.
- **Provide driver training** on fuel-efficient driving techniques (e.g., block shifting or progressive shifting).
- **Reduce unnecessary idling of delivery vehicles**. Turn engines off during pick-ups and deliveries. Avoid running the engine for cooling, heating, or charging batteries by installing separate cab heaters and air conditioners, engine timers that turn engines off after a cool-down period, and timing devices to maintain pre-set temperatures or battery charges.
- **Implement policies to restrict maximum vehicle speed** or program engines not to exceed certain speeds.
- **Install on-board or dashboard fuel monitoring devices**, and train drivers on their use.
- **Implement driver incentive programs** to reward or recognize fuel efficiency gains or fuel-efficient driving techniques.

Box 23. Example: PUROLATOR (Source: Ref. 7)

PUROLATOR

Three-year payback from hybrid-electric delivery vehicles

Purolator is now on the road with 19 hybrid electric vehicles (HEVs) in its in-city pickup and delivery fleet, with 55,000 in-service kilometres travelled since May, 2005.

Powered by Burnaby-based Azure Dynamics technology, the HEVs use half the fuel of gas-powered vehicles. Maintenance costs are also down due to longer oil change intervals, longer brake pad life, and a lower parts-to-service ratio. With the business case based only on financial factors (the company expects pay-back within three years), the environmental benefits from reduced GHG emissions are a valued bonus.

Purolator is putting 115 more HEVs on the road in 2006, and 400 more units per year thereafter to replace its entire 3,000-unit in-city fleet.

Transport 2: Shift to Modes or Equipment That Use Less Fossil Fuel

Worldwide, 95% of transport is fuelled by oil. Rising oil prices and public policies aimed at reducing vehicle emissions and fossil fuel use are strong incentives to explore freight transport alternatives that consume less fossil fuel.

Suggestions: Best practices to reduce the fossil fuel consumption of freight transport:

- **Shift loads to more fuel-efficient modes**. For example, shifting from heavy-duty truck to rail, and further from rail to marine (especially barge), uses less fuel, produces fewer emissions, and reduces traffic congestion.
- **Use freight vehicles fuelled by alternative energy** to reduce costs, fuel consumption, and emissions of freight transport by road.

Transport 3: Optimize Transportation Loads and Routes

The biggest factor affecting the sustainable management of freight transport is load factor – the percentage of the capacity of a truck, railcar, or air or marine container that is used. A one-quarter-full truck uses two-and-a-half times as much fuel per ton-kilometer as a three-quarter-full truck, yet often the trucks on the roads are less than half full. Increasing load factors as well as decreasing distances traveled will result in improved asset utilization, lower costs per unit shipped, reduced fuel consumption, lower emissions, and reduced community impacts from noise and traffic congestion

Suggestions: Best practices to optimize the efficiency of inbound and outbound freight transport loads and routes:

- **Avoid unnecessary product packaging**, and use standardized and modularized packaging, pallets, or containers to optimize transport load factors.
- **Use load planning software** to optimize loading of railcars, trucks, or air or marine containers in terms of weight, dimension, safety, and legal variables. Load planning software can even take hazmat requirements into consideration to determine what can – or cannot – be co-loaded.
- **Maximize bidirectional load factors** through the use of common carriers (rather than typically underutilized private fleets), backhauls, co-shipping, double-stacked containers, and Internet-based load-matching services.
- **Use route planning software** to reduce total transport distances.
- **Schedule freight delivery times** to reduce traffic congestion during peak periods.
- **Work with local suppliers** to shorten inbound transport distances.
- **Investigate and influence suppliers' transportation modes, loading, and routes** for inbound materials to gain the full benefits of sustainable transportation.

Transport 4: Use Reusable or Recyclable Shipping Materials

Most corrugated packaging is used commercially only once, whereas reusable containers made from more durable fiberboard or plastic can be reused about 50 times and 250 times, respectively, before they have to be replaced. Although the initial cost of corrugated packaging is less than that of reusable alternatives, the repeated use of longer-lasting packaging leads to a lower cost per trip as well as reduced waste. Users of reusable, standardized shipping containers have also reported improved asset utilization, reduced product damage and waste, and improved handling safety and efficiency.

Suggestions: Best practices to reduce the cost and waste generated by shipping containers and materials:

- **Switch to reusable shipping containers** instead of using less durable materials such as cardboard or plastic shrink wrap. Reusable containers generally work best in closed-loop distribution systems where containers can be efficiently returned to the point of origin. Containers that are collapsible (designed to fold down when empty), nestable (able to be placed inside each other), and stackable (designed to lock into each other for higher stacking heights) provide additional benefits.
- **Use longer-lasting, recyclable plastic pallets** in place of wooden pallets.
- Where it is impractical to own reusable containers, **enroll in a pallet or container pooling**

service.
- **Use reusable tie-down straps and bands** instead of shrink wrap or disposable strapping. The initial cost of a pallet strap will be recovered in the first 5–15 uses. Also, if plastic strapping is required, ensure it is made of plastic that can be recycled.
- **Use recycled cardboard and pallet**s where cardboard must be used, and recycle them again at the end of their useful lives.
- **Design packaging to be recycled** where reusable packaging or shipping containers are not feasible options.

Transport 5: Transport Hazardous Materials Safely

Hazardous materials (hazmat) are transported every day by road, rail, air, and ocean. Where the substitution of non-hazardous alternatives is not an option, safe transport of hazmat is essential. Improper transportation of hazmat can result in serious – even fatal – accidents; health and safety liabilities; business downtime; environmental contamination; and higher insurance premiums.

Suggestions: Best practices to ensure the safe transport of hazmat by private or third-party fleets:
- **Become knowledgeable about and compliant** with all hazmat transportation rules and regulations for all applicable modes.
- **Develop and implement a dangerous goods transportation security plan** that covers personnel security clearances and checks, package control procedures, security of loading/unloading areas, access control, and emergency communications procedures.
- **Train employees** on regulations concerning safe hazmat handling, labeling, permitting, and transportation.
- **Use load planning software** that takes hazmat constraints into consideration and guards against inappropriate co-loading.
- **Inspect tanks or containers used to transport hazmat** regularly to detect and correct potential liquid or vapor leaks**.**

4.2.5 Reverse Logistics

Reverse logistics – the process of moving goods back from their final destination toward their point of origin for the purpose of capturing value or for proper disposal – is a critical part of product lifecycle management. In 1998, a US study revealed that reverse logistics accounted for an estimated 4% of total logistics costs; however, reverse logistics should be considered not a cost, but an opportunity. Reverse logistics can enhance customer satisfaction, increase brand value, and provide revenue opportunities from reconditioned or recycled products, by reusing parts or materials from returned items. Companies can also market product or packaging take-back programs as value-added solutions for their customers. Sustainable reverse logistics practices are as follows:

- Optimize the efficiency of product returns
- Implement high-value, low-waste disposition strategies

Reverse Logistics 1: Optimize the Efficiency of Product Returns

Product returns can be the result of damage in transit or during use, the end of a lease or a rental period, the expiration of seasonal merchandise, restock programs, product recalls, or excess inventory. For producers of time-based, seasonal, or fashion-oriented products, product returns can be very high, making the efficient handling of the reverse logistics process a competitive necessity. Even for companies where returns are more exceptions than the rule, the cost of handling returns is often disproportionately high in relation to the amount of returns. In addition to customer-initiated product returns, trends toward increased extended producer responsibility and product stewardship regulation also necessitate more efficient reverse logistics processes.

Suggestions: Best practices to optimize the efficiency of the product returns process and minimize related logistics costs, emissions, and product waste:
- **Design products and packaging** to facilitate safe, efficient, and cost-effective recovery and disassembly for reuse or recycling.

- **Implement a proactive take-back program** to reclaim products at the end of their useful lives.
- **Build business rules into the returns process** and track information with products so the reason for return and the disposition status of the product is clear. Clear information can reduce the disposition turnaround time, decrease handling and administrative costs, and reduce waste.
- **Implement a centralized return center** (CRC) devoted to sorting, processing, and shipping returned products to their next destinations. A CRC can increase the value realized from returned items; reduce waste; reduce transportation costs and environmental impacts; and increase the visibility of quality problems that need to be corrected.
- **Outsource reverse logistics to a third party**. Third parties can generate economies of scale that individual manufacturers or retailers often cannot, thereby increasing the realized value of returned products and reducing the amount of waste that would otherwise result.

Reverse Logistics 2: Implement High-Value, Low-Waste Disposition Strategies

Product lifecycle management strategies that realize the value remaining in returned products are gaining ground, as are strategies to avoid waste and the environmental or social harm caused by unnecessary, premature, or unsafe disposal of products.

Suggestions: Best practices to maximize the value realized from, and minimize the waste produced by, returned products and packaging:

- **Assess the value of returned products and determine the resale, reuse, or recycling potential** of the whole product as distinct from the potential value of individual modules, components, or materials.
- **Recondition, cannibalize, and recycle** returned products to recover value and reduce waste.
- **Disassemble and reclaim any recyclable materials and safely dispose of the remainder** where reconditioning is not possible because of product condition or legal or environmental restrictions. These strategies – whether performed in-house or by another party – are aimed at recovering value from returned products and reducing the waste that would result from immediate disposal in a landfill.
- **Donate serviceable returned products to charitable organizations** for redistribution to those in need.

4.2.6 Summary

Table 14 presents a summary of the best practices for the four major links (elements) of sustainable SCL.

Table 14. A Summary of the Best Practices for the Four Major Links (Elements) of Sustainable SCL

Link (element)	Best Practices
Plan	Increase forecast accuracy Consider SCL in product lifecycle management Optimize SCL network design
Store	Incorporate sustainability factors in new warehouse development Optimize warehouse layout and workflow Increase the energy efficiency of warehouse operations Reduce inventory obsolescence or degradation Handle and store hazardous materials safely Automate inventory handling and management processes
Transport	Manage the lifecycle performance of delivery fleet Shift to modes or equipment that use less fossil fuel Optimize transportation loads and routes Use reusable or recyclable shipping materials Transport hazardous materials safely
Reverse logistics	Optimize the efficiency of product returns Implement high-value, low-waste disposition strategies

4.3 Product Stewardship

The opportunities for reducing social, environmental, and economic impacts in a company's interactions with its customers and sales channels generally lie in three areas:

- Improving the processes for efficiently getting the product or service to the consumer – including planning demand and supply
- Product stewardship that adopts a "cradle to grave" approach
- Improving the design of the product or service as part of product stewardship

Success is dependent on supply chain partnerships between suppliers and their customers.

4.3.1 Planning Demand and Supply

The Relationship between Manufacturers and Retailers

Increasing consolidation in the retail market – whether in the grocery sector, general merchandise, white goods or DIY – has changed the dynamics of the supply chain from manufacturer driven to retailer led. Small manufacturers have always had to tailor their production to the needs of their customers, but large and often global brands have had significant bargaining power with their retail customers. Global retailing now competes with global manufacturing and the smart players have recognized the need for a collaborative approach: what the consumer wants to buy rather than what the shop wants to sell or the manufacturer wants to make.

This market-driven approach redefines the way companies manufacture, distribute, promote, and sell products by focusing on consumers, customers, and the supply chain, so that all information and logistics are linked throughout the organization to deliver the most preferred product at the lowest cost. Responsive manufacturing requires a supply chain system that will capture the product sold and ensure that production is geared to meet that need. It is an integral part of a sustainable supply chain because it drives out inefficiency.

Example: Product Traceability
Concerns about product safety are the largest driver in changing consumer demand. Traceability from "farm to fork" is fundamental to consumer confidence and this is increasingly recognized by legislation. European farmers will be subject to strict new levels of accountability, including regular on-farm audits, which will be published and inspected by European Union officials, and ultimately electronic tagging, which could follow a carcass to the processing plant and track it through the boning room.

4.3.2 Product Stewardship

All products have the potential to cause environmental degradation. Product stewardship is a product-centered approach to environmental protection and social consideration. It requires those involved in the product lifecycle, including manufacturers, retailers, users, and disposers, to share responsibility for reducing the environmental impacts of products and improving the quality of life of those using them.

Role of manufacturers: By rethinking their products, their relationships with the supply chain, and the ultimate customer, some manufacturers are dramatically increasing their productivity, reducing costs, fostering product and market innovation, and providing customers with more value at less environmental impact.

Role of retailers: Retailers can have an influence by preferring product providers that offer greater environmental performance, educating the consumer on how to choose environmentally preferable products, and enabling consumer return of products for recycling.

Role of consumers: Ultimately, it is the consumer who makes the choice between competing products and who must use and dispose of products responsibly.

Role of local and national governments: Governments also have a major opportunity via their procurement policies to promote change, e.g., to incorporate environmental and social performance standards into the Calls for Tender process.

Box 24. Marks and Spencer (Source: Ref. 33)

UK's Marks and Spencer Supports the Farmers

Research showed that Marks & Spencer's (M&S) customers want to know more about where their food comes from, and they request closer links to the farmers who produce it. So M&S strives to bridge the gap between farmers and customers, by running the following schemes:

Named Farmer:

M&S includes the name of the farmer or grower on a range of food labels, and the name of the county the food was produced in. As the farmers are an important stakeholder in the food chain, the company wanted to let the customers know who they are. This makes the M&S products more interesting and assures customers that the food is fresh, safe and produced from a known source.

Meet the Farmer:

Over the summer, M&S customers can meet many of the farmers and growers and sample the fresh food range at M&S stands during agricultural shows across the country. Moreover, M&S gives its customers the chance to meet the farmers who produce the food, in some of its bigger stores. Customers can find out more about their farming methods, and let them know how they value traditional farming skills.

Farm Badges:

Proud of their role as a supplier to M&S, the producers have asked for farm badges to put on their farm gates, advertising their farm as a M&S producer.

Fairtrade

M&S's commitment to selling Fairtrade coffee started in 2004 when M&S introduced only Fairtrade-certified coffee and tea in its Café Revive. It took three years' hard work to ensure consistent quality and value was achieved and M&S was the first high street café chain to do this. Since then, Café Revive has sold over 35 million cups of Fairtrade coffee.

M&S believes that it is important to guarantee farmers in developing countries fair terms and a fair price so they can enjoy a better standard of living. Hence, as of March 2006, M&S is converting all the coffee sold to Fairtrade. M&S is the only major retailer to do this, with tea to follow later this year. M&S is also extending its commitment further through areas such as cotton, honey, chocolate, avocados, pineapples, mangos and bananas.

Box 25. Green Marketing (Source: Ref. 16)

Green Marketing

One means for creating awareness is to make necessary adjustments in the marketing strategy of retail outlets and put more emphasis on "green marketing".

As per common perception, green marketing refers solely to the promotion or advertising of products with environmental characteristics. Terms like Lead-free, Recyclable, Refillable, Ozone-friendly, and Environment-friendly are some of the things consumers most often associate with green marketing.

While these terms are green marketing "claims", in general green marketing is a much broader concept, one that can be applied to consumer goods, industrial goods and even services. It incorporates a broad range of activities, including product modification, changes to the production process, packaging changes, as well as new communication strategies and advertising campaigns.

4.3.3 Product Design

Product design taking into account a product's lifecycle impacts on the environment is a very important step to green the supply chain from the origin. Often termed "design for environment" (DfE) or "environmentally conscious design" (ECD), it is a vast subject of intense study and interest recently. It is a complex subject that cannot be fully explored within the scope of this manual. However, several

examples related to this subject will be presented below as a brief introduction to the concepts.

Improving the Design of the Product and Its Packaging

The lifecycle of a product covers the whole supply chain from the extraction of natural resources, through design, manufacture, assembly, marketing, distribution, sale, and use, to its eventual disposal as waste. This process involves designers, industry, marketing people, retailers, and consumers.

Over the past decade many companies have introduced their own product development processes to systemize decision-making. Sustainable development needs to be built into the processes so that decisions are made in full knowledge of the environmental and social impacts of product development, design and build, or market development.

Example 1: Product Design Checklist
Table 15 illustrates the stages at which sustainable development issues may be considered in the design of a product.

Example 2: Product Evaluation Matrix
The Product Evaluation Matrix shown in Table 16 can be combined with software to calculate the final product rating to decide whether a product is accepted or rejected.

Example 3: DfE/Lifecycle Checklist (see section 4.1.5 on “Service Supply Chain Strategies”)

Table 15. Product Design Checklist (Source: Ref. 4)

Product Design Concept Development - Checklist	Project leader	Product development	Marketing	Marketing research	Process development/operations	Engineering	Planning	Packaging & distribution	Purchasing	Finance	Customer management	Sustainable development	Legal
1 Clarify and define project objectives/success criteria	✔	X	X		X	X	X			X	X	X	
2 Develop and research product concepts		X	✔	X									
3 Develop a product brief which fits concept statements		X	✔										
4 Develop process/manufacturing concept and document		✔			X	X							
5 Develop initial product sample		✔	X	X	X								
6 Assess initial volumes, consumer feedback, and positioning			✔								X		
7 Design pilot equipment requirements		✔			X	X							
8 Produce samples		✔			X								
9 Test product with target consumers		X	✔	X								X	
10 Identify potential materials supply requirements		✔			X		X	X	X			X	X
11 Identify potential suppliers									✔			X	
12 Perform initial capacity analysis/timings					X		✔						
13 Determine product design impact on packaging/palletization/distribution		X	X		X		X	✔			X	X	
14 Attempt preliminary financial returns/pricing			✔							X	X		
15 Conduct initial pricing analysis			✔							X	X		
16 Assess preliminary business impact timing implications	✔	X	X		X	X	X	X	X	X	X		
17 Conduct consumer research as appropriate			✔	X									
18 Obtain investigational safety clearances		✔											
19 Develop and review initial product claims		X	✔										X
20 Identify equipment required for manufacturing process		X			X	✔	X						
21 Determine initial capital costs/time frame						✔							
22 Determine engineering resource required						✔							
23 Determine if consumer test results meet success criteria		X	✔	X									
24 Review project against sustainability criteria	X	X	X		X	X						✔	X
25 Submit project to Board for approval		✔	X		X								X

NB: This list is not developed necessarily in time order. Key: X Likely involvement ✔ Lead function

Table 16. Product Evaluation Matrix (Source: Ref. 18)

		worst ..... best									
Evaluation Area	**Criteria**	1	2	3	4	5	6	7	8	9	10
Purchasing and Supply Management	cost										
	vendor performance										
	shelf life										
	packaging safety										
	availability of various sizes (unavailability of a variety of sizes should be rated low)										
	storage requirements (special storage requirements should be rated low)										
	difficulty in dispensing (materials that are difficult to dispense should be rated worst)										
Environment	general environmental information from MSDS										
	regulated by RCRA as listed waste										
	regulated by RCRA as a characteristic waste										
	proprietary vs. constituent availability (proprietary should be rated low)										
	regulated by the Clean Water Act										
	listed and/or regulated by SARA										
	regulated by CERCLA										
	spill management and disposal instructions on MSDS										
	disposal required off-site										
Safety and Hygiene	adequate labeling on containers										
	specific health and safety information on MSDS										
	inhalation risk										
	skin absorption risk and irritation										
	ingestion risk										
	fire and explosion risk										
	product stability										
	hazardous decomposition potential										
	incompatibility										
	hazardous polymerization potential										
	venting (engineering) requirements										
	protective equipment requirements										
	storage requirements										
	carcinogenic potential										
	potential acute and/or chronic health hazard										
	reproductive hazard										
Analytical	specification analysis										
	laboratory capability										
	complexity of analysis										
	frequency of testing										
	disposal analysis										

5. Measuring Performance on GSC

"You cannot manage what you do not measure!"

5.1 Performance on GSC

The focus for greening the supply chain is to improve the performance of the business's own operations, i.e. to increase efficiency and competitiveness. The targets of GSC include reducing or eliminating materials used in manufacturing processes or products, ensuring environmental compliance and greening the practices of supplier operations, and developing new materials, processes, or other solutions to environmental and sustainability issues.

What Is Your Status?

If you want to know how your organization is doing in participating in GSC, use the following quiz to evaluate your environmental position.

Box 26. How environmentally aware is your business? (Source: Ref. 10)

1 Is your business willing to seek out suppliers that are environmentally friendly?
a. As much as possible
b. For a few items that are used frequently
c. It hasn't been discussed

2 What kind of policy does your corporation have for environmental sustainability?
a. We already have fairly detailed policy
b. We want to implement a plan, but have no idea how to go about doing it
c. We currently don't have a plan in place, but recognize the benefits of doing so

3 What kind of relationships does your business have with its suppliers?
a. We research our suppliers to ensure their practices fit with our mandates prior to ordering from them
b. We know who our suppliers are but aren't familiar with their entire operations scheme
c. Nothing beyond simple purchase and sale transactions

4 How important to your company is encouraging sustainable practices?
a. Very important, we publicize our green policies already
b. We'd like to get involved with sustainability but currently don't have the time or resources to do so
c. Not that important, but pressure from consumers is causing us to reconsider

5 What kinds of environmental improvements would you like to make to your business?
a. Whatever we currently don't have in place – like Greening the Supply Chain
b. We'd like to develop an EMS and implement it to save energy and money if possible
c. The bare minimum – whatever is simplest for us

Give Yourself 3 Points for every A, 2 Points for every B, and 1 Point for every C

5-8 Environmentally Unaware	9-12 Environmentally Concious	13-15 Environmentally Friendly

As your organization starts to implement GSC programs or measures, evaluate or assess your company's performance level for each of the best practices presented in Section 4 and the importance of each practice to your company. When identifying GSC improvement opportunities in your company, start with the areas that you rated as having low performance and high importance.
Example: See Table 17 on supply chain logistics.

Table 17. Evaluating Performance on Supply Chain Logistics (Source: Ref. 7)

	PERFORMANCE		IMPORTANCE	
	Low	High	Low	High
PLAN 1				
1. Integrate internal sales and operational planning processes and systems.	○ ○ ○ ○		○ ○ ○ ○	
2. Collaborate with customers on forecasting and planning.	○ ○ ○ ○		○ ○ ○ ○	
3. Collaborate with suppliers on forecasting and planning.	○ ○ ○ ○		○ ○ ○ ○	
4. Electronically collect and share sales, inventory, order, production, and delivery data.	○ ○ ○ ○		○ ○ ○ ○	
PLAN 2				
1. Consider logistics efficiencies in product and/or packaging design.	○ ○ ○ ○		○ ○ ○ ○	
2. Base product design, purchasing, and manufacturing decisions on lifecycle costs.	○ ○ ○ ○		○ ○ ○ ○	
PLAN 3				
1. Use supply chain optimization software to optimize location, distance, load, service, and environmental variables in SCL network decisions.	○ ○ ○ ○		○ ○ ○ ○	
2. Outsource SCL functions that can be more efficiently and cost-effectively performed by third parties.	○ ○ ○ ○		○ ○ ○ ○	
PLAN 4				
1. Collect and analyze data to understand environmental impacts and risks of SCL activities.	○ ○ ○ ○		○ ○ ○ ○	
2. Understand gaps between ISO14001 requirements and your existing environmental management program.	○ ○ ○ ○		○ ○ ○ ○	
3. Implement robust environmental management program to mamage SCL impacts.	○ ○ ○ ○		○ ○ ○ ○	
STORE 1				
1. Follow LEED criteria in building design.	○ ○ ○ ○		○ ○ ○ ○	
2. Select site and situate building to minimize traffic and noise impacts on community.	○ ○ ○ ○		○ ○ ○ ○	
3. Use building products and materials with recycled content.	○ ○ ○ ○		○ ○ ○ ○	
4. Implement soil erosion measures.	○ ○ ○ ○		○ ○ ○ ○	
5. Implement rainwater collection and storage systems.	○ ○ ○ ○		○ ○ ○ ○	
STORE 2				
1. Share excess warehouse space with other users.	○ ○ ○ ○		○ ○ ○ ○	
2. Optimize safety and efficiency of warehouse layout.	○ ○ ○ ○		○ ○ ○ ○	
3. Relate receiving and shipping operations to the flow of goods.	○ ○ ○ ○		○ ○ ○ ○	
4. Make full use of available warehouse height for cartons, pallets, and racking.	○ ○ ○ ○		○ ○ ○ ○	

How Are Your Suppliers Doing?

In addition to “Evaluation and Certification” (section 4.1.3), you need a framework for understanding your suppliers’ environmental fitness. The suggested model in Figure 9 is a useful framework for strategy and supplier decisions on selection, development, and evaluation. By using the framework of corporate and environmental goals, performance measures for issues such as quality improvement, cost reduction, and waste reduction will be created during information gathering. Input data come from the external marketplace and competition, as well as from not only existing suppliers, but also new suppliers, resulting in a supplier assessment and evaluation program.

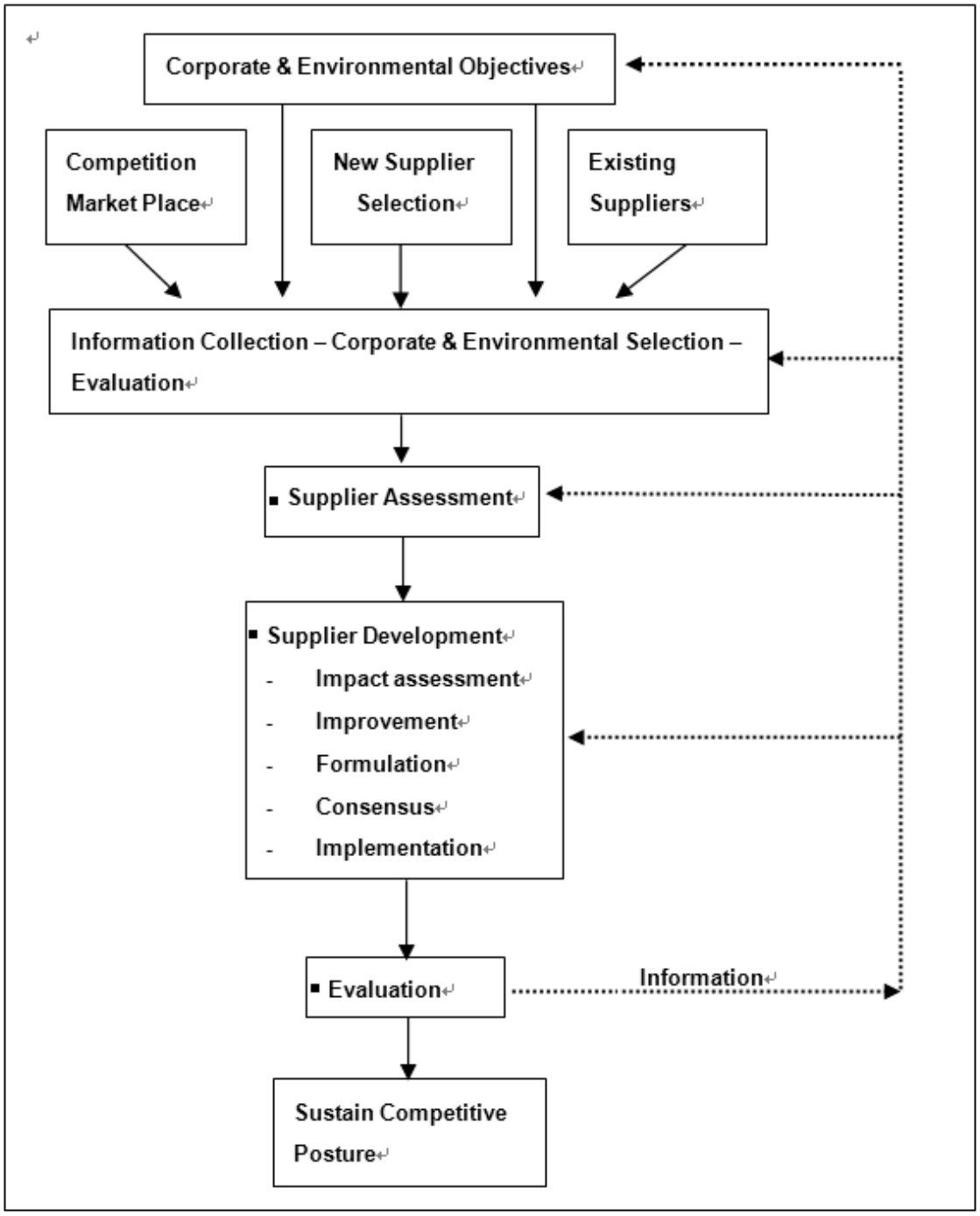


Figure 9. Framework for Selecting, Developing, and Evaluating a Supplier on Environmental Aspects (Source: Ref. 19)

LG used the questionnaire in Table 18 to evaluate the performance of its suppliers, not only before they were selected to provide materials, components, parts, equipment, products, or services, but also after they had been chosen so as to assess the environmental impacts of LG's own products.

Table 18. Evaluation Questionnaire (Source: Ref. 32)

Evaluation 1: Environmental Management System

General principles	Item of evaluation	Yes/No	Comment
1)-(1)	1. Has your company obtained an EMS certificate in accordance with ISO14001?		
1)-(1)	2. Does your company have plans to obtain an EMS certificate within 3 years?		
1)-(2)	3. Has your company set up a system for complying with environment-related regulations and laws?		

Evaluation 2: Eco-Design

General principles	Item of evaluation	Yes/No	Comment
2)-(1)	1. Does your company use materials prohibited by LG?		
2)-(2)	2. Do your products of 50g or more receive an ISO 11469 mark?		

Evaluation 3-1: General Product Information

Name of product		Name of manufacturer	
Weight (g)		Hazardous material	
P/No		Amount used	

Evaluation 3-2: Product Specifications

P/N	Name of part	Weight (g)	Material	Ratio of weight	Hazardous material	Amount (%)	Remarks

5.2 GSC Indicators

Measuring performance on GSC requires some relevant indicators that reduce the extensive environmental data to a limited number of key points that provide a quick assessment of improvement.

There are three types of environmental indicator: performance, management, and condition. For example, materials, energy use, and emissions are performance indicators; costs, training, and legal compliance are management indicators; ambient air, river quality, flora and fauna are condition indicators. Organizations need to choose relevant indicators to assess their GSC improvements and performance, in terms of the company's environmental impact, its management activity, or the external condition of the environment. APO's *Eco-Products Directory for Sustainable Consumption and Production, 2005* (Ref. 21) offers a valuable classification of products for green purchasing and eco-product development. This information in turn provides good inputs for measuring performance on GSC.

To check their progress and achievement on GSC, many Japanese and Korean enterprises choose (1) the percentage of green purchasing (including materials, components, parts, or equipment) achieved, (2) their progress on eco-product development, (3) certification of their first-tier suppliers on ISO 14001, and (4) reductions of emissions or environmental impacts. These indicators can easily be ascertained from their annual environmental or sustainability or corporate social responsibility reports.

Box 27. Common Environmental Performance and Management Indicators Top Ten Most Important Supplier Indicators

• Biodegradable/compostable • Free of ozone depletion substances • Emissions and wastes • Energy efficiency • Recyclable packaging • Hazardous substance content	• Environmental management system • Global warming emissions • Public disclosure • Take back and reverse logistics program • Supply chain logistics • Toxic pollution	• Environmental compliance • Labor issues • Training and awareness program • Communication • Eco-materials, components, and products • Cost

Examples

Canon

In 2005**,** 93.8% products met environmentally conscious standards, 82.1% obtained the Eco Mark, and 93.5% obtained the Energy Star.

Mitsubishi Electric

In 2005, its ratio of eco-products to production value was 70%; it eliminated the use of HCFCs as a foaming agent, complied with the RoHS Directive, reduced its total carbon dioxide emissions per sales by 20% between 1999 and 2006, reduced net shipping weight by 20% from 2003, and eliminated the use of wood for the packing of major products.

Sony

In 2005, achieved a 30% reduction in power consumption in 70% of products categories and a 20% reduction in resource inputs in 90% of product categories; its Green Management indicators are compiled from a greenhouse gas index and a resource index.

Epson

In 2005, Epson developed 290 Epson Ecology Products with 324 profile sheets, greenhouse gas emissions were reduced by 3.4% compared with 2004, the environmental accounting report revealed JPY4.2 billion of environmental investment and JPY6.6 billion in savings from reductions in the use of water, hazardous chemicals, and energy.

SAMSUNG Electronics

SAMSUNG is developing environment-friendly products that minimize their impact on the environment through the whole process from the acquisition of raw materials, production, transportation, usage, and end-of-life disposal by adding “environment” to function, price, quality, and design as essential factors in product development. SAMSUNG Electronics has performed Life Cycle Assessments (LCAs) on its main products and it obtained certified Korean Type III Eco-labeling in 2005.

LG

All LG products are assessed against its Eco-Index, which includes criteria such as hazardous substances, energy use, resource consumption, and recycling. In 2005 LG products obtained Korean Type II Eco-labeling and won many achievement awards.

5.3 Methods

Methods are the procedures used to generate values for metrics (parameters) or environmental indicators. It is neither practical nor relevant to present all the methods corresponding to the environmental indicators described in section 5.2. In addition, measurement of the values of environmental indicators will depend on the methods employed by individual users of this Manual. Nonetheless, some frequently employed methods will be presented below as examples.

A number of leading US companies have significantly increased their competitiveness by engaging in the following SCEM activities to improve their environmental performance:

- Reducing the obsolescence and waste of maintenance, repair, and operating materials through enhanced purchasing and inventory management practices.
- Substantially decreasing the costs resulting from scrap and material losses.
- Increasing revenues by converting wastes to by-products.
- Reducing the use of hazardous materials through more timely and accurate materials tracking and reporting systems.
- Decreasing the use and waste of solvents, paints, and other chemicals through chemical service partnerships.
- Recovering valuable materials and assets with efficient product take-back programs.

In order to reduce the extensive materials and cost data to a limited number of key GSC indicators (e.g. percentage of green purchasing achieved, eco-products developed and environmental impacts reduced) so as to assess improvements in GSC or to evaluate the benefits of GSC, it is necessary to identify the costs occurring in the various lifecycle stages of the product/service (see Table 19 for an example).

Table 19. Linking the Lifecycle Stages to Costs (Source: Ref. 18)

Life Cycle Stages	Direct Costs	Indirect Costs	Uncertain Costs
Definitions	Incurred costs that are traditionally allocated to an activity	Incurred costs that are not traditionally allocated to an activity	Costs that potentially may be incurred in the future
Stage 1: Design 	• Preparing specifications and drawings • Testing • Disposing of testing materials	• Designer training • Record keeping	• Managing spills or accidents in testing • Complying with new regulations
Stage 2: Acquisition 	• Purchasing • Taxes • Shipping • Financing	• Material handling • Storage • Record keeping	• Managing spills or accidents in storage and handling • Disposing and replacing of obsolete resources
Stage 3: Consumption 	• Labor • Equipment maintenance • Incoming inspection	• Delivery to job site • Employee training • Industrial hygiene	• Resource misuse • Managing spills or accidents in use • Packaging disposal • Equipment failure • Occupational exposures and injuries
Stage 4: Disposition 	• Resource storage • Resource recycling • Resource treatment • Resource transport • Resource disposal • Insurance	• Employee training • Waste analysis • Reporting and record keeping	• Complying with new regulations • Legal liabilities • Employee health claims

Table 20 illustrates some approaches to the measurement of the costs and benefits of GSC improvements in a procured material. Remember that costs hidden in other budgets are a major source of related savings. The benefits include savings on equipment and management costs, and they usually last for several years.

Table 20. Annual Benefits of a Sample Sourcing Initiative (Source: Ref. 9)

Type of Benefit	How to Calculate it	Example
Reduced raw materials waste	Materials saved per unit x Units of production	$.25 less materials purchased per unit x Planned volume per year of 1,000,000 units = $250,000
Reduced transportation costs	Reduction in number of shipments or in shipping cost per load if capacity of truck maximized	6 fewer trailer loads received per year x Average cost per load of $3,000 = $18,000
Reduced waste disposal costs	Disposal costs per unit of product x Planned volume of production	$.20 savings per unit of product x 1,000,000 units = $200,000
Reduced compliance costs	Lowered consulting and legal expenses related to violations or new permits	Avoided cost of new permit = $100,000 if non-hazardous materials are used
Reduced cost of incidents	Average number of incidents per year x Average cost per incident for cleanup and employee health/absence/overtime	2 reduced incidents per year x $7,800 average cost incident = $15,600
Reduced risk of business interruption due to regulatory violation, boycott, supplier interruption, spill, toxic release, etc.	Likelihood of risk x Reduction of likelihood of risk x Estimated cost of risk	2% likelihood x 50% reduction in chance of plant shutdown for a week due to supplier interruption x $6,000,000 lost fixed cost and revenue = $60,000 cost reduction
Customer retention rate increase	Percentage increase in repeat sales x Profit per unit sale	5,000 units sold beyond plan because of increase in customer retention x $100 profit per unit = $50,000
Increased market share as a result of enhanced reputation attracting new customers	Number of new customers per year x Sales per customer per year x Profit per unit sale	20,000 new customers per year x 2 units sold per customer per year x $100 profit per unit = $4,000,000

A common system used is “materials and energy flow analysis,” which is part of the environmental management accounting system in large organizations. Materials and energy flow in physical units (e.g., kg/unit of production) is called physical accounting, which has the same structure as cost accounting or management accounting. The US GSC references (Refs 5, 13, and 18) all used environmental cost accounting or a lifecycle cost approach to calculate the benefits of SCEM, and most large European and Japanese companies have set up materials and energy flow systems and apply the cost data to calculate the benefits of GSC.

The tracking of materials depends on the preparation of process maps. Process mapping is typically a team exercise in which all the production steps associated with or required by a specific materials management process are visually diagramed. An input material summary (Table 21) is a good start in setting up a materials and energy flow database within a company. An example of material tracking is shown in Table 22.

Table 21. Input Material Summary (Source: Ref. 5)

Attribute	Description Stream # ___	Stream # ___	Stream # ___
Material Name/ID			
Source/Supplier			
Hazardous Component			
Annual Consumption Rate			
Purchase Price, $ per ___			
Overall Annual Cost			
Material Flow Diagram available (Y/N)			
Delivery mode			
Shipping Container Size & Type			
Storage Mode			
Transfer Mode			
Control Mode			
Empty Container Disposal/Management			
Shelf Life			
Supplier would accept expired material (Y/N)			
accept shipping containers (Y/N)			
Acceptable Substitute(s), if any			
Alternate Supplier(s)			

Table 22. Example of Material Tracking (Source: Ref. 18)

Waste		Waste Quantity			Management Costs	
Category	Type	Amount	Units	Percentage of Total	Amount	Percentage of Total
Chemicals and Oils	hydrazine/ ammonia/ carbon	85	gallons	5%	$530	10%
	lab packs	49	gallons	3%	$572	10%
	lab waste	14	gallons	1%	$189	3%
	monosodium phosphate	3	gallons	0%	$297	5%
	oil/ fuel/ solvent (non-hazardous)	13	gallons	1%	$2,209	40%
	paints	55	gallons	3%	$89	2%
	parts washer mineral spirits	495	gallons	31%	$702	13%
	rags (solvent content)	55	gallons	3%	$549	10%
	sodium bicarbonate/ ammonium	55	gallons	3%	$122	2%
	soil contaminated oil	5	gallons	3%	$122	2%
	urbine mineral oil	700	gallons	44%	$154	3%
	TOTAL	**1,579**	**gallons**		**$5,535**	
Coal By-Products	commercial bottom ash	264	tons	0%	$763	0%
	commercial fly ash	36,372	tons	60%	$235,703	87%
	waste bottom ash	22,706	tons	38%	$32,810	12%
	waste fly ash	914	tons	2%	$2,968	1%
	TOTAL	**60,256**	**tons**		**$272,244**	
PCBs	bulk liquid	20,620	pounds	100%	$16,800	79%
	bulk solid	45	pounds	0%	$4,526	21%
	TOTAL	**20,665**	**pounds**		**$21,326**	

It is then important to allocate the environmental costs correctly from the materials and energy flow database. Environmental costs are often misallocated. Take the case of a company's wastewater treatment facility. The costs of operating the facility are predominantly caused by a few of the company's products whose production generates significant quantities of wastewater. If, as shown in Figure 10, the costs of operating the treatment facility are accumulated into an overhead account and allocated equally to all of the company's products, the wastewater costs are obscured and product cost information is misleading. In this case, product B appears to be less expensive to produce than it actually is (see Table 23). Figure 11 demonstrates a correction that allows the environmental costs to be tracked directly to the responsible product, process, or facility.

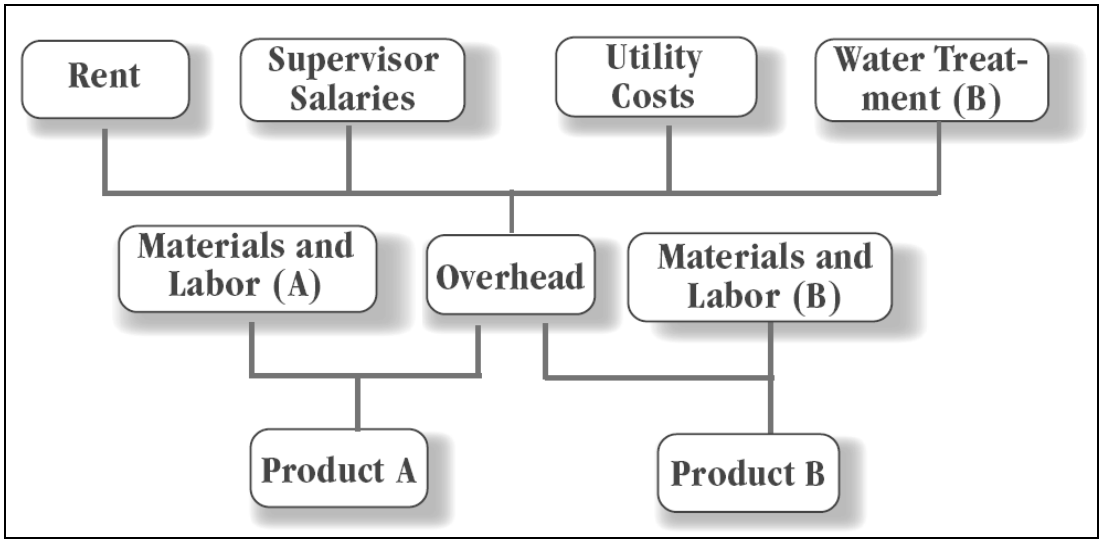


Figure 10. Misallocation of Environmental Costs (Source: Ref. 5)

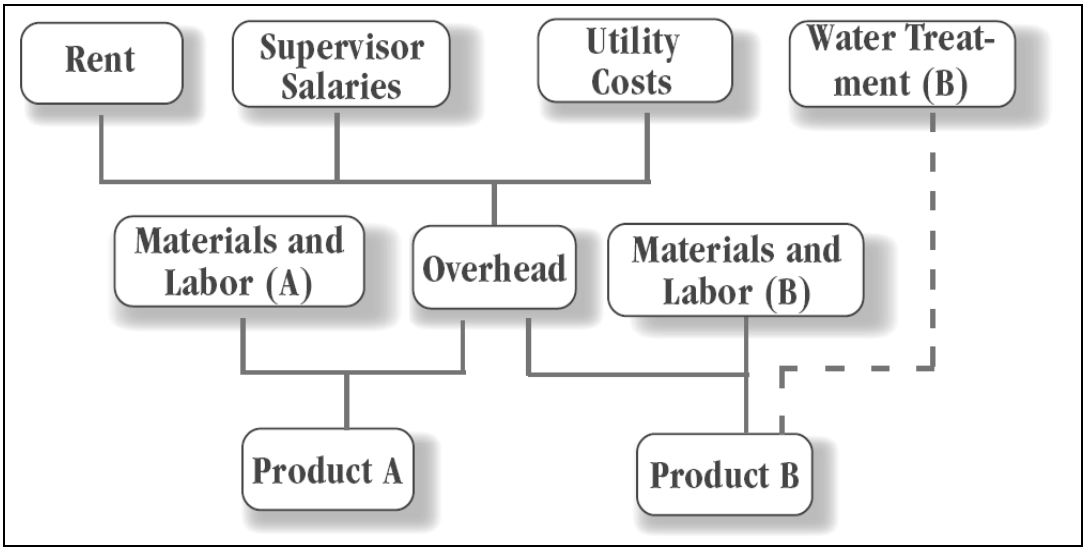


Figure 11. Improved Cost Allocation (Source: Ref. 5)

Table 23. Example of the Effects of Incorrect Cost Allocation (Source: Ref. 23)

	Process A (Clean)	**Process B (Dirty)**
Correct treatment of environmental costs		
Revenue ($)	200	200
Production costs ($)	100	100
Environmental costs ($)	0	50
Correct profit ($)	100	50
Environmental costs treated as overheads		
Revenue ($)	200	200
Production costs ($)	100	100
Environmental costs ($)	0	50
Overheads ($)	25	25
Book profit ($)	75	75
Error (%)	-25	50

Such inaccurate information (arising from the incorrect calculation of benefits or hidden costs) may lead to the inappropriate assessment of environmental performance or to poor decision-making on environmental investment. Furthermore, dirty products are sold too cheaply whereas environmental-friendly products may be sold at too high a price. As a result, market share may be lost in the most sustainable fields of activity and, at the same time, the company loses its competitive advantage.

To improve corporate eco-efficiency, the allocation of overhead costs should instead focus on the identification of activities causing the environmental impacts of material flows. The strength of this method is that it enhances the understanding of the business process and the activities associated with each product or service. It reveals the value that is added or where it is destroyed. Many references are available that show in detail how to apply materials-flow-oriented activity-based costing to products or services.

5.4 Summary and suggestions for comparing potential benefits of GSC options

For future-oriented companies, i.e. companies aiming at preserving the environment while at the same time securing their profits, it is essential effectively to control concise and valuable information on materials and costs to support business decision-making. In addition to establishing certain measurements for producing the indicators with which to assess performance on GSC, appropriate methods such as materials-flow-oriented activity-based costing can identify hidden costs and benefits.
In summary, the following steps are suggested for comparing the potential benefits of GSC options:

- Identify the materials and energy flows related to each product/service
- Collect the physical data and costs on materials and energy flows
- Identify the appropriate cost allocation for each activity
- Use activity-based costing to calculate the costs of the products/services
- Identify the opportunities for reducing the environmental impacts
- Estimate the benefits related to reduction, reuse and recycle of different options
- Use net present value to compare the potential benefits of the GSC options

6. Case Studies

6.1 Who's Doing What on GSC?

Global retailers and brand owners have a huge influence on greening the supply chain and their policy decisions will drive change across the market. This will affect all the manufacturers and suppliers who need to participate in the business of the supply cycle.

Some examples of GSC based on different classifications are shown in Table 24.

Table 24. Examples of GSC

Company	GSC issue	Key Development
Supplier Evaluation, Certification and Outreach		
General Motors	Sets new level of environmental performance for suppliers	Requires supplier performance standards Offers education and assistance, including packaging reduction and other pollution prevention opportunities
Nike	Eco-efficiency through supply chain metrics	In conjunction with CH_2MHill, Nike assists suppliers in meeting environmental and business standards, including waste reduction and minimizing consumption of resources
Roche Vitamins	Fortifies its environmental commitment	Offers education and assistance Publishes voluntary performance requirements for suppliers
Environmentally Preferable Purchasing		
Bristol-Myers	Workshops for procurement staff	Educates internal procurers on considering the environmental costs of products rather than just the product costs
DaimlerChrysler	Environmental rating of material content	Requires suppliers to disclose material content, then uses this information to rate suppliers for purchasing decisions
The GAP	Sustainable forestry	Requires suppliers to use certified sustainable wood
Environmentally Conscious Design and Manufacturing		
Eastman Kodak	Eco-efficiency indicator	Evaluates lifecycle impacts of components and raw materials from suppliers

The pioneers started greening their supply chains some time ago and have established different systems or tools based on their experience. The following 12 case studies reveal how these leaders from different industries across the world are implementing their GSC measures or programs.

6.2 Sample Case Studies

Case Study 1

Company: Ford and General Motors
Location: USA
Product type: Automotive
GSC development: Ford Motor Company required ISO 14001 3rd Party certification from suppliers with manufacturing facilities by 1 July 2003, and GM required conformity with ISO 14001 requirements by the end of 2002 (Source: Ref. 27)

Case Study 2

Company: Adidas-Salomon
Location: USA
Product type: Sports goods
GSC development: Adidas-Salomon's supply chain is long and complex, relying on about 570 factories around the world. In Asia alone, its suppliers operate in 18 different countries. Outsourcing therefore raises a broad range of issues and concerns for the company. Employment standards have to be evaluated throughout the supply chain to ensure fairness and legal compliance on such matters as wages and benefits, working hours, freedom of association, and disciplinary practices as well as on even more serious issues such as forced labor, child labor, and discrimination. Furthermore, health and safety issues, environmental requirements, and community involvement also need to be considered. The company has its own "standards of engagement" (SOE) and the level of acceptability is based on the values of the company itself. Contractors, subcontractors, suppliers, and others are therefore expected to conduct themselves in line with Adidas-Salomon's SOE. The company has a 30-strong SOE team, most of whom are based in the countries where suppliers are located (Asia, Europe, and the US). About 800 audits were conducted at different levels in the supply chain during 2000.
(Source: Ref. 26)

Case Study 3

Company: Bristol-Myers Squibb
Location: USA
Product type: Pharmaceuticals
GSC development: Bristol-Myers Squibb works with suppliers in an attempt to ensure the highest level of quality, expertise, experience, and fit with its operating culture. The company has developed an environmental, health, and safety (EHS) questionnaire that may be sent to most third-party manufacturers. Based on the results of the questionnaire, it may conduct a site evaluation. EHS works closely with sourcing staff to determine the priorities for the site evaluation. The evaluation team will make recommendations and then develop and track an action plan for the contractor. Bristol-Myers Squibb, in conjunction with other major pharmaceutical companies, has signed up to the Green Suppliers Network (GSN), a collaborative venture between industry and the US Environmental Protection Agency. GSN works with all levels of the manufacturing supply chain to achieve environmental and economic benefits, improve performance, minimize waste generation, and remove institutional roadblocks through its innovative approach to leveraging a national network of manufacturing technical assistance resources.
(Source: Ref. 28)

Case Study 4

Company: SC Johnson
Location: USA
Product type: Household cleaning products
GSC development: SC Johnson developed the "Greenlist™ process" with the aim of making better products through better material inputs and by reducing the company's footprint. The Greenlist represents new opportunities for SC Johnson to achieve its environmental goals by focusing on improvements in raw materials and the supply chain. Committed to eco-efficiency, SC Johnson has looked for every opportunity to reduce, reuse, recycle, and refill in its operations, products, and packaging. By using fewer resources more efficiently, SC Johnson has cut 420 million pounds of waste from its processes and products over the last decade, resulting in a saving of USD135 million. Raw material components at SC Johnson are classified in four categories: surfactants, propellants, insecticides, and resins. Each category is rated using criteria such as biodegradability and toxicity. The materials used are then classified as best, better, accepted, and restricted according to those criteria. At present, the Greenlist covers 80% of SC Johnson's purchase volume. SC Johnson also uses other tools to green its supply chain, such as its supplier's quality assurance program and environmental management questionnaire (whose 12 questions evaluate the environmental practice of suppliers). Preferred suppliers of SC Johnson must achieve a score of 4–5 in the supplier audit. The Greenlist has been found effective in tracking progress and results.
(Source: Ref. 22)

Case Study 5

Company: ASUS
Location: Republic of China
Product type: Electronics
GSC development: ASUS's supply chain guidance includes a green policy and a notice about green purchase requirements. ASUS requires its suppliers to coordinate their operations, and ASUS's green management system ensures that suppliers implement green management policies in their factories. ASUS has established an Advanced Green Classroom to provide courses and respond to questions so that suppliers understand ASUS's requirements for green purchases and for components that are WEEE/RoHS compliant. ASUS suppliers may log in to its supplier relationship management (SRM) website, where they can familiarize themselves with WEEE, RoHS, and other regulations and can then link to the component approval procedure.

Once a year, ASUS's certified suppliers must pass the certification of ASUS's green management audit in the following areas:

1. Quality system requirement
2. Design control
3. Document control and quality record
4. Management of raw material vendors
5. Product identification and lot traceability
6. Inspection and test
7. Equipment calibration
8. Materials management
9. Production schedule
10. Purchasing
11. Customer service

Since November 2005, ASUS has carried out a quarterly business review to evaluate how its suppliers comply with its green standards. Suppliers are evaluated in terms of quality, cost, delivery, service, and technology. Outstanding suppliers can become long-term cooperating partners, and they also have the chance to become the Annual Best Supplier. The Annual Best Supplier needs to demonstrate the following characteristics:

- collaborative process
- direct feedback
- support of continuous improvement in relationship

The green component approval procedure has also been established on an **eGreen Management Platform**. Suppliers of green parts are required to provide a hazardous substances warranty letter, information on composition, a Material Safety Data Sheet for each component, and a third-party test report for further approval.
(Source: Ref. 29)

Case Study 6

Company: Seiko Epson
Location: Japan
Product type: Electronics
GSC development: At Seiko Epson, the green procurement of production materials occurs in two separate phases. In the first phase, Seiko Epson carries out surveys and certification of green vendors and its goal is to achieve 100% green vendor certification. Seiko Epson is committed to working closely with its suppliers to implement environmental initiatives so as to enable its suppliers to achieve green vendor certification. The requirements for green vendor certification at Seiko Epson are as follows:

- Certification that products do not contain banned substances
- Certification that substances banned from manufacturing are not used
- Passing of Seiko Epson waste control audit
- Implementation of environmental initiatives

Seiko Epson implemented its first green vendor survey in May 1999, covering approximately 2,400 suppliers in Japan. Awareness was low, leading to a small number of response at the beginning. Through communication and guidance provided in the form of seminars, telephone calls, written requests, and direct meetings, green vendors increased from 25% in 1999 to 95% in 2001. In 2000, Seiko Epson extended its green vendor program to its 15 overseas sites by dispatching personnel to stress the importance of green vendors and translating the documents into English and Chinese for easier and more effective communication.
(Source: Ref. 30)

Case Study 7

Company: IKEA
Location: Sweden
Product type: Home furnishing products
GSC development: IKEA requests itself and its suppliers to continuously reduce the environmental impacts of their operations. As a result, all IKEA suppliers must:

- Work to reduce waste and emissions to air, ground, and water
- Handle chemicals in an environmentally safe way
- Handle, store, and dispose of hazardous waste in an environmentally safe manner
- Contribute to the recycling and reuse of materials and products
- Use wood from known areas, well managed and preferably independently certified

And all IKEA suppliers must not:

- Use or exceed the use of substances forbidden or restricted in the IKEA list of chemical substances and compounds
- Use wood originating from Natural Parks, Natural Reserves, and Natural Forests

(Source: Ref. 24)

Case Study 8

Company: LG
Location: Republic of Korea
Product type: Electronics
GSC development: LG started its Eco-Supply Chain Management (E-SCM) with guidelines in 2001, a pilot project in 2002, and a survey in 2003:

Year 2001 E-SCM infrastructure setup:

- Establish E-SCM operation standards and guidelines
- Develop partner assessment matrix
- Establish corporate list of restricted hazardous substances

Year 2002 pilot project and product analysis:

- E-SCM pilot project
- Survey of hazardous materials in components
- Finalization of E-SCM standard format

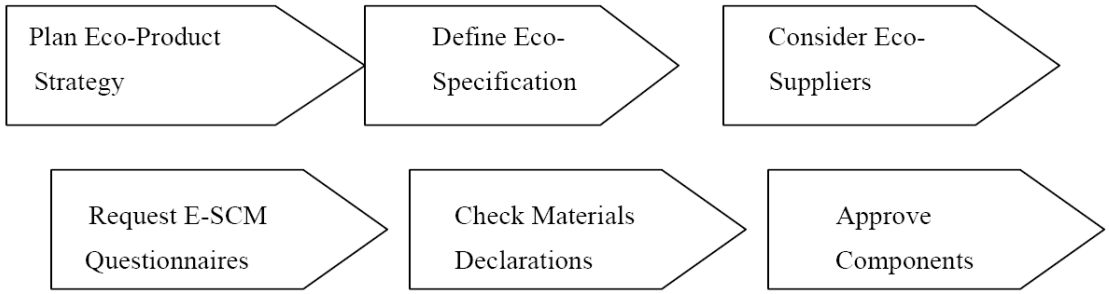
Year 2003 expansion of E-SCM to all suppliers:

- Collect detailed environmental data from suppliers
- Develop a hazardous materials database system
- Expand partner assessment
- Improve the assessment index

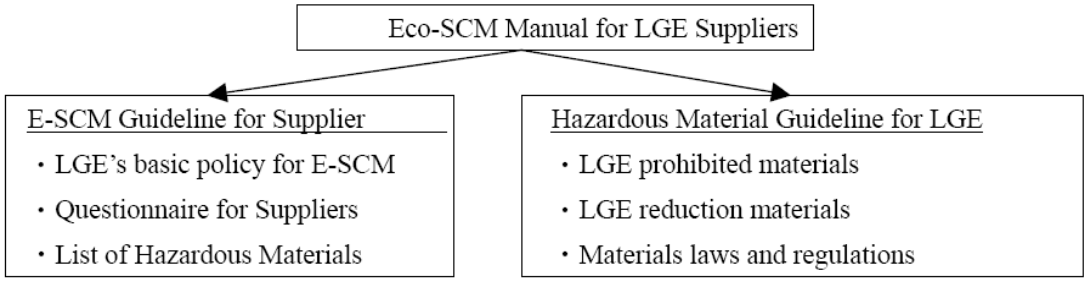
At LG, responsibility for E-SCM lies in the Green Planning Group and the Procurement Group under the corporate Quality Reliability Center. E-SCM begins by establishing an environmental policy, then promotes education among suppliers, sends out questionnaires, assesses the returned questionnaires according to the criteria, gets feedbacks from suppliers, and selects the suppliers.

The E-SCM process in product development proceeds according to defined decision-making steps. There is also a manual.

Box 28. E-SCM decision-making steps



Box 29. Contents of E-SCM manual



There are three criteria for supplier selection at LG: (1) environmental management (8 sub-criteria), (2) eco-design (7 sub-criteria), and (3) product information (material declaration). Beginning March 2003, LG has been offering education to suppliers. The first meeting attracted 130 people from 80 suppliers from different countries such as China and Vietnam.
(Source: Ref. 31)

Case Study 9

Company: Canadian Autoparts Toyota, Inc. (CAPTIN)
Location: Canada
Service type: Transportation of auto parts
GSC development: As part of its ISO 14001 initiative, Delta-based CAPTIN is now using returnable packaging to transport the 6,000 aluminum wheels it ships to customers each day. Working with a Langley-based supplier, CSL Plastics, CAPTIN came up with a plastic pallet and divider system to replace cardboard cartons and wooden pallets that customers had to recycle or dispose of themselves. Because of their 10-year expected lifespan, the reusable pallets provide payback in less than two years compared with conventional packaging. Once payback is achieved, they also provide lower per unit costs. In addition, both employees and customers prefer the improved ergonomics of the new packaging, and CAPTIN has realized productivity gains in the packaging process.

Benefits achieved through the sustainable logistics supply include:

- Lower per unit lifecycle cost
- Less waste in landfills; reusable packaging for 6,000 units means 1,000 fewer cardboard boxes and 200 fewer wooden pallets used each day
- Improved customer satisfaction
- Improved ergonomics and employee health and safety

(Source: Ref. 7)

Case Study 10

Company: Marks and Spencer (M&S)
Location: UK
Service type: Retailer
GSC development: M&S includes the name of the farmer or grower on a range of food labels and the name of the country the food was produced in. As the farmers are an important stakeholder in the food chain, M&S wanted to let the customers know who they are. Over the summer, M&S customers can meet many of the farmers and growers and sample the fresh food range at M&S stands at agricultural shows across the country. M&S's commitment to selling Fairtrade coffee started in 2004 when M&S introduced only Fairtrade-certified coffee and tea in its Café Revive. It took three years' hard work to ensure consistent quality and value were achieved and M&S was the first high street café chain to do this. Since then, Café Revive has sold over 35 million cups of Fairtrade coffee. M&S believes that it is important to guarantee farmers in developing countries fair terms and a fair price so they can enjoy a better standard of living. Hence, as of March 2006, M&S converted all the coffee sold to Fairtrade, with tea to follow later. M&S is the only major retailer to have done this. M&S is also extending its commitment further through products such as cotton, honey, chocolate, avocados, pineapples, mangoes, and bananas.
(Source: Ref. 15)

Case Study 11

Company: City Care and Christchurch City Council
Location: New Zealand
Service type: Construction maintenance and management
GSC development: City Care is in the business of the construction, maintenance, and management of roads and wastes from the parks and other facilities. It employs 500 people based in Christchurch, Auckland, and Tauranga. The company is committed to sustainable development and has sought to lead by example, although it recognizes that, in the price-driven industry in which it operates, this could put it at a disadvantage if the value of sustainable practices is not recognized throughout the supply chain.

In 2001, Christchurch City Council awarded a cleaning contract to a lowest-price tenderer because the selection process was substantially price driven. The Council later realized that its own tender processes were producing poor community outcomes in high-labor-content tenders, because they were rewarding companies that had the lowest wage rates, at the expense of companies whose employees had better terms and conditions.

On reviewing this event, Christchurch City Council found it was restricted by Transfund rules and its own procurement policy, and set about assessing its terms and conditions to establish how they could incorporate sustainable development principles. As a result, the Council will be considering introducing the framework established by The Redesigning Resources group as a basis for its future tender process for specific and agreed projects. It is proposed that contractors will be asked to supply and validate information relating to energy efficiency, good employer practices, eco-efficiency, hazardous substances, health & safety, local supply base, accountability, and governance. This will give companies such as City Care that can demonstrate good practice via their Triple Bottom Line report and accreditation to ISO14001 and NZS 4801 a potential advantage in the selection process.
(Source: Ref. 4)

Case Study 12

Organization: European Union (EU)
Location: Europe
Industry type: Forestry and building materials
GSC development: The majority of EU timber trading is with countries with effective enforcement of forestry legislation. However, illegal logging is a serious problem in some countries and regions from which the EU imports forest products. This has led to efforts by states and international organizations to tackle the problem of unsustainable and illegal logging through a number of actions, including through public procurement. Forest certification schemes, such as the FSC (Forestry Stewardship

Council) or PEFC (Program for the Endorsement of Forest Certification schemes), include criteria regarding aspects of the environmental sustainability of the harvesting of the wood. These criteria are often used in technical specifications in EU contracts to define exactly what sustainable timber means from an environmental point of view.
(Source: Ref. 25)

6.3 Lessons Learnt from the Case Studies

Table 25 summarizes the GSC issues and lessons learnt through the 12 case studies presented above.

Table 25. GSC Lessons Learnt from the 12 Case Studies

GSC issue	Case study											
	1	2	3	4	5	6	7	8	9	10	11	12
Recyclability				X	X		X	X	X			
Reuse				X	X		X	X	X			
Lifecycle approach				X	X	X		X	X			
Packaging				X	X	X		X	X			
Eco-design and eco-materials				X	X	X	X	X				
ISO 14001 or certification	X					X		X			X	X
EHS performance			X									X
Social issues		X							X	X	X	X
Greenhouse gas or CO_2 reduction							X		X			
Ozone depletion							X	X				

Glossary

Understanding the terms associated with green supply chain management

Design for the Environment (DfE)
The DfE approach helps industry eliminate or minimize the environmental impacts of products during the design stage. It can involve reducing the toxicity of a product, extending the life of a product, extending the life of the materials used, improving the selection of materials, and reducing the energy and material intensity required to produce, use, and dispose of the product.

Eco-efficiency
Eco-efficiency is a management strategy that links financial and environmental performance to create more value with less ecological impact. Eco-efficiency is the ability to meet economic performance goals while using environmentally benign modes of doing business (World Business Council for Sustainable Development).

Eco-labels
Consumer information tools that provide information related to the environmental characteristics of products and thus allow consumers to compare the environmental performance of products of the same type.

Eco-Management and Auditing Scheme (EMAS)
The European Union has developed EMAS as its own environmental management tool to evaluate, report on, and improve environmental performance in all economic sectors. Participation in EMAS is voluntary and open to public or private organizations operating in the EU and the European Economic Area.

Environmental audit
A management tool comprising a systematic, documented, periodic, and objective evaluation of how well a project, organization, or piece of equipment is performing with the aim of helping to safeguard the environment. The audit should facilitate management control of environmental practices and assess compliance with policy objectives and regulatory requirements.

Environmental management system (EMS)
The EMS is a means for companies or organizations to implement an environmental management plan or procedures that comply with established environmental policy objectives and targets. A key feature of any effective EMS is the preparation of documented system procedures and instructions to ensure efficient communication and continuity of implementation. There are certification systems such as EMS ISO 14001 and the EU's EMAS scheme (EMAS is now compatible with ISO 14001), which demonstrate that a system is operated to an internationally recognized standard. Alternatively, a customized system can be developed addressing the particular needs of the operation.

Environmentally preferable
Products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services. Items considered in this comparison may include raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal.

Environmentally Preferable Purchasing (EPP)
EPP means choosing products or services that have a reduced environmental impact. Considering products that are energy efficient, limit the use of toxic elements, and reduce waste are some of the criteria for EPP (USEPA). Corporate and institutional consumers can incorporate environmental requirements into their product and packaging specifications.

Environmental product declaration
A description of the aspects and impacts of a product, system, or service over its entire life, from raw material extraction, through manufacturing and use, to end-of-life disposal or recycling.

Environmental Supply Chain Management (ESCM)
ESCM is defined by Five Winds International as “the organization of activities to address the environmental performance of materials, components, goods and services that an organization buys and uses”.

Environmental Technologies Action Plan
In 2004, based on the aims of the EU Lisbon Agenda, the European Commission launched the Environmental Technologies Action Plan (ETAP). Its objective is to stimulate the development and use of environmental technologies in Europe.

Extended producer responsibility (EPR)
EPR is a policy option that extends the responsibility of producers to include the environmental impacts of their products over the entire product lifecycle. This occurs when a product is discarded by the consumer. EPR strategies include product take-back, recycling, and disposal.

Green public procurement
Contracting authorities and entities take environmental issues into account when tendering for goods or services. The goal is to reduce the impact of the procurement on human health and the environment.

Green purchasing or green procurement
This is a way of adding environmental considerations to the price and performance criteria businesses use to make purchasing (transaction) decisions. Green purchasing is a consideration of supply chain management and is also known as environmentally preferable purchasing (EPP), green procurement, affirmative procurement, eco-procurement, and environmentally responsible purchasing. Green purchasing attempts to identify and reduce environmental impacts and to maximize resource efficiency.

Green Supply Chain Management (GSCM)
GSCM involves traditional supply chain practices that integrate environmental criteria into decision-making at each stage of materials management, including post consumer disposal; also referred to as Greening the Supply Chain, or Environmental Supply Chain Management, or Responsible Supply Chain Management.

Integrated Product Policy (IPP)
IPP is an approach that begins by asking how the environmental performance of products can be improved most cost-effectively. It is founded on the consideration of the impacts of products throughout their lifecycle, from the natural resources from which they come, through their use and marketing, to their eventual disposal as waste.

ISO 14000
The ISO 14000 series is a family of environmental management standards developed by the International Organization for Standardization (ISO). The ISO 14000 standards are designed to provide an internationally recognized framework for environmental management, measurement, evaluation, and auditing. They do not prescribe environmental performance targets, but instead provide organizations with the tools to assess and control the environmental impact of their activities, products, or services. The standards address the following subjects: environmental management systems; environmental auditing; environmental labels and declarations; environmental performance evaluation; and lifecycle assessment.

Life Cycle Assessment (LCA)
LCA is a process of evaluating the effects that a product has on the environment over the entire period of its life, thereby increasing resource-use efficiency and decreasing liabilities. It can be used to study the environmental impact of either a product or the function the product is designed to

perform. LCA is commonly referred to as a "cradle-to-grave" analysis. LCA's key elements are: (1) identify and quantify the environmental loads involved; e.g., the energy and raw materials consumed, the emissions and wastes generated; (2) evaluate the potential environmental impacts of these loads; and (3) assess the options available for reducing these environmental impacts.

Life Cycle Costing (LCC)
Assessment of the costs of goods or services over the entire lifecycle.

Lifecycle perspective
A lifecycle perspective considers the environmental impacts of a product or activity across its entire life by planning products and activities from inception to final use and disposal - "cradle to grave." Tools such as Life Cycle Management (LCM) and Life Cycle Assessment (LCA) can help evaluate options to ensure that material substitution or process changes do not shift environmental and financial impacts to another stage in the lifecycle.

Materials management
The business process that supports the complete cycle of materials flows, including internal control of purchasing, production materials, planning, warehousing, shipping, and distributing finished products.

National Action Plans (on Green public procurement)
EU member states' concrete commitments for greening their public procurement. They contain an assessment of the existing situation, ambitious targets for a three-year period, and respective measures. The NAPs were to be drawn up for the first time by the end of 2006 and then revised every three years.

Natural resource protection
Natural resources include air, water, minerals, fossil fuels, plants, and animals. They consist of both renewable and non-renewable resources. Protection implies sustainability, equitable access, and conservation.

Pollution prevention
A strategy to avoid the creation of wastes at the start of a manufacturing or production process, focused on reducing or eliminating toxicity and air and water emissions; preventing the transfer of pollution from one environmental medium (air, water, or land) to another; including "source reduction" and "waste reduction," which deal with preventing the creation of wastes rather than managing them after they are created.

Product stewardship
An approach to environmental protection in which manufacturers, retailers, and consumers are encouraged or required to assume responsibility for reducing a product's impact on the environment. An example of this approach is a requirement that a manufacturer take back its product when it reaches the end of its useful life. It includes all of the following terms, which represent various approaches to product stewardship: product responsibility, shared product responsibility, producer responsibility, manufacturer responsibility, extended product responsibility, extended producer responsibility.

Product take-back
Activities to obtain used products from industrial customers or consumers, and then recycle or reuse these products.

Public procurement
The process used by governments and regional and local public authorities or bodies governed by public law (more than 50% financed, supervised, or managed by public authorities) to obtain goods and services with taxpayer money.

Resource efficiency
Resource efficiency is a measure of how effectively resources such as energy, water, and materials are being used to meet needs. It improves as fewer resources are used and as enhanced and more

diverse services and products are provided over longer periods of time. Improvements in resource efficiency can help to break the link between economic growth and pollution emissions.

Supply Chain Environmental Management (SCEM)

SCEM is a broad term that refers to a variety of approaches through which companies work with their suppliers to improve the environmental performance of the products or manufacturing processes of the supplier, customer or both.

Supply chain management

The oversight of materials, information, and finance as they move in a process from supplier to manufacturer, to wholesaler, to retailer, to consumer. Supply chain management involves coordinating and integrating these flows both within and among organizations. It is concerned with planning, implementing, and controlling the flows of raw materials, in-process inventory, and finished goods from the point of origin to the point of consumption, and the corresponding information flows. It covers purchasing, the manufacturing process, and customer delivery.

Sustainable consumption

Sustainable consumption is the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources and toxic materials and emissions of waste and pollutants over the lifecycle, so as not to jeopardize the needs of future generations.

Sustainable public procurement

Contracting authorities take into account all three pillars of sustainable development (economy, society, and environment) when procuring goods, services, or works.

References

Major References with Description

The following references were the main ones used when compiling this manual and are recommended to readers interested in obtaining in-depth information.

Reference	Description
Asian Productivity Organization, *Handbook on Green Productivity,* 2006	Provides details of the GP concept, methodology, tools, and techniques.
Clean Technology Environmental Management Program, United States-Asia Environmental Partnership, *Supply Chain Environmental Management: Lessons from Leaders in the Electronic Industry,* 1999	Reports on supply chain environmental management that can assist the electronics industry to meet market trends and challenges.
European Commission, *Buying Green: A Handbook on Environmental Public Procurement*, 2004	Provides guidance on public green procurement.
Global Environmental Management Initiative, *New Path to Business Value – Strategic Sourcing EHS*, 2001	Shows how companies can measure the EHS performance of supply chain environmental management.
Greater Vancouver Regional District, Canada, *Sustainable Supply Chain Logistics Guide*, 2006	Describes in detail the best practices on greening supply chain logistics.
Green Business Network, The National Environmental Training and Education Foundation, *Going Green Upstream: The Promise of Supplier Environmental Management,* 2001	Demonstrates success to motivate suppliers to start or improve their supply chain environmental management.
New Zealand Business Council for Sustainable Development, *Business Guide to a Sustainable Supply Chain – A Practical Guide*, 2003	Describes step by step with examples on sustaining the supply chain.
PPRC, *Supply Chain Management for Environmental Improvement: Practical Solutions for Economic and Environmental Vitality,* 2004	Provides detailed step-by-step guidance on how to develop strategic partnerships with suppliers/contractors.
The International Council for Local Environmental Initiatives, *Green Purchasing Good Practice Guide,* 2000	Provides best practice on the greening of public procurement.
UNEP, *Green Shops and Saving Cost: A Practical Guide for Retailers*, 2006	Provides guidance with successful examples of green retailing supply chain.
USEPA, *Enhancing Supply Chain Performance with Environmental Cost Information, Example from Commonwealth Edison, Andersen Corporation, and Ashland Chemical*, Environmental Accounting Project, 2000	Demonstrates the successful application of environmental accounting to a variety of supply chain management decisions within three industries.

USEPA, *Suppliers' Perspective on Greening the Supply Chain*, Business for Social Responsibility and Education Fund, 2001	Gains insights from suppliers on effective strategies for supply chain environmental management.
USEPA, *The Lean and Green Supply Chain – A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance*, Environmental Accounting Project, 2000	Uses materials tracking and environmental accounting to demonstrate supply chain environmental management.

References Cited in the Text

1. Asian Productivity Organization, *Handbook on Green Productivity*, 2006
2. Industrial Development Bureau, ROC, *Brochure on Eco-Design and Greening Supply Chain*, 2003
3. Asian Productivity Organization, *Green Productivity Training Manual*, 2003
4. New Zealand Business Council for Sustainable Development, *Business Guide to a Sustainable Supply Chain – A Practical Guide*, 2003
5. USEPA, *The Lean and Green Supply Chain – A Practical Guide for Materials Managers and Supply Chain Managers to Reduce Costs and Improve Environmental Performance*, Environmental Accounting Project, 2000
6. USEPA, *Suppliers' Perspective on Greening the Supply Chain*, Business for Social Responsibility and Education Fund, 2001
7. Greater Vancouver Regional District, Canada, *Sustainable Supply Chain Logistics Guide*, 2006
8. Green Business Network, The National Environmental Training and Education Foundation, *Going Green Upstream: The Promise of Supplier Environmental Management*, 2001
9. Global Environmental Management Initiative, *New Path to Business Value – Strategic Sourcing EHS*, 2001
10. Canadian Centre for Pollution Prevention & MEIA, *Greening the Supply Chain*, on the Canadian government website
11. Hammer Burt, *Effects of Green Purchasing Strategies on Suppliers Behavior*, unpublished
12. The International Council for Local Initiatives (ICLEI), *Green Purchasing Good Practice Guide*, 2000
13. Clean Technology Environmental Management, United States-Asia Environmental Partnership (US-AEP), *Supply Chain Environmental Management: Lessons Learned from the Leaders in the Electronics Industry*, 1999
14. PPRC, *Supply Chain Management for Environmental Improvement: Practical Solutions for Economic and Environmental Vitality*, 2004
15. UNEP, *Green Shops and Saving Cost: A Practical Guide for Retailers*, 2006
16. Michael Jay Polonsky, *An Introduction to Green Marketing*, Department of Management, University of Newcastle, Australia
17. Staffordshire County Council, *Greening the Supply Chain: A Green Purchasing Guide*, 2001
18. USEPA, *Enhancing Supply Chain Performance with Environmental Cost Information, Example from Commonwealth Edison, Andersen Corporation, and Ashland Chemical*, Environmental Accounting Project, 2000
19. Robert Sroufe, A Framework for Strategic Environmental Sourcing, in *Greening the Supply Chain*, Springer-Verlag London Ltd., 2006
20. APO, *Greening Supply Chain – Enhancing Competitiveness through Green Productivity*, 2001
21. APO, *Eco-Products Directory for Sustainable Consumption and Production*, 2005
22. USEPA, *Greening the Supply Chain at SC Johnson*, Environmental Sustainability Case Study, 2003
23. Stefan Schaltegger and Roger Burritt, *Contemporary Environmental Accounting – Issues, Concepts and Practice*, Greenleaf Publishing, 2000
24. Industry Canada and Dalhousie University, *Environmental Supply Chain Management – Influences, Practices and Opportunities in Nova Scotia*, 2005
25. European Commission, *Buying Green: A Handbook on Environmental Public Procurement*, 2004
26. Adidas-Salomon: Supply-chain management, *WBCSD Case Studies*, Feb.1, 2002
27. Data compiled by author through personal correspondence with companies

28. Bristol-Myers Squibb website
29. Asus website
30. Seiko Epson website
31. Green Procurement Study in the Republic of Korea
32. LG green purchasing documents
33. http://www2.marksandspencer.com/foodmagazine/

Relevant Websites

Australian Green Procurement: www.greenprocurement.org.au/toolbox.htm

Electronics Supply & Manufacturing, *Creating a Green Supply Chain*: www.my-esm.com/showArticle.jhtml?articleID=21400480

European Commission – Green Public Procurement: http://ec.europa.eu/environment/gpp/index_en.htm

Foreign Affairs and International Trade Canada, Greening Operations – Buying Green: www.international.gc.ca/trade/sd-dd/EnvironMan/system/greenop/buygrn-en.asp

Government of Canada – Procurement: www.greeninggovernment.gc.ca/default.asp?lang=En&n=256986C5-1

Green Supply Chain in China: http://supplychain.establishinc.com/public/blog/94144

GreenBiz, *Green Procurement*: www.greenbiz.com/toolbox/essentials_third.cfm?LinkAdvID=32453

GreenBiz, *How Supply Chain Management Practices are Greening Procurement*: www.greenbiz.com/toolbox/howto_third.cfm?LinkAdvID=4206

Manitoba Environmental Industries Association Inc., *Greening the Supply Chain*: www.meia.mb.ca/greeningthesupplychain.html

New Zealand Business Council for Sustainable Development, Sustainable Supply Chain: www.nzbcsd.org.nz/supplychain/content.asp?id=237

Norway's Green in Practice (GRIP) Purchasing: www.grip.no/Innkjop/English/available_material.htm

OECD, *Environmental Indicators and Outlooks*: www.oecd.org/topic/0,3373,en_2649_34283_1_1_1_1_37465,00.html

Office of the Federal Environmental Executive, *Green Purchasing*: www.ofee.gov/gp/gp.asp

Pacific Northwest Pollution Prevention Resource Center – Supply Chain Management for Environmental Improvement: www.pprc.org/pubs/grnchain/intro.cfm

Pollution Prevention World Information Network, *Greening the Supply Chain*: www.p2win.org/main/ns/70/doc/113/lang/EN

Sustainable Supply Chain Forum: www.sscf.info/DesktopDefault.aspx?tabid=52

Swedish Environmental Advisory Council, *Green Headline Indictors*: www.sou.gov.se/mvb/english/Formeractivities/green_head.htm#Use%20of%20energy

Swiss Federal Office for the Environment – IPP, LCA, GPP: www.bafu.admin.ch/produkte/index.html?lang=en

UK Environment Agency – Green Supply Chain: www.environment-agency.gov.uk/business/444251/1122184/?lang=_e

UNEP, *Good Practices – Possible Solutions – Supply Chain Management*: www.agrifood-forum.net/practices/scm.asp

Appendix 1. Training Slides on Greening the Supply Chain

Suggestions for use:

This is a set of slides summarizing the main points of GSC according to the Manual for the training of employees or staff in preparing a GSC program or implementing GSC measures.

GREEN SUPPLY CHAIN

★ Asian Productivity Organization ★

1

Outline of the Training

- Unit 1: Why Green Your Supply Chain?
- Unit 2: External Standards
- Unit 3: Introducing a Green Supply Chain
- Unit 4: Implementing a GSC Program
- Unit 5: Collaborative Partnering with Suppliers and Vendors
- Unit 6: Supply Chain Logistics
- Unit 7: Product Development & Stewardship
- Unit 8: Measuring Performance
- Unit 9: Examples of GSC

2

UNIT 1

WHY GREEN YOUR SUPPLY CHAIN?

3

Why Green Our Supply Chain?

"Working together with our business partners, we can accomplish more and do better in reducing environmental impacts"

- General Motors

4

Reasons for Greening the Supply Chain?

- Conserve resources, including energy
- Improve environmental footprint
- Market development
- Economic benefits
- Health and safety
- Reduced liabilities

5

Motivations for Greening the Supply Chain

- Regulatory stance
- Customer pressure
- Enhanced brand image
- International purchasing restrictions
- Risk management
- Cost reductions, enhanced quality, increased innovation

6

Key Drivers for Greening the Supply Chain

- Markets campaigns
- Shareholder interest
- Strategic sourcing and suppliers consolidation
- Initiatives by business organizations
- Government activities
- Market trends

7

UNIT 2

EXTERNAL PRESSURE OR STAKEHOLDER REQUIREMENTS

8

External Stakeholder Requirements Influencing GSC: Regulations, Practices and Standards

- CERES
- EuP
- GRI
- ISO 14001
- REACH
- RoHS
- WEEE

9

UNIT 3

INTRODUCING A GREEN SUPPLY CHAIN

10

What is a Green Supply Chain?

- *"Greening the supply chain (GSC)" refers to buyer companies requiring a certain level of environmental responsibility in core business practices of their suppliers and vendors.''*

11

What is Supply Chain Environmental Management?

***Supply chain environmental management (SCEM) is a broad term that refers to a variety of approaches through which companies work with their suppliers to improve the environmental performance of their products or manufacturing processes, their customers, or both*.**

12

What is a Sustainable Supply Chain?

- *"Management of raw materials and services from suppliers to manufacturer/service provider to customer and back with improvement of the social and environmental impacts explicitly considered."*

13

Relevant Terminology

- GSC
- SCEM
- SSC
- ESCM
- GSCM or GrSCM
- RSCM

14

Focus of a Green Supply Chain

- Improve performance of business operations
- Working with suppliers and vendors to increase efficiency and competitiveness
- Working effectively with customers and sales channels

15

Targets of *GSC*

- Reduce or eliminate materials used in manufacturing processes and products
- Environmental compliance and practice of supplier operations
- Joint development of materials, processes and products to solve environmental issues

16

How Does the *Greening Process* Start?

- **Begin** with suppliers of raw materials
- **Create a green purchasing plan** to improve manufacturing processes
- **Improve the distribution stage**, namely bulk quantities shipped and reduced transport volumes and shipments, including shipments to customers
- **Increased consumer purchasing awareness**

17

Business Implications of GSC

- Reduce costs
- Improve risk management
- Enhance quality
- Increase innovation and new product development
- Enhance brand name and reputation

18

Benefits of a Green Supply Chain

- **For SMEs**: cost reductions, increase competitiveness, attract customers
- **For the company**: reduce environmental impacts, enhance relationship with suppliers, enhance brand image, reduce waste costs, attract investment, positive media attention
- **For the consumer**: easier access to eco-products, influence business operations for sustainable development

19

Examples of GSC Savings at Large Corporations

- **Hewlett-Packard** eliminates 30,000 cu. ft. polystyrene computer packaging and 6 million pounds PVC packaging in 2007
- **Nike** removes a toxic compound from its "Air" shock absorption shoes – the AirMax 360
- **Wal-Mart** saves 480 million gallons of water and 20 million gallons of diesel fuel, and reduces energy consumption by 30%

20

Boeing

- Sponsors Supplier Technical Exchange forums every 18 months to collaborate on common environmental challenges
  - During these week-long events, Boeing brings together 40-50 people from Boeing and representatives from the company's key suppliers to exchange ideas and work jointly to address environmental issues
- Works one-on-one with suppliers to help them find environmentally preferable substitutes for hazardous materials

21

McDonald's

- Driving good environmental management upstream into its supply chain
- Began the initiative the environmental scorecard for suppliers of agricultural products
- Monitors its suppliers' most significant direct environmental impacts--solid waste, energy use, water supplies and air quality

22

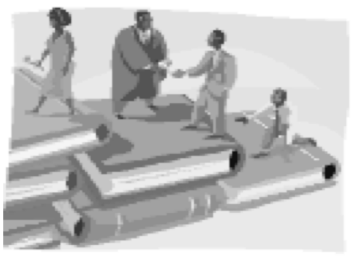
Sony

- Sony designates suppliers that cooperate in the production of environmentally sensitive products as Green Partners
- Sony established its Sony Green Partner Standards in July 2001
- Under this program, Sony auditors visit suppliers to check environmental management activities
- Suppliers that meet Sony's standards qualify as Green Partners

23

UNIT 4

IMPLMENTING A GSC PROGRAM



24

Where and How to Apply GSC?

- Look at the environmental impacts along your supply chain and identify opportunities for improvement

25

Team Formation

- **Getting started on GSC**
- **Cross-functional**
  - **Procurement**
  - **EH&S**
  - **Manufacturing**
  - **Marketing**
  - **R&D**

26

Information Collection

Two main types of information:

- Information relating to the environmental impacts or sustainability issues of an organization's products/services
- Information concerning business partners

27

Data Collection Methods

- **Meetings and structured seminars**
- **Questionnaires**
- **Site visits**

28

Views of Our Business Partners

- Motivated by requests
- Need more collaboration
- Cost change
- Tap emerging markets
- Require training

29

Further Resources

- References, case studies, tools
- Promoting organizations:
  - ISM
  - CSP
  - IGPN
  - ICLEI
  - GEMI

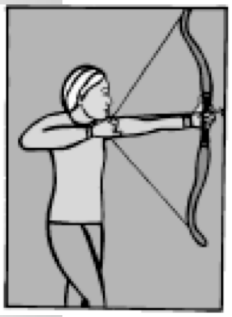
30

Identification of GSC Opportunities

- GSC initiatives currently in use
- Identify potential issues affecting your supply chain
- Map risks along your supply chain
- Evaluate items to purchase

31

Setting Targets



Specific, measurable and attainable:
80% of products obtained eco-labeling,
30% reduction in consumption

32

Generation of GSC Options

- Customers and sales

- Suppliers and vendors

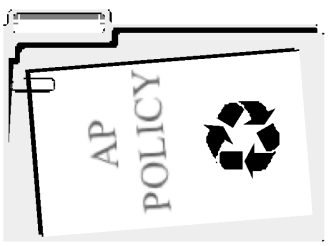
- Internal options

33

Customers and Sales

- Product development and stewardship

- Green marketing
- Product take back



34

Suppliers and Vendors

- Set guidelines
- Establish standards
- Evaluate procedures
- Audit protocol
- Contract terms
- Joint problem solving

35

Internal Options

- Policy and strategies
- Procurement criteria
- Buying energy, greening meetings and travel

36

Screening and Assessment of GSC Options

- Build evaluation criteria
- Resolve barriers for change
- Prioritize business partners

37

GSC Implementation

- Top management support
  - Conduct analysis
  - Secure approval
  - High-level commitment
  - Demonstrated and dedicated efforts

38

GSC Implementation – Integrate into Existing System

- Merge environmental policy with supply chain activities
- Audit suppliers included in quality audits
- Integrate GSC initiatives into purchase of office supplies, materials, etc.

39

GSC Implementation – Decision Making

- **Run pilot project on GSC, implement decision making procedures for GSC, include GSC in the management decision process, establish GSC decision making modes or models within the organization**

40

Formulation of GSC Implementation Plan

Specific actions can include:

- Reduce consumption
- Alter specification terms
- Seek alternative supply
- Criteria for supplier selection
- Criteria for product design
- Request information
- Internal assessment

41

GSC Implementation - Communication

- Clear, consistent, frequent*two-way* communication with business partners
- Hold workshops and seminars
- Questionnaire, site visits, audits
- Communicate internally on GSC programs through intranet, meetings, trainings, etc.

42

GSC Implementation – Work with Departments and Suppliers *one-on-one*

- Establish task force, engage experts or consultants, select the champion
- Take time to change habits, people make mistakes, learn from one another

43

GSC Implementation – Promotion and Training

- Target audiences and provide organized training
- Promote awareness, network and publicize

44

Monitoring GSC - Indicators

- Establish relevant indicators to monitor GSC performance
- Monitor GSC progress, obtain feedback and collect further information for future opportunities

45

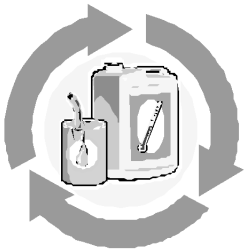
Management Review and Continuous Improvement

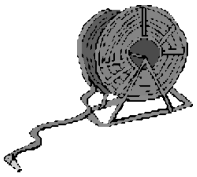
- Checking the GSC Program
  - Effectiveness, methodology, benefits, barriers
  - Corrective actions and changes needed
  - Include changing market, new regulations, technical improvements in management reviews

46

UNIT 5

COLLABORATIVE PARTNERING WITH SUPPLIERS/VENDORS





47

Four Level of Suppliers

- Spot purchasing
- Competitively based incumbent relationships
- Preferred supplier
- Strategic partnership or alliance

48

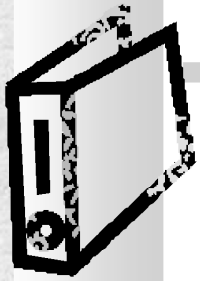
Suggestions on Partnering with Suppliers

- Involve suppliers early
- Identify opportunities where suppliers can help
- Prioritize opportunities for improvement
- Identify new and alternative suppliers
- Establish terms and agreements for a partnership
- Consider becoming environmental mentor

49

Procurement Policy and Product Specifications

- Define requirements in contracts
- Develop procurement policy and product specifications
- Examples:
  - Restrict certain substances
  - Apply eco-labeling standards
  - Adopt existing industrial standards



50

Supplier Standards, Criteria, Evaluation and Certification

- EMS, ISO 14001
- GRI, Balanced Scorecard
- Social Issues: labor, safety, working conditions
- Governance
- Eco-efficiency, energy efficient

51

Outreach and Assistance to Suppliers

- Make suppliers aware of requirements
- Offer education and training
- Bear transition costs
- Offer assessment
- Offer technical assistance
- Get support from customers

52

Potential Service Managed by Suppliers

- **Chemicals and laboratory supplies**
- **Office supplies**
- **Cleaning and maintenance supplies**
- **Scrap, packaging and recyclables**
- **Energy management**
- **Office furnishings**
- **Office equipment**
- **Water supply**
- **Delivery and take back**

53

Energy and Water Considerations

- Energy- and water-efficient products and services
- Products that use renewable technology
- Energy-saving performance contracts

54

Example of Paper and Paper Products

- Printing and writing papers
- Tissue and towel products
- Newsprint
- Paperboard and packaging products
- Miscellaneous products

55

Example of Non-Paper Office Products

- Binders (paper, plastic covered)
- Office recycling containers
- Office waste receptacles
- Plastic desktop accessories
- Plastic envelopes
- Plastic trash bags
- Printer ribbons
- Toner cartridges
- Plastic binders (solid)
- Plastic clipboards
- Plastic clip portfolios
- Plastic file folders
- Plastic presentation folders

56

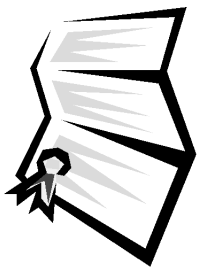
Implementing Supplier Service Strategies

For the organization

- Assess potential areas
- Prioritize opportunities
- Develop draft plan
- Involve the supplier
- Complete agreement with supplier

For the supplier

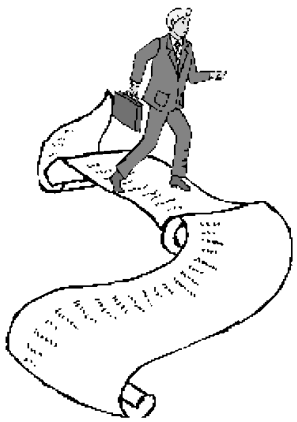
- Assess potential service
- Assess advantages and benefits
- Develop operational plan
- Complete agreement



57

UNIT 6

SUPPLY CHAIN LOGISTICS



58

What are Sustainable Supply Chain Logistics?

- Sustainable supply chain logistics are the planning, storage, transportation, and reverse logistics processes involved in getting goods and services to the right *place*, at the right *time*, and in the right *condition*, while *minimizing the impacts* on our natural and social environments.

59

Did You Know?

Freight movement was responsible for 21% of the growth in greenhouse gas (GHG) emissions between 1990 and 2003, almost entirely due to emissions from trucking.

60

Benefits of Sustainable SCL

Financial benefits

- Increased revenue
- Reduced costs
- Increased asset utilization
- Enhanced customer service

Environmental benefits

- Reduced fuel consumption
- Increased energy efficiency
- Reduced emissions
- Reduced waste

Social benefits

- Reduced community impacts

61

SCL - Planning

- Supply chain activities at strategic level:
  - Increase forecast accuracy
  - Consider SCL in product lifecycle management
  - Optimize SCL in network design



62

SCL - Storage

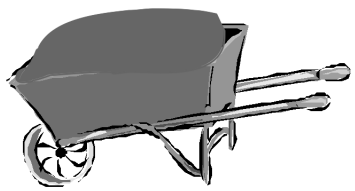
- Storage: warehouse and inventory
  - Incorporate sustainability factors in warehouse
  - Optimize warehouse layout and workflow
  - Increase energy efficiency of warehouse operations
  - Reduce inventory obsolescence
  - Handle and store hazardous materials safely
  - Automate inventory handling and management processes

63

SCL - Transportation

Inbound and outbound of goods

- Lifecycle of delivery fleet
- Use less fossil fuel
- Optimize loads and routes
- Use reusable and recyclable shipping materials
- Transport hazardous materials safely



64

SCL – Reverse Logistics

Moving goods back:

- Optimize efficiency of product returns
- Implement high value, low waste disposition strategies

65

UNIT 7

PRODUCT DEVELOPMENT AND STEWARDSHIP

66

Opportunities with Customers and Sales

- Improve process efficiency of getting products and services to customers
- Product stewardship
- Improve design of products or services

67

Supply and Demand

- *Success is dependent on supply chain partnerships between suppliers and customers*
- *What customers want to buy rather than shops want to sell.....*

68

Product Stewardship

- A product-centered approach, requiring manufacturers, retailers, users and disposers to share responsibility for reducing environmental impacts

69

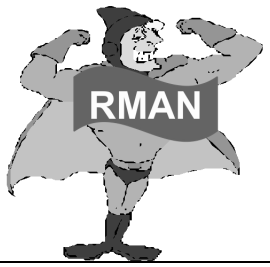
What are the Roles?

- Manufacturer – product design
- Retailer – influences customers to choose
- Customer – final choice of product or service
- Government – procurement policy, tendering process

70

Product Design Criteria and Evaluation

- EHS and Supply Chain Management
  - Recycled content, e.g. RMANs
  - Packaging material and safety
  - Toxic substances, e.g. MSDS



71

Examples of Product Design Tools

- Environmentally Conscious Design (ECD) or Design for Environment (DfE) are complex processes under intense study
- Examples of tools used inECD/DfE:
  - Product design checklist
  - Product evaluation matrix
  - DfE/Life Cycle Checklist

72

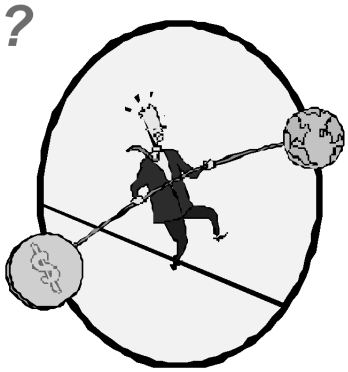
UNIT 8

MEASURE PERFORMANCE

73

Where are you and what is your environmental stance?

Do you know the environmental impacts of your supply chain and will you seek environment friendly suppliers?



74

Evaluating GSC Performance

- Evaluate or assess your practice to identify opportunities for improvement:
  - Importance - identify high importance areas on greening your supply chain
  - Performance - identify areas where existing performance is low

75

How Are Your Suppliers Doing?

- Selection and screening of suppliers
- Development of suppliers
- Evaluation of suppliers
- Sustain the champions and stars
- Identify new and alternative suppliers

Look for the green tree or green star

76

Environmental Impacts vs. GSC Indicators

Environmental impacts	GSC indicators
■ Biodegradable	■ EMS
■ Compostable	■ GHG emissions
■ Ozone depletion	■ Public disclosure
■ Emissions	■ Take back and supply chain logistics
■ Waste	■ Environmental compliance
■ Energy efficiency	■ Labor issues
■ Packaging	■ Training and awareness
■ Toxic substance content	■ Communications
	■ Costs and benefits

77

GSC Indicators

For suppliers:

- Public Disclosure of environmental information
- Environmental program/practices
- Monitoring/assessment of suppliers
- Reverse logistics program
- Hazardous substance management
- Environmental compliance/emissions
- Energy efficiency
- Transportation and storage management



78

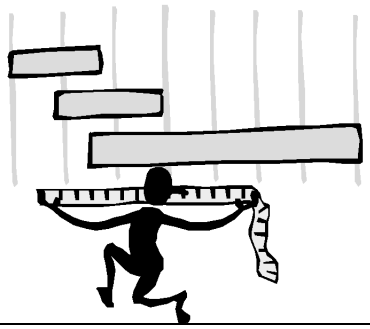
GSC Indicators - Examples

- Canon – products: 82.1% Eco Mark, 93.5% Energy Star
- Sony – 30% reduction in energy consumption, 20% reduction in resource utilization
- Epson – 3.4% reduction in GHG in 2005 compared to 2004

79

GSC Metrics

- Reduction of materials, waste, emissions, water, energy, etc.
- Increase revenue, costs reductions, benefits gained



80

Tracking Materials and Costs

- Material summary, material and energy flow
- Environmental cost accounting, allocation of costs, activity-based costing

81

Comparison of Costs and Profit

- Product A (clean)
  - Profit w/correct cost = $100
  - Profit w/incorrect cost = $75
  - Error = -25%
- Product B (dirty)
  - Profit w/correct cost = $50
  - Profit w/incorrect cost = $75
  - Error = +50%

82

UNIT 9

EXAMPLES OF GSC

83

Supplier Evaluation and Certification

- General Motors – requires performance standard, offers training and assistance
- Nike – assists suppliers in meeting environmental standards, reducing waste and resources
- Roche Vitamins – publishes voluntary standards, offers training and assistance

84

Environmentally Preferable Purchasing

- Bristol-Myers – considers environmental costs rather than product costs
- DaimlerChrysler – asks suppliers to disclose materials content for purchasing decision making
- The GAP – requires suppliers to use certified wood

85

Eco-Design and Cleaner Production

- Eastman Kodak – evaluates life cycle impacts of materials and components
- Xerox – works with suppliers on recyclable or recycled products and parts
- Volvo – requires suppliers not to use banned substances

86

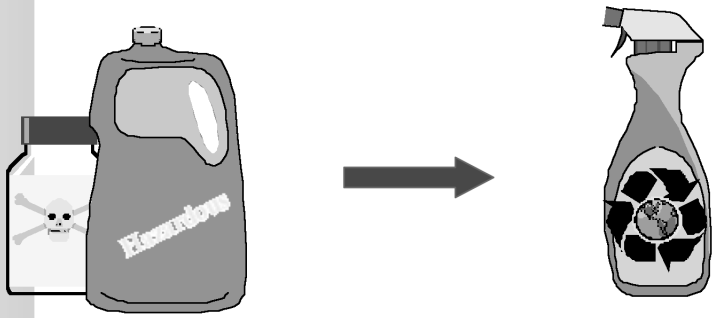
Suppliers Managed Service

- **Intel – offers just-in-time inventory management**
- **Johnson Controls – offers energy and environmental services to customers**
- **Motorola – offers chemical inventory including selection, containers and logistics**

87

SC Johnson

Products that have a lesser or reduced effect on human health and the environment when compared with competing products that serve the same purpose



88

ASUS

Established eGreen Management Platform and used green management audit to instruct its suppliers on quality, design, document control, testing…….

89

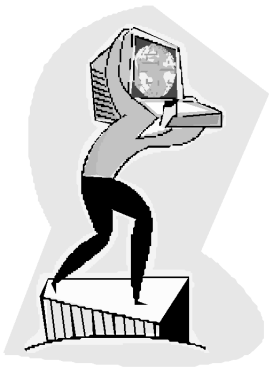
IKEA

All IKEA suppliers must reduce waste and resources, handle hazardous substances safely, recycle materials and products and use certified wood

90

LG

- Eco-supply chain management:
  - Environmental management
  - Eco-design
  - Material declaration



91

Canadian Autoparts Toyota

- Returnable packaging:
  - Result of ISO 14001 initiative
  - Use plastic pallets to replace cartoons
  - Payback in two years
  - Lower unit costs
  - Increased customer satisfaction
  - Improved ergonomics for employees

92

More Information and Resources

Glossary, reference, websites, training slides, awareness brochure, decision making software

93

Examples of Relevant Websites

- UNEP
- European Commission
- Asian Productivity Organization
- US EPA
- ICLEI
- New Zealand Business Council for Sustainable Development
- The Pacific Northwest Pollution Prevention Resource Center
- Greater Vancouver Regional District

94

Dedicated to Making a Difference

Greening your Supply Chain to make a better world tomorrow!

95

Appendix 2. Train the Trainer Slides

Suggestions for use:

This is a set of slides for the training of trainers on GSC. The slides should be use in conjunction with the Manual and Appendix 1 on training slides. The main purpose of this training is to request potential trainers to actually work on the different aspects of GSC so that they will be familiar with the tools and techniques before becoming a trainer.

Green Supply Chain - A Platform for Stimulating "Green" Innovations

Asian Productivity Organization

What is Green Productivity ?

- **What are the GP concepts, focuses and practices?**
- **What are GP guiding principles, tools and techniques?**
- **What are the steps and tasks for setting up a GP program?**

What Are the Environmental Impacts of Your Supply Chain?

- What is the life cycle of your supply chain?
- Identify potential issues with your supply chain: suppliers, retailers and customers
- Select a product in your organization:
  - Which supplier provides this product?
  - Does the supplier provide information such as GHG, energy/water efficiency, ozone depleting substances, toxic substance content, recyclability about this product?
  - Check its costs, volume and frequency of purchase, alternative brands available

How to Implement GSC?

- How to select and prioritize GSC options?
- How to set GSC targets?
- How to formulate a GSC program/plan?
- What are the opportunities for further improvement?

Implementing GSC

- How to raise awareness of GSC in the company?
- How to conduct training on GSC?
- How to set up an approval procedure or establish a decision making mode/model on GSC?

Working with Suppliers/Vendors

- Do you know your suppliers/vendors?
  - How do you identify and select your suppliers?
  - How do you set criteria/terms in the contract?
  - What information do you collect from your suppliers?
  - How do you assess or evaluate your suppliers?

Sustainable Supply Chain Logistics

- How do you plan your supply chain logistics?
- What are you warehouse operations?
- How do you transport your supplies and products?

Product Development

- Who are your retailers, marketing and sales people, and your customers?
- Product development:
  - Do your retailers provide product take back?
  - Do you know what green marketing is?
  - Do you know what kind of eco-products your customers want?
  - Have you ever worked or how do you work with your manufacturers, retailers, sales and marketing customers on eco-product development?

Measure Your GSC Performance

How do you assess your performance on reducing environmental impacts:

- **What kind of internal indicators do you use?**
- **Do you also assess each suppliers's performance on reducing environmental impacts, how?**
- **What metrics and methods do you use?**
- **How do you assess the benefits of reducing environmental impacts?**

What Do You Learn from Others?

- **From the GSC case studies:**
  - **How companies are establishing partnerships with their suppliers: Sony, LG, ASUS?**
  - **How companies are putting criteria or standards in their procurement requirements to restrict toxic substances content?**
  - **How do companies apply a life cycle approach to develop their products and green their supply chain?**

Resources Required for GSC

- **Reference and websites**
- **Scope, definition and terminology**
- **Case studies**
- **Tools and methodologies: software, material energy flow oriented activity-based costing**

How to Become a Trainer

- Familiarity with aspects of GP and GSC
- Ability to motivate people
- Ability to apply relevant tools and methods
- Resourceful in identifying information and opportunities
- Learn from case studies

Appendix 3. Green Procurement Decision Making Tool

Suggestions for use:

This software is provided on the web by the Canadian government, which allows enterprises to download it for their own use. Please read the instructions in this appendix before applying the software, and go to the web (http://www.pwgsc.gc.ca/greening/text/proc/decision-e.html) and Task 3 of section 3.3 of the Manual for more details if necessary.

Commodity # 1

Environmental attributes (Y-axis)	**Use**	**Disposal**
Greenhouse gas emissions and air contaminants		
Energy and water efficiency		
Ozone depleting substances		
Waste and supporting reuse and recycling		
Hazardous waste		
Toxic and hazardous chemicals and substances		
Other*:		
Totals	0	0
Grand Total	0	

To be rated on a scale of 1 to 10 points	
High	8 to 10 points
Medium	5 to 7 points
Low	1 to 4 points

*These environmental attributes have been suggested for the purposes of the tool, however other attributes can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Operational Requirements (X-axis)	**Overall**
Volume and frequency of purchase	
Cost related to the environmental impacts	
Usability and effectiveness of alternatives	
Feasibility and accessibility of alternatives	
Minimal risk of liability (corporate and personal)	
Costs and level of effort related to the green procurement are reasonable	
Other*:	
Grand Total	0

To be rated on a scale of 1 to 20 points	
High	16 to 20 points
Medium	9 to 15 points
Low	1 to 8 points

*These operational requirements have been suggested for the purposes of the tool, however other requirements can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Commodity # 2

Environmental attributes (Y-axis)	**Use**	**Disposal**
Greenhouse gas emissions and air contaminants		
Energy and water efficiency		
Ozone depleting substances		
Waste and supporting reuse and recycling		
Hazardous waste		
Toxic and hazardous chemicals and substances		
Other*:		
Totals	0	0
Grand Total	0	

To be rated on a scale of 1 to 10 points	
High	8 to 10 points
Medium	5 to 7 points
Low	1 to 4 points

*These environmental attributes have been suggested for the purposes of the tool, however other attributes can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Operational Requirements (X-axis)	**Overall**
Volume and frequency of purchase	
Cost related to the environmental impacts	
Usability and effectiveness of alternatives	
Feasibility and accessibility of alternatives	
Minimal risk of liability (corporate and personal)	
Costs and level of effort related to the green procurement are reasonable	
Other*:	
Grand Total	0

To be rated on a scale of 1 to 20 points	
High	16 to 20 points
Medium	9 to 15 points
Low	1 to 8 points

*These operational requirements have been suggested for the purposes of the tool, however other requirements can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Commodity # 3

Environmental attributes (Y-axis)	Use	Disposal
Greenhouse gas emissions and air contaminants		
Energy and water efficiency		
Ozone depleting substances		
Waste and supporting reuse and recycling		
Hazardous waste		
Toxic and hazardous chemicals and substances		
Other*:		
Totals	0	0
Grand Total	0	

To be rated on a scale of 1 to 10 points	
High	8 to 10 points
Medium	5 to 7 points
Low	1 to 4 points

*These environmental attributes have been suggested for the purposes of the tool, however other attributes can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Operational Requirements (X-axis)	Overall
Volume and frequency of purchase	
Cost related to the environmental impacts	
Usability and effectiveness of alternatives	
Feasibility and accessibility of alternatives	
Minimal risk of liability (corporate and personal)	
Costs and level of effort related to the green procurement are reasonable	
Other*:	
Grand Total	0

To be rated on a scale of 1 to 20 points	
High	16 to 20 points
Medium	9 to 15 points
Low	1 to 8 points

*These operational requirements have been suggested for the purposes of the tool, however other requirements can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Commodity # 4

Environmental attributes (Y-axis)	Use	Disposal
Greenhouse gas emissions and air contaminants		
Energy and water efficiency		
Ozone depleting substances		
Waste and supporting reuse and recycling		
Hazardous waste		
Toxic and hazardous chemicals and substances		
Other*:		
Totals	0	0
Grand Total	0	

To be rated on a scale of 1 to 10 points	
High	8 to 10 points
Medium	5 to 7 points
Low	1 to 4 points

*These environmental attributes have been suggested for the purposes of the tool, however other attributes can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Operational Requirements (X-axis)	Overall
Volume and frequency of purchase	
Cost related to the environmental impacts	
Usability and effectiveness of alternatives	
Feasibility and accessibility of alternatives	
Minimal risk of liability (corporate and personal)	
Costs and level of effort related to the green procurement are reasonable	
Other*:	
Grand Total	0

To be rated on a scale of 1 to 20 points	
High	16 to 20 points
Medium	9 to 15 points
Low	1 to 8 points

*These operational requirements have been suggested for the purposes of the tool, however other requirements can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Commodity # 5

Environmental attributes (Y-axis)	Use	Disposal
Greenhouse gas emissions and air contaminants		
Energy and water efficiency		
Ozone depleting substances		
Waste and supporting reuse and recycling		
Hazardous waste		
Toxic and hazardous chemicals and substances		
Other*:		
Totals	0	0
Grand Total	0	

To be rated on a scale of 1 to 10 points	
High	8 to 10 points
Medium	5 to 7 points
Low	1 to 4 points

*These environmental attributes have been suggested for the purposes of the tool, however other attributes can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

Operational Requirements (X-axis)	Overall
Volume and frequency of purchase	
Cost related to the environmental impacts	
Usability and effectiveness of alternatives	
Feasibility and accessibility of alternatives	
Minimal risk of liability (corporate and personal)	
Costs and level of effort related to the green procurement are reasonable	
Other*:	
Grand Total	0

To be rated on a scale of 1 to 20 points	
High	16 to 20 points
Medium	9 to 15 points
Low	1 to 8 points

*These operational requirements have been suggested for the purposes of the tool, however other requirements can be evaluated, as applicable. The tool is valid, as long as the same criteria are used for each commodity evaluated.

More Instructions

1. If there are less than 5 commodities, make sure that the scores are at zero for the remaining available commodity sheets.

2. If there are more than 5 commodities,
a. Place yourself on the commodity # 1 tab; right click “Move or Copy…”; “under Before sheet:” highlight “(move to end)”; place a checkmark beside ‘Create a copy”; click “ok”.
b. Change the name of the sheet to Commodity # 6 or the name of your commodity.
c. Go to the Chart sheet. It is the first of the sheets. From the Chart itself, right-click and go to “source data”; Under the “series” tab, click “Add”; next to name, type the name of your sheet (Commodity # 6 or commodity name); next to the X-value, click on the icon with the red arrow (you then must go back to the Commodity # 6 sheet and click on the cell that corresponds to the Grand Total for the x-axis (cell C 23), then do the same for the y-axis (cell C 12). Repeat process for more commodities.
d.You may rename the commodity sheets as applicable.

Appendix 4. Awareness Brochure on Green Supply Chain

Suggestions for use:

This brochure on GSC is a sample for raising awareness in the organization. Organizations are encouraged to modify it to suit their needs and post their GSC awareness brochures in their organizations for publicity and education purposes.

What is "Green" Supply Chain?

"Greening the supply chain" (GSC) refers to buyer industries/organizations necessitating requirements of environmental responsibility and meeting certain environmental requirements in the business management systems and practices of their suppliers and vendors.

Why Green Our Supply Chain?

Greening our supply chain helps to:

- Conserve natural resources and minimize our environmental "footprint"
- Improve worker safety and health
- Reduce energy use, greenhouse gas emissions and waste to landfills
- Stimulate new markets and create jobs
- Reduce liabilities
- Provide potential cost savings $$$

Key drivers pushing GSC:

- Government intervention in the form of legislation
- Increasing market demands for greener products
- Non-government organizations (NGOs) seeking more transparency in our environmental activities
- Increasing demands from institutional investors
- Expanding notions of corporate liability
- Growing evidence of the impacts that aspects of business have on the environment

How to Green Our Supply Chain?

Targets of green supply chain:

- Eliminate or mitigate the negative aspects of production and the use of its products
- Energy reduction
- Reduce or reuse packaging
- Change raw materials or fuels
- Use equipment to control or reduce outputs harmful to the environment
- Increase employee environmental training
- Find alternate uses for "waste" materials other than disposal
- Change handling practices

Working with our business partners:

- Identify the sustainability issues of our supply chain cycle
- Collaborative partnering with our suppliers/vendors
- Collect information about our suppliers and on the products/services provided
- Study our supply chain logistics and optimize the planning, storage, transportation and reverse logistics
- Work with our retailers, sales and marketing people on green marketing and product take back
- Communicate with our customers to develop eco-products/services to suit their needs.

Green Supply Chain Program

Our Mission/Policy

Our Company shall work with our business partners (suppliers, vendors, contractors, retailers, sales and marketing, customers) to reduce the environmental impacts of our supply chain, with the goal of improving the environmental and financial performance of our corporation and our business partners.

What Are Others doing?

Wal-Mart

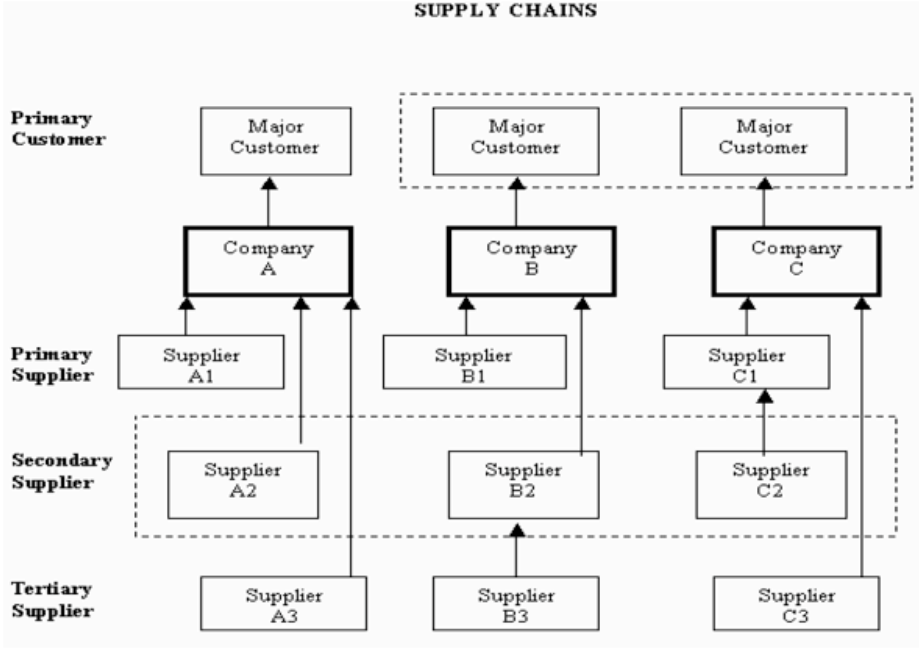
Through its Zero Waste initiative, $312B-retailer Wal-Mart has so far saved 478.1 million gallons of water, 20.7 million gallons of diesel fuel, and millions of pounds of solid waste. Through its 100% Renewable Energy program, the company expects to reduce energy consumption by 30% at all of its new stores in seven years.

Sony

In 2005, achieved a 30%-reduction in power consumption in 70% of product categories, reduced resource input by 20% in 90% of product categories, while its Green Management indicators are composed of a greenhouse gas index and resource index.

Where Can I Learn More?

- New Zealand Business Council for Sustainable Development, *Business Guide to a Sustainable Supply Chain – A Practical Guide*, 2003
- Greater Vancouver Regional District, Canada, *Sustainable Supply Chain Logistics Guide*, 2006
- PPRC, *Supply Chain Management for Environmental Improvement: Practical Solutions for Economic and Environmental Vitality*, 2004



What Are the Benefits of a Green Supply Chain?

- ***SMEs***: reduce costs, increase competitiveness, attract customers
- ***Large corporations***: reduce environmental impacts, enhance brand image, attract investment and media attention
- ***Customers***: easier access to eco-products, influence business operations for sustainable development