

Strategies for Sustainable Supply Chain Management: Supplier Interaction Devices

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Abstract:

In a competitive business environment that requires strategy and innovation to improve the bottom line, supply chain management has been vital in creating competitive advantage. Increasingly, companies are also identifying sustainability as an opportunity to create competitive advantage. This project explores supply chains as a leverage point in advancing sustainable development. Corporations have developed different tools to interact with their suppliers on sustainability. Three of these devices were analyzed against a framework for strategic sustainable development to identify some of their strengths and weaknesses. A general set of criteria for sustainable supply chain management devices that employs a strategic, whole-systems perspective was then developed.

Keywords: Supply chain management, sustainable supply chain management, supplier interaction, sustainability, sustainable development

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Statement of Contribution

This thesis was written in a collaborative fashion with each of the three team members bringing their respective strengths and perspectives to the process.

The development of the original topic idea was influenced by each of our backgrounds—Shannon’s in Economics, Estela’s in Business Management, and Anne’s in Non-Governmental Organizations (NGOs). Our common interest in how businesses can contribute to sustainable development led us to our thesis topic on Sustainable Supply Chain Management.

During the literature review, we divided the work evenly, with each of us sourcing reference material, reading, and taking notes to share with the others. Key documents were read by all group members.

Each group member took the opportunity to learn about a specific companies sustainability initiative and the devices used within that initiative to address supply chain management. After collaborative sessions with group members and advisors, a template of the analysis was developed. Subsequently, each member analyzed a company’s device; Anne focusing on Hydro Polymers, Estela McDonald’s Sweden, and Shannon Hewlett Packard. From our analysis of the companies, the criteria were developed in several group sessions.

Throughout the process, core ideas emerged through dialogue in regular group meetings. All members reviewed and revised each other’s work and contributed to all aspects of the thesis.

Challenges notwithstanding, we are unanimous in our conclusion that the experience of writing a group thesis yielded far stronger results than any attempt to do so individually might have.

Karlskrona, June 2007

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Executive Summary

Introduction

As awareness grows regarding the importance of sustainable development, supply chain management is evolving into more than coordinating a network of companies exchanging resources. Traditionally, supply chain management has represented an opportunity to strengthen a company's position in the market through efficiency and resource optimization.

The emerging field of sustainable supply chain management aims to achieve these objectives while also benefiting society and the Earth by spreading values, visions, and actions for sustainability to other companies and consumers. Sustainable supply chain management (SSCM) integrates the principles of sustainability into supply chain activities, generating not only economic, but also ecological and social value throughout the supply network.

Companies are beginning to use various devices to interact with their suppliers regarding sustainability (hereafter referred to as "SSCM devices"). This study explores the emerging field of sustainable supply chain management and the use of such devices. The research questions are as follows.

Main question:

How do, and how could, supplier interaction devices contribute to sustainable supply chain management?

Sub questions:

From a sustainability perspective, what are some strengths and weaknesses of three current supplier interaction devices?

What are some necessary criteria of a device intended to move suppliers toward sustainability?

In order to take a closer look at the interactions between key actors in the supply chain and the impacts these relationships have on sustainable development, a new perspective of supply chain management must be used. A framework for understanding SSCM provides such a perspective.

This framework was designed and employed by the authors to analyze SSCM devices, which led to the creation of a set of criteria for SSCM devices and a template for businesses to initiate a conversation with their suppliers about this issue.

Methodology

The following methods were used to answer the research questions:

Literature Review

The literature review provided context and informed this study of current business devices regarding companies' efforts to influence their supply chain to move towards sustainability.

Interviews

Interviews were conducted with Hydro Polymers and McDonald's Sweden to complement the theoretical research and gain a practical understanding of current SSCM initiatives and devices.

Supplier Interaction Device Analysis

Three SSCM devices currently used by companies were analyzed to determine their strengths and weaknesses. Hydro Polymers, McDonald's Sweden, and Hewlett-Packard (HP) were chosen.

Results

Analysis of the Hydro Polymers Device

Overall, the Hydro Polymers device is very effective. It uses a principled definition of sustainability, employs a framework to help its user create a strategic plan for sustainability, and it is part of a larger sustainable supply chain initiative.

Despite the device's many strengths, it also has one key weakness. The device lacks clarity regarding prioritization of actions, which may result in poor decisions.

Analysis of the McDonald's Sweden Device

The McDonald's Sweden guidance device provides a holistic introduction of sustainable development to suppliers. One of its major strengths is that it triggers its user to identify a comprehensive list of potential sustainability aspects and challenges.

The device's useful step-by-step approach guides strategic planning for sustainability. Its main weakness is that it lacks a mechanism to evaluate the success of the device.

Analysis of the HP Device

HP's self-assessment device is widely used among its supply chain and has contributed to high levels of compliance with the Electronics Industry Code of Conduct. Although HP makes clear their objective to spread social and environmental responsibility through their supply chain, no reference is made as to what this phrase represents and/or stands for. HP's device lacks alignment with sustainability principles, a systems perspective and a strong strategic element.

SSCM Device Criteria

Some necessary criteria for an SSCM interaction device are: visionary leadership, non-reductionism, systems perspective, consistency, and accountability. Visionary leadership was chosen for the purpose of unifying the supply chain around the vision of sustainability. An example of visionary leadership is facilitating the supplier to develop a vision (on which to build a strategic plan) of the company operating in a sustainable future. Non-reductionism was chosen to shift the focus from all the various social and ecological problems to their underlying causes. An example of non-reductionism is adopting a systems perspective that demonstrates simplicity without reductionism. A strategic approach was chosen because it is likely to facilitate the development of a plan for the supplier company to achieve sustainability. An example of taking a strategic approach is

employing backcasting from principles of success to identify actions toward sustainability. Consistency was chosen because it ensures that actions are not *ad hoc* or unproductive undertakings. An example of consistency is brainstorming actions that will move the supplier toward sustainability. Accountability was chosen for its ability to motivate suppliers to take meaningful steps toward sustainability. An example of accountability is implementing a rewards/consequences system to create incentives for sustainability.

Conclusions

Our findings demonstrate that a device that is likely to spread sustainability through a company's supply chain should communicate a clear understanding of sustainability and the company's sustainability initiative. Additionally, it should be strategic and relevant to sustainable development. It should facilitate actions toward achieving sustainability and hold suppliers accountable to agreed-upon standards.

Ultimately, the framework for sustainable supply chain management laid out in this thesis—and based on the generic five level framework for planning in a complex system—is well suited to contribute to an SSCM interaction devices.

Abbreviations

BTH	Blekinge Tekniska Högskola
EICC	Electronic Industry Code of Conduct
FSSD	Framework for Strategic Sustainable Development
HP	Hewlett-Packard
PVC	Polyvinyl Chloride
SCM	Supply Chain Management
SER	Social and Environmental Responsibility
SSCM	Sustainable Supply Chain Management
SSD	Strategic Sustainable Development
TNS	The Natural Step

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1 Introduction

1.1 Global Socio-Economic Unsustainability

When the earth is observed from a systems perspective, patterns begin to emerge. Ecosystems and human society are showing signs of stress and decline (Ash et al. 2005, 20, 23). Recent reports from the Intergovernmental Panel on Climate Change¹ and announcements from business leaders such as Wal-Mart's CEO Lee Scott have increased awareness on a global scale of some of the challenges faced by the Earth and human civilization (IPCC 2007; Scott 2007). Society must act strategically if it is to redirect itself toward a sustainable future (Broman et al. 2000, 3-6; Holmberg and Robert 2000, 291-308).

Social and environmental concerns are increasing in both scope and severity. Ecosystems are experiencing a decline in productivity and both the quality and quantity of resources is shrinking. At the same time, a growing human population and rising consumption levels have increased the demands on the globe's ecosystem services.

¹ Formed by the World Meteorological Organization and the United Nations Environment Programme in 1998. A series of reports released in 2007 have affirmed that greenhouse gases are continuing to rise and that humans are influencing global climate. Accessed <http://www.ipcc.ch/>.

An abbreviated list of global sustainability problems include:

- Loss of biodiversity
- Habitat loss and fragmentation
- Water scarcity
- Shrinking forests
- Expanding deserts
- Eroding soils
- Reduced food productivity
- Rising carbon dioxide levels
- Falling water tables
- Rising global temperatures
- More destructive storms
- Melting glaciers
- Rising sea level
- Dying coral reefs

Source: Brown 2001; Ash et al. 2005

Social problems are also on the rise worldwide. Increased poverty levels and the widening of the gap between the rich and poor have increased social tensions all around the globe. Thirty-five percent of the world's population live in countries in which basic political rights and civil liberties are denied, such as freedom of speech, religion, press, fair trials and democratic political processes (The World Revolution 2007).

In the business arena, companies have been increasingly called upon to assume greater responsibility for social and environmental impacts throughout their supply chain. For example, many transnational corporations that source products from around the world are being held accountable for promoting and protecting the rights of workers that make their products—regardless of whether they are direct employers or not (Business for Social Responsibility 2007).

If businesses wish to prosper in the future, they must respond to these circumstances, along with other related global trends including stricter laws and regulations and demanding stakeholders. Sustainable supply chain management (SSCM) has been identified as a strategy to address global social and ecological unsustainability and an opportunity to lead transformational change towards a sustainable future.

This thesis focuses on sustainable supply chain management and the authors hope to contribute to the ongoing dialogue regarding corporate sustainability.

1.2

A New Paradigm

At the core of corporate culture is the ‘business as usual’ mindset which has produced a misconception that society is passing through a ‘cylinder’ where the walls represent a constant set of constraints represented by resources available and the ability of ecosystems to absorb human impacts. The cylinder paradigm acknowledges that humans influence the Earth and social systems, but it sees these impacts as sporadic problems that can be addressed individually as they arise.

A new way of thinking has emerged that sees linkages between social and environmental problems on a global scale, and that these problems are systematically increasing. In order for corporations, and ultimately society, to become sustainable, they must think beyond the ‘business as usual’ paradigm prescribed by the cylinder metaphor. In reality, society has entered a ‘funnel’ where the walls are closing in, representing the systematic decrease in resources available—environmental and social—and a systematic increase in demand on those resources due to growing population and consumption habits (see Figure 1). These factors conspire to limit the resources available and as this trend continues, society experiences reduced quality of life. Unlike what the cylinder paradigm conveys, society will not reach a state of equilibrium and the survival of civilization is ultimately threatened.

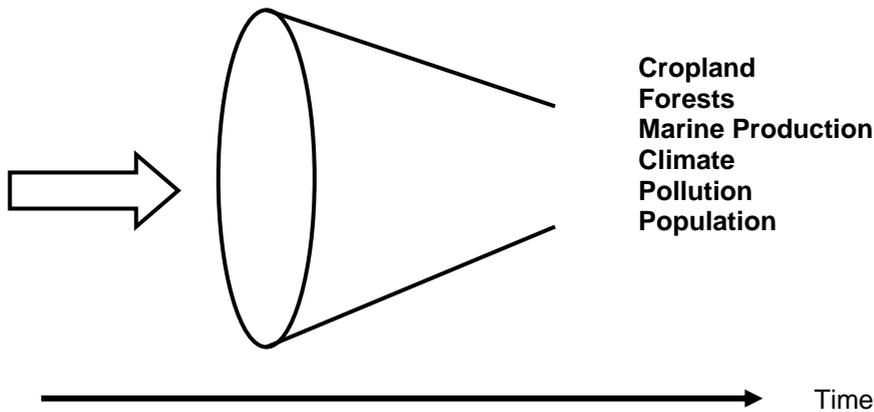


Figure 1. Funnel Paradigm

Source: Robèrt et al. 2006, xxi

By accepting the reality of the funnel paradigm, businesses can develop strategic actions to deal with and avoid the prospect of declining profits and decreased revenue. They can turn these threats into strategic opportunities to create competitive advantage.

The influence companies can exert over their suppliers has the potential to accelerate the pace towards reaching global sustainability.

1.3 Framework for Strategic Sustainable Development

This thesis uses a set of definitions and concepts which taken together comprise what is referred to as the framework for strategic sustainable development (FSSD). The FSSD consists of the five level framework,

sustainability principles, the ‘backcasting’ concept, and the ABCD methodology.

1.3.1 The Five Level Framework

The generic five level framework provides a mental model for planning in a complex system and consists of the following levels: (i) the system, (ii) success in the system, (iii) strategies, (iv) actions, and (v) tools (Robèrt 2000, 243-254; Robèrt et al. 2002, 204).



Figure 2. The generic five level framework

Source: Robèrt 2000, 249

When applied to strategic sustainable development, the framework becomes a conceptual framework to help its users achieve their sustainability goals. It provides a context for understanding the complex nature of sustainability

problems and how to use systematic planning and decision-making in solving them.

1.3.2 Sustainability Principles

A common definition for sustainability was put forth in 1987 by the World Commission on Environment and Development in their report entitled "Our Common Future" which later came to be known as the Brundtland Report. It states that "[s]ustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The Brundtland report brought attention to society's dependence on natural systems and how society may be jeopardizing the Earth's resources. This definition lacks precision and fails to provide guidance to achieve sustainability. It is therefore useful to explore the implications of not compromising the ability of future generations to meet their needs.

A set of four sustainability principles (see Table 1) was developed through a process of a scientific consensus to provide a more clear understanding of sustainability (Holmberg and Robèrt 2000, 299-300). These principles were developed with a strict set of criteria in mind which require the principles to be (Ny et al. 2006, 63-64):

- *Science based* and relevant to current scientific knowledge.
- *Necessary* to achieve sustainability.
- *Sufficient* to cover all relevant sustainability aspects.
- *General* enough so all can understand them.
- *Concrete* enough to guide problem analysis and decision-making.
- *Distinct* and non-overlapping to allow comprehension and develop indicators for monitoring.

Table 1. The socio-ecological principles for sustainability

<p>In the sustainable society, nature is not subject to systematically increasing...</p> <ol style="list-style-type: none">I. ...concentrations of substances extracted from the Earth's crust,II. ...concentrations of substances produced by society,III. ...degradation by physical means. <p>And in that society...</p> <ol style="list-style-type: none">IV. ...people are not subject to conditions that systematically undermine their capacity to meet their needs.

Source: Ny 2006, 5

1.3.3 Backcasting

One of the unique aspects of FSSD is its use of backcasting. Backcasting is a form of strategic thinking that requires its users to have a clear understanding of success—for example a sustainable society—and then ask, “what must be done now in order to achieve this vision?” Sustainability is reached when backcasting is used to visualize success and to plan how to achieve it looking backward from the vantage point of the future vision. Backcasting helps avoid *ad hoc* solutions and reductionism (Holmberg and Robèrt, 2000).

In contrast to forecasting, backcasting is “planning from success” by starting with the desired outcome in mind and then determining the steps required today to achieve the outcome. It focuses in minimizing the remaining gap to the goal rather than on arbitrary incremental improvements in relation to the present situation (as often is the case with forecasting planning).

Further, using backcasting to plan from success can help solve trade-offs between competing short-term goals. For example, backcasting shows that a future society will not have to choose between nuclear power and coal power. Even though nuclear power contributes less to climate change and therefore seems more desirable, backcasting from sustainability illustrates that nuclear power may not be an energy solution due to its violations of the four sustainability principles. In this way, the apparent present day dilemma that resulted from forecasting-based thinking is solved by creating a long-term vision and realizing that the energy system of the future cannot be either nuclear or coal power but something else that does not violate the sustainability principles.

Backcasting can be applied to foresee certain changes in legislation or on the market, thereby being helpful in identifying business opportunities and avoiding risks. Good business means avoiding unnecessary costs today and in the future (Holmberg and Robèrt 2000, 291).

1.3.4 ABCD Methodology

The ABCD methodology is a tool comprised of four steps for systematically applying backcasting from a principled definition of success. For illustrative purposes the examples given here are for sustainability.

The purpose of the A step is to create a shared mental model and understanding of the planning process. For example, the A step describes the natural laws by which the planet is governed. The A step “creates context and meaning for the participants and shares the “rules” of the game” (Ny et al. 2006, 65; Robèrt 2000, 247). In the B step the participants identify violations of—and compliances with—the sustainability principles in their current operations. The C step asks the participants to brainstorm solutions and create a vision for the organization's future in which no violations of the sustainability principles occur. In the D step the participants prioritize the measures identified in the C step (Robèrt et al. 2002, 291-308).

The ABCD methodology can be a simple, yet powerful tool for strategic planning.

1.4 Supply Chain Management

Supply chain management (SCM) oversees and optimizes the processes of acquiring inputs from suppliers, converting those inputs into a finished product, and delivering those products—or outputs—to customers.

SCM is an umbrella term that refers to a variety of approaches for the management of natural and human resources from the supplier to the manufacturer or service provider to the consumer and back (Kummer et al. 2006, 1). This includes the identification and creation of new opportunities for products and services in cooperation with upstream and downstream partners, and the involvement of internal as well as external stakeholders in decision making on supply chain matters (Kummer et al. 2006, 1).

Traditionally, a supply chain is:

A network of companies that exchange resources such as materials and information to deliver products to customers. Supply chains consist of a company, its suppliers, its distributors, and its customers.

Source: Introduction to Supply Chain Management, Tooling University

In the traditional supply chain structure resources flow downstream to the consumer. The supply network consists of a focal company and its suppliers, retailers, and customers. Figure 3 shows the basic structure of a supply chain.



Figure 3. Traditional supply chain structure

Source: Adapted from Beamon 1999

Efficient supply chain management has become a requirement for success for many businesses. It is also responsible for the management of all external resources helping SCM make an important contribution to the competitive advantage of the organization (Preuss 2005, 124). Twenty-five years later, supply chain management has evolved to represent more than sourcing, procurement, conversion, and logistics management activities. It represents an opportunity to not only strengthen an organization's position in the market, but also to demonstrate corporate social responsibility and spread values, visions and practices that represent sustainability.

In order to take a closer look at the interactions between key actors in the supply chain and the impacts these relationships have on sustainable development, a new perspective of supply chain management must be taken. A framework for understanding SSCM provides such a perspective.

1.5 What Is a Sustainable Supply Chain?

Many companies have recently announced the adoption of sustainability values as part of their corporate culture. The supply chain manager can play an important role in this initiative, which has the potential to achieve environmental and social sustainability more thoroughly than any other agent in the whole organization (Preuss 2005, 126).

SSCM can trigger a domino effect among the company's supply chain partners. Encouraging the suppliers to integrate sustainability into their business operations is an upstream solution addressing the root cause of environmentally and socially damaging practices, products, and services.

Building from the definition of a supply chain offered above, a sustainable supply chain is one that provides the same function but in compliance with

the four sustainability principles (see Section 1.2.1). Therefore, for the purposes of this thesis, the authors define a sustainable supply chain as:

A network of companies that exchange resources—including materials, services, and information—in a way that is sustainable.

Consequently, the authors define sustainable supply chain management as:

The management of materials, services, information, and relationships among a network of companies in a way that is not in violation of the four sustainability principles.

A sustainable supply chain creates economic, ecological, and social value throughout the entire supply network. A shared sustainability vision among the supply chain actors yields these benefits by extending the focus all the way upstream², downstream³, and then ‘closing the loop’ as the unserviceable product and waste materials are addressed.

Figure 4 shows an example of a supply chain reflecting the elements from the traditional structure (Figure 3) with the inclusion of closed loops for resources and shared information.

² Upstream supply chain management focuses on the focal company’s suppliers.

³ Downstream supply chain management focuses on the focal company’s customers.

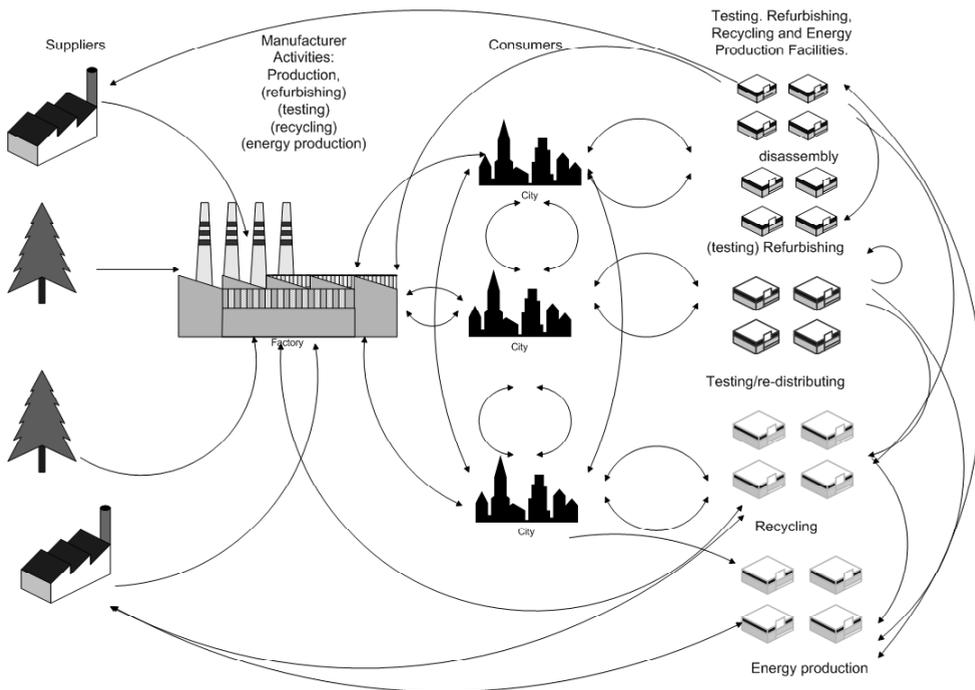


Figure 4. Sustainable supply chain network

Source: Quariguasi et al. 2006

1.5.1 Types of SSCM Strategies

Two general types of SSCM strategies have emerged: supplier assessment and supplier engagement. Although both initiatives might be used by the same company—either in conjunction or at different stages of the SSCM initiative—there are major differences between them.

SSCM Supplier Assessment Strategy

Certain tools and actions are characteristic of an assessment initiative. For example, the focal company might distribute a code of conduct to all

members of the supply chain, conduct periodical audits to confirm compliance with the code, or use evaluation systems to determine a new provider's sustainability status before being accepted into the supply chain. Supplier assessment initiatives can be useful for companies with particularly large or global supply chains. As a result, certain industries tend to favor assessment strategies (e.g. electronics and apparel).

SSCM Supplier Engagement Strategy

The cornerstone of the engagement strategy is the relationship between the focal company and the supplier. Generally, the two companies agree to form a long-term partnership that is both financially successful and sustainable. As a result, engagement strategies focus on educating the supplier about sustainability and working closely with them to integrate sustainability into their core business strategy and throughout their operations.

Engagement-based initiatives create opportunities for proactive actions that will move organizations beyond compliance and into strategic upstream thinking. Favored by small- to medium-sized enterprises, engagement initiatives utilize custom devices, including training, and sometimes request the supplier to create their own goals and actions for sustainability. The supplier company may be encouraged to report back to the focal company on their sustainability successes and challenges.

1.6 Importance of Sustainable Supply Chain Management

As society realizes the unsustainable side effects of irresponsible industrial development, organizations are increasingly being held accountable for their role in the destruction.

Businesses are aware of the growing demand for products that embody global environmental and social responsibility. Society is increasingly

demanding that companies embrace sustainable values and that these be represented in the products and services they deliver. Product life cycles are considered and consumers may avoid products with known harmful effects to the environment and society (Willard 2005, 57). The practice of boycotting products perceived as harmful is especially common in industrialized countries (Quariguasi et al. 2006, 3).

In recent years, consumers and governments have been pressing companies to reduce the negative environmental and social impacts of their products and operations (Thierry et al. 1995). As a result, corporate social responsibility has become a core business strategy that creates value for companies. Sustainable development is now a goal for businesses that recognize the need to go beyond regulations and laws in order to be socially and environmentally responsible.

As organizations integrate sustainability into their business plans and operations they are becoming increasingly aware of the need to address the sustainability of their suppliers as well. Businesses have always relied on their supply chains to deliver value to their customers, but leading businesses are recognizing the contribution supply chains make to the value of their brands and reputation (McInnes 2005, 1).

In a competitive business environment that requires more attention to the bottom line, supply chain management is vital to competitive advantage and sustainable business improvement (Lee 2002, 14).

Just as environmental and social misdeeds can pose a risk to businesses, sustainability also has the power to differentiate a company or product in a crowded marketplace. For example, eco-labeling (e.g. the flower label promoted by the European Union, the organic label of the United States Department of Agriculture, and the Nordic Swan label used in the Nordic countries) adds value to green products.

Embracing sustainability as a strategy for financial gains, risk avoidance, and competitive advantage is known as the search for “green gold” (Esty et al. 2007). Financial gains do not have to be sacrificed to achieve environmental and societal responsibility. Rather, strategies that promote

sustainability will deliver prosperity and increased financial gains for the company (Esty et al. 2007).

The current trend of corporate sustainability is characterized not only by modifying values and operations, but also by influencing supply chain partners to do the same. Corporations face the challenge of providing products and services that are sustainable through all stages of the supply chain or risk losing market share to those who manage to do so.

1.7 Purpose

The purpose of this research is to learn from current devices⁴ companies are using to interact with suppliers to create a sustainable supply chain. The analysis of several supplier interaction devices will provide insight into current practices and help identify strengths and weaknesses of the various devices.

The main anticipated result of the authors' work will be a set of criteria that supplier interaction devices should adopt to be effective in moving suppliers towards sustainability.

This thesis aims to offer insight into how businesses deal with the complexity of SSCM. It is the authors' hope that the criteria can be used by businesses across a wide variety of size and industry sectors, as well as governments and non-governmental organizations, for the ultimate purpose of moving a society towards sustainability.

⁴ In this context, device is intended to be an inclusive term for any tool or action used to interact with suppliers on sustainability (e.g. a code of conduct, workshop, sustainability analysis template, etc).

1.8 Scope and Limitations

The scope of this study's research was narrowed and refined through a process of group collaboration. Preliminary research determined the feasibility of the project and informed the authors' decision to focus the research on upstream supply chain management within the boundaries of the business sector.

Due to information availability and time constraints, it was determined that the study would include three SSCM devices. SSCM initiatives as a whole were not analyzed due to time constraints.

This study is based on the information that had been made public or available to the authors at the time the research phase began. Additional information was gathered through interviews with representatives from two of the three companies selected. Attempts to interview a representative from the third company were unsuccessful.

1.9 Research Questions

This study explores the emerging field of sustainable supply chain management. The main research question is:

- How do, and how could, supplier interaction devices contribute to sustainable supply chain management?

Together the two sub-questions answer the main research question. The sub questions are:

- From a sustainability perspective, what are some strengths and weaknesses of three current supplier interaction devices?
- What are some necessary criteria of a device intended to move suppliers toward sustainability?

2 Methods

The authors used a combination of methods (see Table 2) to answer the research questions.

Table 2. Research methods with corresponding research questions

RESEARCH QUESTION	METHODS
How do, and how could, supplier interaction devices contribute to sustainable supply chain management?	Literature review Analysis of three existing supplier interaction devices Interviews with company representatives
From a sustainability perspective, what are some strengths and weaknesses of three current supplier interaction devices?	Analysis of three existing supplier interaction devices Interviews with company representatives
What are some necessary elements of a device for moving suppliers toward sustainability?	Analysis of three existing supplier interaction devices

2.1 Literature review

The authors conducted their research within the conceptual framework of sustainability and supply chain management, which involved a review of academic literature to identify existing trends and areas of research. The

literature review identified established knowledge about SSCM and determined possible gaps in research.

Further, the literature review provided context and informed the author’s study of current SSCM devices used by companies in their efforts to influence their supply chain to move towards sustainability.

2.1.1 Search Strategy

A review of the interface of sustainability and supply chain management was conducted using credible sources including peer-reviewed journals, academic papers, business reports, and books written by established experts in their field.

The literature review was designed to cover a wide and inclusive range of relevant material. To achieve this goal, the keywords and resources detailed below were selected.

Keywords

Table 3 contains terms used in keyword searches. This is not an exhaustive list, but rather is a selection of the more relevant keywords used. Together, these keywords elicited the majority of the authors’ references.

Table 3. Main keywords used

Sustainability and strategic planning	Supplier sustainability assessment
Supply chain management	Green gold
Green supply chain	Supplier engagement
Supply chain management	Supplier code of conduct
template/tool/audit	Supplier assessment templates
Environmental supply chain	Supplier questionnaire
Integrated chain management	Supplier environmental performance
Sustainable logistics	Spreading sustainability supply chain
Green logistics	

2.1.2

Resources Used

A comprehensive literature review was undertaken for this research using the resources listed below (see Table 4).

Table 4. Resources used, ranked in a descending order of usefulness

RESOURCE	REASON FOR SELECTION
ELIN	Provides access to the full text of all online resources in the BTH library. Content is provided by almost two-dozen publishers, giving the authors access to the full texts of thousands of documents.
Libris	Swedish national library system providing access to the authors to over 5 million titles held at Swedish libraries through interlibrary loans.
ebrary	Provides online access to more than 60,000 titles from more than 200 academic, STM, and professional publishers. All documents are full-text searchable, enabling the authors to identify the most relevant references.
BTH Library	Contains titles held at the three BTH libraries: Library Gräsvik in Karlskrona, Library Infocenter in Ronneby, and Library Piren in Karlshamn.
Access My Library	Enables public online access to articles available through local public libraries in the U.S. There are currently over 4,000 journals with over 28 million articles.
Google Scholar	A free online service that searches literature such as peer-reviewed papers, theses, and books. Google's 'relevance ranking' approach enabled the authors to identify the most relevant references.

These resources were selected based on access to them through the Blekinge Institute of Technology (BTH) library and Internet. Due to the quality and quantity of material identified through the literature review, it was determined that the resources used provided sufficient depth and breadth to this study.

The authors were in contact with Beatrice Kogg⁵ to help guide the research focus. Her PhD thesis provided valuable insight into ways focal companies interact with suppliers on sustainability.

2.2 Interview Methodology

Interviews were conducted to complement the theoretical research and gain a practical understanding of current SSCM initiatives and devices. The respondents were sustainable development practitioners from two companies, Hydro Polymers and McDonald's Sweden.

The interviews were conducted via telephone. The questions (Appendix A) were framed in a straightforward, structured manner in order to obtain factual information of the process and progress of interacting with suppliers on sustainability and on the creation and effectiveness of the device they use to this end.

To ensure validity, the interviews were recorded. Responses included in this thesis were verified with the respondent and the respondents were given the opportunity to correct any misunderstandings.

2.2.1 Supplier Interaction Device Analysis

To enrich the authors' understanding of SSCM, research was conducted on existing SSCM devices. The framework for strategic sustainable development was used as a starting point to create an analysis methodology

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(see Section 2.2.3). First, the SSCM devices were selected, then the analysis methodology was created, and finally it was applied to the devices.

2.2.2 Selection of Companies

When selecting devices to study, the following criteria were considered:

- Influence:** Has the company demonstrated influence over its supply chain?
- Diversity:** Do the three companies together represent a range of industry sectors and geographical locations?
- Access:** Are relevant documents and company representatives available to allow thorough research?

Based on these criteria, Hewlett-Packard (HP), Hydro Polymers, and McDonald's Sweden were identified and selected to be the subjects of the authors' analysis (see Table 5).

Table 5. Selection criteria results for selected case study companies

COMPANY	INFLUENCE	DIVERSITY	ACCESS
Hydro Polymers	YES	YES	YES
McDonald's Sweden	YES	YES	YES
HP	YES	YES	YES/NO

Although access to HP representatives was not available, the company was selected because access to relevant documents was available, it exhibits great influence over its supply chain, and it brought diversity to the research (demonstrated by the profiles of each of the selected companies below).

In an attempt to address the potential bias of the study, two different conceptual approaches to sustainability are included in the selected set of SSCM devices. The authors' intent of this study is to develop a framework

for SSCM devices based on the FSSD, test it against current devices and draw conclusions based on the results of the study. Therefore, two of the three devices are based on the FSSD and the third provides a reference point.

Hydro Polymers

Hydro Polymers is a chemicals company based in the United Kingdom with production facilities there and in Scandinavia. Their primary products are polyvinyl chloride (PVC), the intermediary product, vinyl chloride monomer (VCM), and caustic soda used primarily in the Nordic pulp and paper industry (About Hydro Polymers).

McDonald's Sweden

McDonald's restaurants are found in 100 countries and territories around the world and serve nearly 52 million customers each day. McDonald's Corporation is the world's largest chain of fast food restaurants (McDonald's Corporation). This study will focus on McDonald's Sweden where McDonald's occupies 75 percent of the fast food hamburger market (Rosenblum 1999, 1).

HP

HP is a U.S.-based technology company that operates in more than 170 countries around the world. It provides technological services to consumers, businesses and institutions globally. The company's offerings span IT infrastructure, global services, business and home computing, and imaging and printing (About HP).

2.2.3

SSCM Five Level Framework

A framework for sustainable supply chain management and subsequently sustainable supply chain management devices was developed based on the generic five level framework for planning in a complex system (see Table 6).

The generic framework for planning for success in any complex system was used as a starting point, going from the broad and general framework to progressively more detail. To create a five level framework specific to the SSCM device, it was necessary to refine the generic five level framework. In Column B, the system was specified as an organization and *success* was defined as sustainable supply chain management. In Column C, this was narrowed down further. Here, the system was defined as an SSCM device.

The analysis conducted for this study identified where the SSCM device contributes to each level of the five level framework (see Table 6, Column C). Therefore, the analysis conducted was of the tool as its own system and not as a tool in the SSCM system.

Table 6. The generic five level planning framework applied to SSCM and SSCM devices

Column A: Characteristics of the Generic Five Level Framework (for achieving success in any complex system)	Column B: Characteristics of the SSCM Five Level Framework (for achieving SSCM within an organization)	Column C: Characteristics of an SSCM device
System Level: Fundamental characteristics of the complex system are understood	System Level: Actors and flows that comprise the organization's supply chain governed by natural laws, biogeochemical cycles, etc.	System Level: Fundamental characteristics of the device
Success Level: Define what success means for the system	Success Level: Sustainability principles made relevant to the organization and adopted by all actors in the supply chain	Success Level: Inherent device success principles based on the sustainability principles
Strategy Level: Backcasting from the Success Level to select and prioritizing of actions	Strategy Level: Backcasting from the organizational sustainability principles and vision	Strategy Level: Overall strategic guidelines for moving towards success
Actions Level: All concrete actions taken in the system	Actions Level: All concrete actions taken in the system to implement strategies achieve SSCM in the system	Actions Level: Specific actions required by the device
Tools Level: Tools and concepts available to support actions toward the strategy to achieve success in the system	Tools Level: Tools and concepts available to support the strategy to achieve SSCM	Tools Level: Monitoring components to assess the device's overall performance

2.2.4

SSCM Five Level Framework Analysis

After the companies were selected and a framework for SSCM devices based on the generic framework for planning in a complex system was created, an analysis methodology was developed based on Column C from Table 6.

The analysis methodology (see Table 7) was used to analyze the three current SSCM devices. Some strengths and weakness of the selected devices were identified at each of the five levels.

Table 7. Guiding questions

LEVEL	QUESTIONS
System	What does the device look like? What is the format and content of the device? How does the device contribute to the companies SSCM initiative?
Success	What are the inherent device success principles or characteristics of the device?
Strategy	What are overall strategic principles or guidelines for moving towards success (either implicitly or explicitly stated)? Are the strategies <i>ad hoc</i> or do they use forecasting?
Actions	Does the device recommend any actions? Are the actions aligned with the stated goals (Success Level) and strategy (Strategy Level)? Are the actions effective?
Tools	Does the device have a monitoring component to assess the device's overall performance?

2.3 SSCM Device Criteria Development

The next phase of the research built on the results of the initial literature review and analysis of current devices. Backcasting (see Section 1.3.3) was employed from a vision of SSCM (see Section 1.5) to determine what general criteria SSCM devices should have to facilitate progress towards sustainability among their suppliers.

2.3.1 Criteria Identification

The development of a set of criteria that characterize successful sustainable supply chain management devices was informed primarily by:

- Backcasting from the authors' definition of SSCM; and
- Analyzing current sustainable supply chain management devices.

The interviews informed criteria identification to a lesser extent.

After (1) the SSCM device framework was developed and (2) the analysis of SSCM devices was conducted, the authors then looked for commonalities in the analysis results that were consistent with the SSCM device framework.

Following this process, a list of desirable general criteria in SSCM devices was devised through a group brainstorm process and refined so that the criteria are:

- *Necessary* to achieve a successful interaction device; and
- *General* to all such devices and non-overlapping.

The list of criteria aims to inform the creation of an SSCM device and assist companies with a strategic approach for interacting with its supply chain to move it towards sustainability.

2.4

SSCM Communications Template

A template to introduce the supplier to the focal company's sustainable supply chain initiative was created based on the SSCM device criteria.

A two-page format was used to briefly communicate the focal company's sustainability values, goals and expectations to their suppliers.

3 Results

3.1 Literature Review and Interview Results

Results from the literature review were incorporated into the introduction (see Section 1), informed criteria development (see Section 2.4) and were reflected upon in the discussion (see Section 4).

Results from the interviews were incorporated into the SSCM device analysis (see Section 3.2) and as such were reflected upon in the discussion (see Section 4).

3.2 SSCM Device Analysis Results

The results from the analyses of the Hydro Polymers, McDonald's Sweden, and HP supplier interaction devices are summarized in Table 8.

Table 8. Some strengths and weaknesses of three current supplier interaction devices

DEVICE	STRENGTHS	WEAKNESSES
Hydro Polymers	<p>Principled definition of sustainability</p> <p>Employs a strategic framework</p> <p>Part of a larger sustainable supply chain initiative</p>	<p>Vagueness regarding how to prioritize actions</p>
McDonald's Sweden	<p>Explains subject and importance of sustainability</p> <p>Principled definition of sustainability</p> <p>Provokes its users to think of potential sustainability aspects and challenges and assign responsibility</p>	<p>Has no system for identifying actions to achieve success</p> <p>Lacks a component to measure the device's success</p>
HP	<p>Widely used</p> <p>Provides data regarding the performance of suppliers</p>	<p>Lacks alignment with sustainability</p> <p>Has no system for identifying actions to achieve success</p>

3.2.1

Hydro Polymers SSCM Interaction Device Analysis

The results from the analysis of the Hydro Polymers device are outlined in Table 9.

Table 9. Analysis summary of the Hydro Polymers SSCM device

FIVE LEVEL FRAMEWORK	HYDRO POLYMERS DEVICE'S CONTRIBUTIONS
System Level	Part of an interactive program to teaches suppliers to perform an ABCD analysis and backcast to achieve sustainable development
Success Level	To move the PVC industry towards sustainability—as defined by the four sustainability principles—and serve as a role model for industry at large
Strategy Level	Uses backcasting from vision (Success Level)
Actions Level	ABCD analysis but with limited guidance on how to prioritize actions
Tools Level	Success of device determined via supplier presentations on progress toward sustainability

System Level

The cornerstone of Hydro Polymer’s SSCM initiative, their Sustainable Product Design device, is a 22-page document designed to complement a workshop teaching suppliers how to perform an ABCD analysis and use backcasting to assess their own operations against the system conditions (Sustainable Product Design, 2-3).

The purpose of the document is to provide structure for Hydro Polymers’ key raw materials suppliers and help these companies “think through” their sustainability issues. The device was developed in 2005 in conjunction with The Natural Step (Leadbitter 2007).

Jason Leadbitter from Hydro Polymers describes the company’s work with their suppliers in an interview.

In a way, what we're trying to do with our raw materials suppliers is to say 'look guys, we are here to help and give you guidance, but we also want you to full engage with this. So we're not going to do the work for you, you need to do that yourselves. But we have demonstrated already that the risk of engaging in this is absolutely minimal, in fact quite the opposite. We think it'll bring you a lot of business benefits.'

(Leadbitter 2007)

The document has two parts. First it introduces the business case for sustainability, explains the backcasting concept, and sets forth Hydro Polymers' vision for a sustainable supply chain. Next, the document outlines a template for an ABCD analysis over nineteen pages (see Section 1.3.4). The ABCD analysis helps the supplier to:

- Use systems thinking and backcasting from sustainability principles to identify gaps between current practices and a sustainable future.
- Brainstorm ways to improve operations to achieve sustainability. To assist users in generating ideas, the template provides example answers from an imagined supplier responding to the template (Sustainable Product Design, 3).

Hydro Polymers' twelve key raw materials suppliers use the device, but this is merely an implementational constraint due to Hydro Polymers' limited resources. In theory, the device could be used by any of their suppliers. Other suppliers have expressed interest in being included in Hydro Polymers sustainable supply chain initiative and the company is currently working on ways to leverage this interest (Leadbitter 2007).

The format, content, and system boundaries of the device provide a structure and context that facilitates strategic planning for sustainability.

Success Level

The Hydro Polymers device explicitly defines success as moving the PVC industry towards sustainability and serving as a role model. “In the future, the PVC industry is seen as a role model for sustainable development within industry at large” (Sustainable Product Design, 2). The company identifies its supply chain as a crucial component to achieving this, citing “constructive cooperation between business corporations throughout the Hydro Polymers’ supplier-customer value chain” (Sustainable Product Design, 2).

Hydro Polymers invites their suppliers to participate in a meaningful endeavor to lead the industry—and ultimately the global business community—towards sustainability. The device sets forth a clear vision that emphasizes cooperative partnership between Hydro Polymers and the suppliers.

Since introducing the device in June 2006, Hydro Polymers has direct evidence that nearly half of their twelve key raw materials suppliers are actively engaged in sustainable development. A meeting in June 2007 will convene all the key raw materials suppliers who will be required to deliver presentations on their sustainability progress to Hydro Polymers and their peers. The company exhibiting the most progress will receive an award (Leadbitter 2007).

Strategy Level

Backcasting guides progress towards success. Hydro Polymers employs backcasting to help their suppliers understand a shared vision for success and identify where the company is currently positioned in relation to that vision. Through backcasting, Hydro Polymers teaches their suppliers to identify where their current operations fall short of the envisioned future. “[The device] will show the overall gap between today and a successful future, focusing on challenges and business opportunities for your product/service development team” (Sustainable Product Design, 2). The company is then asked to brainstorm actions to achieve the vision.

By agreeing on a shared vision and employing backcasting and the ABCD analysis to identify strategic opportunities to achieve the vision, Hydro Polymers hopes to engage their key suppliers in overcoming sustainability challenges.

Actions Level

The main action resulting from device is that the company will conduct “a sustainability analysis of [their] own products and services supplied to Hydro Polymers” (Sustainable Product Design, 2). Additionally, the sustainability analysis guides a brainstorm on potential early measures.

The ABCD analysis described in the device provides a framework within which actions towards sustainability are identified, but the device doesn’t give guidance on how to prioritize these actions beyond stating that “strategically smart first steps to take” should be prioritized (Sustainable Product Design, 3).

Tools Level

The strategy designed by Hydro Polymers to implement their device has a built-in monitoring component. One year after Hydro Polymers introduced the device and explained the process for the ABCD analysis to the key raw materials suppliers, the companies are to reconvene to report on their progress toward sustainability. This meeting is scheduled to take place in June 2007 (Leadbitter 2007). In this way, Hydro Polymers will monitor the success of the device.

3.2.2

McDonald’s Sweden SSCM Interaction Device Analysis

The results from the analysis of the McDonald’s Sweden device are outlined in Table 10.

Table 10. Analysis summary of the McDonald’s Sweden SSCM device

FIVE LEVEL FRAMEWORK	MCDONALD’S SWEDEN DEVICE’S CONTRIBUTIONS
System Level	Introduces suppliers to sustainability and helps them identify sustainability aspects and challenges of their operations
Success Level	Compliance with four sustainability principles
Strategy Level	Uses backcasting from vision
Actions Level	Step-by-step approach to generate a list of sustainability aspects with no identification of actions
Tools Level	No component to measure the device’s success

System Level

The McDonald’s Sweden Guidance for Product’s Sustainability Analysis is one of a set of seven “pathfinder documents” based on the FSSD that guides users through a product sustainability analysis. Each document focuses on a core process of McDonald’s Sweden’s business (e.g. goods transportation, construction, and packaging), but the approach for each is similar (Rosquist, 2007).

As part of a larger initiative to create and implement a full sustainability plan, the device analyzed is designed to guide the suppliers’ first steps toward sustainability and is essentially a B step analysis in the ABCD methodology (see Section 1.3.4). The C and D steps—identifying and

prioritizing actions—are not included in this device and come at a later stage in the initiative.

The device is comprised of an introduction, six steps, and two appendices. The introduction explains the importance of McDonald's role in promoting sustainable practices in agriculture and explains the background of their SSCM initiative. Backcasting and the four sustainability principles are explained at the beginning of this section. The document then describes the purpose of performing a product sustainability analysis and its structure. The six steps guide the user through the process of conducting a product sustainability analysis, based on the ABCD methodology. The appendices provide relevant background information.

Success Level

This device aims to build on the close working relationships that McDonald's Sweden has established with their suppliers (Rosquist 2007). McDonald's Sweden goal reflects its commitment to sustainability and is intended to facilitate the integration of sustainability among its suppliers. “[This document] was our contribution to help them start out” (Rosquist 2007).

The device defines success as compliance with the four sustainability principles. Because of this clearly articulated vision of success, the device is likely to create a deeper understanding of sustainability for its users.

The device has been used by ten key suppliers that account for over 90 percent of the volume of McDonald's Sweden's supplied materials. All of the key suppliers have conducted sustainability analysis regarding the practices associated with the products they supply to McDonald's Sweden (Rosquist 2007).

Strategy Level

The device uses backcasting from the four sustainability principles. It provides an opportunity for users to identify the sustainability aspects of their business and then instructs the user to prioritize these aspects according to their impacts. The end result is a refined list of aspects on which to be improved or addressed.

The strategy is built on the idea that if the user is committed to the sustainability goal, backcasting from the four sustainability principles will lead into strategic and innovative ideas to guide the path towards sustainability.

Actions Level

The device employs a systems perspective to guide its user to generate a list of significant sustainability aspects and challenges the company faces. The clear and well-explained definition of sustainability coupled with the use of strategic backcasting from a vision of success facilitates this process.

Actions are identified and prioritized in the next stages of McDonalds Sweden's SSCM initiative.

Tools Level

No component to monitor the device's success was identified. McDonalds Sweden is currently not measuring the device's return on investment (Rosquist 2007).

3.2.3

HP SSCM Interaction Device Analysis

The results from the analysis of the HP device are outlined in Table 11.

Table 11. Analysis summary of the HP SSCM device

FIVE LEVEL FRAMEWORK	HP DEVICE'S CONTRIBUTIONS
System Level	Enables the supplier to assess their performance with respect to the EICC, thus informing HP of the supplier's status
Success Level	Lacks alignment with any definition of sustainability and success is compliance with the EICC
Strategy Level	Lacks strategic planning element
Actions Level	Has no system for identifying actions to achieve success
Tools Level	Success of device determined by the number and percentage of suppliers who complete the self-assessment

System Level

The goal of HP's sustainability initiative is to “provide products and services that are safe and environmentally sound throughout their lifecycles, conduct operations in an environmentally responsible manner, and create health and safety practices and work environments that enable HP employees to work injury-free” (HP Supplier SER Performance Assessment Questionnaire). Within this goal HP uses various documents to assess and verify the suppliers' commitment to this process.

Two of those documents make up what is referred to as the HP self-assessment device, which is a set of questions HP gives to their first tier suppliers⁶. The self-assessment questionnaires are divided into two parts and are based on the Electronic Industry Code of Conduct (EICC). Part I asks questions with regards to labor and ethical issues while Part II focuses on health, safety, and environmental concerns (HP Supplier SER Performance Assessment Questionnaire).

In the course of doing business with their suppliers, HP has meetings at their facilities, which gives HP the opportunity to review their operations. HP conducts supplier visits and plant tours, particularly during the supplier qualification and contract renewal phase. During these plant visits and tours, HP observes the supplier's operating and environmental practices (HP Supply chain SER Conformance).

In 2004, HP began to conduct onsite SER audits at their suppliers' facilities. The self-assessment questionnaire responses are used as an initial baseline assessment for determining if an onsite SER audit should be conducted.

Success Level

HP aims to continue providing leadership to the electronic industry's efforts to raise labor and environmental standards in their supply chains through collaboration, supplier audits, and capacity building.

Their primary goal is to audit 95 percent of high-risk product materials and component and manufacturing supplier sites by the end of 2007. These audits are complemented by self-assessments that are later submitted to HP.

⁶ HP has approximately 600 suppliers from whom they buy directly (HP FY06 Global Citizenship Report, 46). Second tier suppliers are companies from whom a focal company's suppliers are supplied (i.e. their suppliers' suppliers).

Since HP's supplier self-assessment device aims to assess the supplier's performance against the EICC, success was determined to be compliance with this code. The device explicitly states that HP requires their suppliers to accurately identify any areas where their operations do not conform with the EICC in order to work collaboratively to achieve these standards.

The EICC claims to encourage its users to exceed compliance levels and strive to achieve international standards in order to advance social and environmental responsibility (SER), although it provides no framework or support to do this. The supplier assessments HP uses are based on the EICC, but the idea of exceeding compliance is absent from the questionnaires.

Strategy Level

The device acts as a guideline for moving suppliers toward success (compliance with the EICC) in that it asks suppliers to report on their operations and to be in compliance with the code.

HP's device is marginally strategic. It articulates a vision for success and measures suppliers against that vision, but it does not help suppliers identify actions to reach it. Additionally, sustainability is difficult to achieve because the device fails to incorporate a principled definition of SER. This lack of a broad context—that sustainability principles would provide—can lead to actions that are *ad hoc*, not flexible, or poor investments.

Actions Level

The self-assessment device enables the supplier and HP to assess the supplier's performance with respect to the supplier code of conduct. In cases of non-conformance with the code, HP may request a corrective action plan be implemented (HP Supply chain SER Conformance).

Based on the self-assessment, HP may or may not provide recommended actions for those areas identified as opportunities for improvement.

Tools Level

HP's supplier audits provide an isolated glimpse of activities and feedback on current practices. Because of the nature of such devices, it is deduced that HP's self-assessment device achieves its purpose if the questionnaire is completed and returned to HP by the supplier.

Therefore, HP determines the success of the device by both the total number and percentage of their first-tier suppliers who have completed the self-assessment.

3.3 SSCM Device Criteria Results

Our understanding of SSCM and analysis informed the development of a set of criteria for SSCM devices. Supplier interaction devices should exhibit the following characteristics:

- Visionary Leadership
- Non-reductionism
- Strategic Approach
- Consistency
- Accountability

These criteria are not intended to be an exhaustive list but are offered as a suggestion of some elements of a device likely to move suppliers toward sustainability. Further, they do not stand alone, but should be taken as a set of complementary criteria for sustainable supply chain management (see Figure 5).

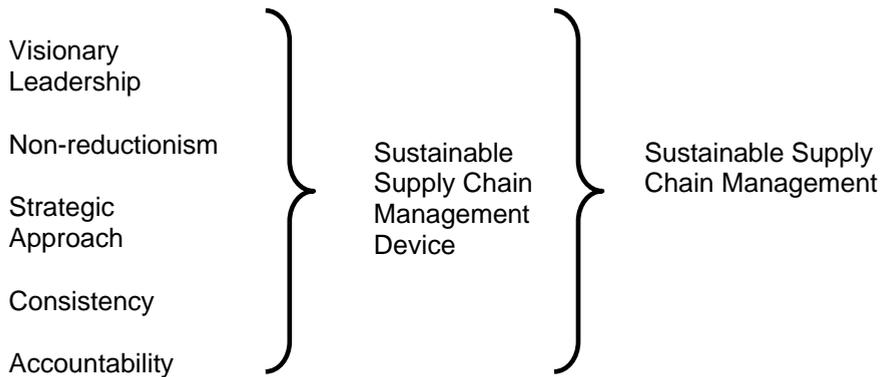


Figure 5. The criteria for supplier interaction devices contribute to SSCM

3.3.2 Visionary Leadership

The device should lead the focal company’s suppliers toward sustainability and visionary leadership is likely to effectively lead this change.

The authors chose visionary leadership for the purpose of unifying the supply chain around the vision of sustainability. Strong leadership brings a sense of purpose and commitment to both the focal company and the supplier company, therefore reinforcing the overall SSCM objectives.

Both Hydro Polymers and McDonald’s Sweden’s devices exhibited visionary leadership by setting compliance with the sustainability principles as the long-term goal of their SSCM activities. Conversely, HP’s device demonstrated the importance for visionary leadership. The device achieves what it sets out to achieve, but the goal is compliance-focused and not visionary. Therefore, HP has only made inconsistent and incremental progress toward sustainability in its supply chain.

Examples of visionary leadership include:

- Helping the supplier to develop a vision (on which to build a strategic plan) of the company operating in a sustainable future.
- Articulating clearly the company’s organizational values and expectations of suppliers.

- Providing suppliers with support and access to relevant resources.
- Helping suppliers promote sustainability throughout the industry.

3.3.3 Non-reductionism

The device should provide a systems perspective of sustainability to shift the focus from all the various social and ecological problems to their underlying causes.

The authors chose non-reductionism to address systemic unsustainability where levels of complexity are lower and to help communicate a clear understanding of the sustainability challenge.

Both Hydro Polymers and McDonald's Sweden's devices exhibited non-reductionism through the examples below. The emphasis on incremental improvement in the HP device demonstrated the importance of non-reductionism.

Examples of non-reductionism include:

- Adopting a systems perspective that demonstrates simplicity without reductionism.
- Putting forth a definition of sustainability that is based on scientific principles.
- Explaining why the company is committed to sustainability and how it relates to its overall mission.

3.3.4 Strategic Approach

Similar to the non-reductionism criteria, the device should employ a strategic approach based on a systems perspective that understands material and information flows between all actors in the supply chain.

HP, Hydro Polymers, and McDonald's Sweden have had much success in their use of a clear vision of success. Hydro Polymers and McDonald's

Sweden build on this vision with their use of backcasting from the vision. HP's vision is focused on short-term results, and as a result lacks a full strategic approach.

The contrast in these two methods—and resulting outcomes—highlighted the need to include “strategic approach” as one of the authors’ criteria. The authors chose a strategic approach because it is likely to facilitate the development of a plan for the supplier to achieve sustainability.

Examples of a strategic perspective include:

- Setting a clear vision for the focal company’s SSCM initiative.
- Employing backcasting from principles of success (see Table 6) to identify actions toward sustainability.
- Conducting a SWOT analysis⁷ to identify sustainability strengths, weaknesses, threats, and opportunities.

3.3.5 Consistency

The device should facilitate actions that are consistent with the principles of SSCM (as laid out in Column B of Table 6).

Looking back to the authors’ definition of SSCM as “the management of materials, services, information, and relationships among a network of companies in a way that is not in violation of the four sustainability principles,” the need for SSCM devices to elicit actions consistent with the sustainability principles became apparent.

The authors chose consistency to help the supplier company avoid actions that may be *ad hoc*, unproductive or a poor investment, or lead the company down ‘blind alleys.’

⁷ A SWOT analysis is a tool frequently used by organizations to develop a strategic plan. The chief purpose of a SWOT analysis is to assess opportunities, identify threats, and weigh strengths and weaknesses (Morris 2005, 53).

Examples of consistency include:

- Brainstorming actions that will move the supplier toward sustainability.
- Prioritizing actions strategically according to a principled definition of sustainability.

3.3.6 Accountability

The device should ensure accountability to validate and legitimize SSCM both within the focal company and among supplier company's stakeholders.

The authors chose accountability to define expectations and for its ability to motivate suppliers to take meaningful steps toward sustainability.

For a supplier, the ultimate display of accountability is whether the focal company continues to do business with you. However, Hydro Polymers' device has demonstrated that a more personal approach to accountability can be an effective way to create positive pressure for sustainability and lead to significant improvements in a short period of time.

Examples of accountability include:

- Collecting information from suppliers periodically to assess their improvement over time.
- Implementing a rewards/consequences system to create incentives for sustainability.
- Requiring suppliers to periodically report on their progress to the focal company.
- Requiring suppliers to proactively present their next steps toward sustainability.

3.4 SSCM Communications Template Results

A template to introduce the supplier to the focal company's sustainable supply chain initiative is included in Appendix B.

4 Discussion

The following sections explore the answers to the research questions and reflect on the validity of the results.

4.1 From a sustainability perspective, what are some strengths and weaknesses of three current supplier interaction devices?

4.1.1 Validity of SSCM Device Analysis

The authors chose to apply the FSSD as an analytical tool to the devices for its ability to be customized to a specific context (in this case, SSCM devices) and for its broad systems perspective.

4.1.2 Reflecting on Hydro Polymers' SSCM Device

Overall, the Hydro Polymers device was determined to be very effective. Its strengths are its use of a principled definition of sustainability, employing a strategic framework, and being part of a larger sustainable supply chain initiative.

This is a dialog; this is a continuous process. These guys don't just come and visit Hydro Polymers once a year and that's it. These suppliers actually have an ongoing relationship with us through the procurement and purchasing departments and we have what's called an Advanced Quality Audit procedure. What we do need to do

is to change that Advanced Quality Audit procedure to basically tick off progress on sustainability. And that's where the stick comes in again.

Source: Leadbitter 2007

Hydro Polymers has established close relationships with its key raw materials suppliers and in less than one year have succeeded in engaging more than fifty percent of them on sustainability. The real number may actually be higher, since suppliers will not report on their progress until after publication of this paper (Leadbitter 2007).

Despite the device's many strengths, it also has one key weakness. The device lacks clarity regarding prioritization of actions, which may result in poor decisions. More guidance should be provided in the device explaining that actions should "take care of the short-term challenges but also prepare for coming actions" for compliance with the sustainability principles (Ny 2006, 6). Despite this drawback, the device is a good example of how to effectively engage suppliers on sustainable development.

4.1.3 Reflecting on McDonald's Sweden's SSCM Device

The McDonald's Sweden's device is a complete introduction guide to suppliers. It explains well the subject of sustainability and its importance as a goal for society. One of its major strengths is that it triggers a brainstorming process and encourages users to take advantage of their own expertise and identify creative solutions for sustainability issues.

The device's excellent step-by-step approach to identify sustainability aspects and brainstorm solutions guides its user in creating a strategic plan with actions prioritized by impacts. This device is a good example of a way to engage suppliers on sustainability by motivating them to be part of the solution.

Unfortunately, there is no performance evaluation for the success of the device, all of which can only be determined through anecdotal evidence

collected informally by McDonald's Sweden. Although the sustainability goal is often considered an on-going effort, a component to measure the device's success would contribute to the device's validity and should be incorporated.

4.1.4 Reflecting on HP's SSCM Device

In 2002, HP was the first electronics company to establish a supply chain social and environmental responsibility program and in 2004 was instrumental in leading the electronics industry to adopt a standardized code of conduct to extend the commitment to corporate SER to the supply chain (Supply chain programs).

HP's self-assessment device is widely used by its first-tier suppliers and has contributed to supplier compliance with the EICC. Its strengths are in its ability to reach a large percentage of HP's suppliers and influence a large number of companies. Additionally, the device provides qualitative data that HP uses to compare suppliers to one other and also compare the same company over time.

The device's greatest weakness is that it doesn't help the supplier develop a strategic plan for moving toward sustainability, and although HP makes clear that its objective is to spread SER through their supply chain, no explanation is given regarding the meaning of this phrase.

Overall, HP's SSCM device is a good example of how a large company with numerous suppliers can conduct an assessment process.

4.2 What are some necessary criteria of a device intended to move suppliers toward sustainability?

4.2.1 Validity of Criteria

Our criteria were reinforced by a case study by analyzing a small Swedish textile firm's green supply chain initiatives. Researcher Beatrice Kogg found that "the process of greening a supply chain can be very complex" (Kogg 2003, 43). Her study reveals how the textile company overcame the unique challenges they faced.

A good understanding of the actors in the supply chain as well as of the local context in which they operate has helped Verner Frang to find ways to motivate the relevant actors to comply with its environmental requirements. Still, it must be emphasized that the company would never have been able to achieve its objective of supplying eco-labeled textiles had it not been willing to go outside its traditional patterns of supply chain interaction.

Source: Kogg 2003, 44

The Verner Frang example reinforces the importance of visionary leadership, non-reductionism, a strategic approach, consistency and accountability. These criteria were essential to Verner Frang's success.

4.2.2 Visionary Leadership

Facilitating transformational change for SSCM requires initiative and leadership. The focal company should adopt a process that drives the actors in their supply chain toward continuous improvement. It is important to understand that the focal company and the suppliers share the same

objective—for the supply chain to succeed (Manga and Hollenhorst 2004, 2).

4.2.3 Non-reductionism

Facilitating transformational change for SSCM requires thoughtful communication. Trust is increased and uncertainty is reduced when buyers and suppliers have a collaborative relationship (Davies 2006, 35). Whether the focal company chooses an assessment or engagement strategy, their focus should be on the long-term relationships with their suppliers.

4.2.4 Strategic Approach

Facilitating transformational change for SSCM requires strategic planning. Backcasting from principles is a useful activity that enables brainstorming within minimum constraints to allow the greatest level of creativity (Holmberg and Robert 2000, 293-294).

4.2.5 Consistency

Facilitating transformational change for SSCM requires actions that are aligned with sustainability (Robert 2000, 247). SSCM devices should therefore be designed to help the supplier either understand this imperative or to guide the actual process of identifying and prioritizing actions.

4.2.6 Accountability

Facilitating transformational change for SSCM takes commitment and responsibility. Suppliers should be held responsible to agreed-upon standards and the SSCM device (or the larger SSCM initiative within which

the device is nested) should include a mechanism to ensure that progress toward these goals is being made.

4.3 How do, and how could, supplier interaction devices contribute to sustainable supply chain management?

4.3.1 Validity of SSCM Device Contributions

The nature of the authors' research questions is such that by answering the two sub-questions the main question is answered. Thus, by addressing the validity of the findings of the two sub-questions, the validity of the findings for the main research question is inherently addressed.

4.3.2 Contributions of Three SSCM Strategies

The three basic categories of supplier interaction strategies identified by the authors are (1) assessment; (2) engagement; and (3) a combined strategy that uses both engagement and assessment methods.

Assessment Strategy

HP has embraced the assessment strategy. Their supplier self-assessment device facilitates a flow of information from the suppliers to HP. By the end of 2006, HP had successfully introduced the supplier SER program to 557 of their 600 first tier suppliers. Of those, 445 have completed self-assessments and 115 suppliers have been audited at 254 sites (HP FY06 Global Citizenship Report: Supply Chain Approach 2007).

Codes of conduct, inspections, and audits are common practice but in most cases are flawed due to their prescriptive nature. They provide an arbitrary “snapshot” which causes reductionism and are therefore not likely to lead to sustainable development. These devices have often become an exercise in seeking compliance with local law rather than moving beyond it (Welford and Frost 2006, 166-176).

Additionally, the periodical assessments and codes of conduct to which a supplier may be subjected can be numerous, depending on the extent of the supplier’s customer base. Complying with various competing standards might overwhelm and paralyze a supplier, thus hampering its progress toward sustainability.

An alternative approach exists, in which the focal company engages the supplier in a partnership toward sustainability.

Engagement Strategy

McDonald's Sweden and Hydro Polymers both designed their devices to engage suppliers and encourage them to analyze their own operations against a principled definition of sustainability. A shared framework that facilitates common mental models for sustainability gives the supplier the responsibility to develop their own path toward sustainability.

Engaging the supply chain to address the sustainability of their operations is an innovative idea. After an initial sustainability workshop—a strategy Hydro Polymers and McDonald’s Sweden both used to implement their respective devices—both McDonald’s Sweden and Hydro Polymers have enjoyed marked success, albeit with a smaller total number of suppliers than HP.

Although engagement strategies can be more time-consuming and costly for the supplier, the open-ended approach based on FSSD can help the supplier proactively respond to the requests of many customers at once and achieve stronger internal results since the principled vision of sustainability can be merged with the corporate mission. Engagement strategies of this

nature (or strategies that use assessment and engagement) have a much larger potential impact than assessment strategies alone.

Combined Strategy

When used together, engagement strategies can add value to assessment strategies. For example, Hydro Polymers launched its sustainable supply chain initiative focusing initially on supplier engagement but the company is now moving toward a two-pronged strategy that incorporates assessment. Its procurement and purchasing departments already have an auditing system in place and Hydro Polymers is taking steps to incorporate sustainability criteria into this process (Interview Notes, 2007).

4.4 SSCM Communications Template

Whether a company uses supplier engagement or assessment devices, it is important to remember that these devices should be integrated into a larger sustainable supply chain strategy. To initiate a discussion on sustainability with supply chain partners, a template (see Appendix B) was developed by the authors based on the criteria that characterize sustainable supply chain management devices (Sections 3.3 and 4.3) and the SSCM five level framework (see Section 2.2.2). Since the template is based on the criteria and SSCM five level framework, its validity rests on their validity.

The authors hope that the template can be adapted by businesses or other organizations to communicate their sustainability initiative, motivations, and the role that the supplier will play in the sustainability initiative.

4.4.1

Role of Criteria in Template Development

The template lays out a structure with five main sections: our commitment, sustainability principles, sustainability values, our partnership, and our expectations. While the set of criteria are reflected throughout the document, certain sections are influenced more by some criteria than others (see Table 12).

Table 12. The set of criteria influenced the format of the template

Template Section	Main Criteria it Reflects
Our Commitment	Strategic Approach
Sustainability Principles	Consistency
Sustainability Values	Visionary Leadership
Our Partnership	Non-reductionism
Our Expectations	Accountability

5 Concluding Remarks

5.1 Key findings

The literature review (Section 2.1) and analysis of current sustainable supply chain management devices (Section 3.1) identified a need for a set of criteria for such devices that is both rooted in scientifically derived sustainability principles and based on a strict framework for SSCM.

The authors' findings demonstrate that to spread sustainability through a company's supply chain, a device should communicate a clear understanding of sustainability and the company's sustainability initiative. Additionally, it should be strategic and relevant to sustainable development. It should facilitate actions toward achieving sustainability and hold suppliers accountable to agreed-upon standards.

Ultimately, the authors expect the framework for sustainable supply chain management laid out in this thesis—and based on the generic five level framework for planning in a complex system—to be well suited to contribute to SSCM interaction devices.

5.2 Suggestions for Further Research

Based on the authors' scientific inquiry into SSCM, the areas identified as priorities for further research include:

Empirical Verification

This thesis would benefit from a complementary longitudinal empirical study to verify whether the criteria resonate with companies and actually do lead to sustainable supply chain management. Expert feedback would help refine the findings and ensure usefulness to companies.

Supply Chain Design

Further research into the design of supply chains to maximize sustainability would be beneficial. This would include looking at how the FSSD can be applied to the study of resource flows through a focal company's supply network and how organizations can design these flows to be more sustainable.

Template Development

Our research found many companies developing their own SSCM devices, and it was felt that a template for such devices that could be customized to the needs of each company would be a practical contribution. The authors recommend further research into developing a template for SSCM interaction devices. The template should incorporate expert feedback and be tested in a real-world application prior to publication.

Eco-labels

As discussed in Section 4.1.1, a Swedish textile company transformed their supply chain to achieve the Nordic Swan eco-label. The Swan label for textiles requires that the material be grown according to strict organic methods, and that other processes and actors in the supply chain adhere to specific requirements, including the ginning, spinning, weaving, knitting, and wet processing of the material (Kogg 2004). In line with this, further research is recommended into eco-labels as a stepping-stone to SSCM could be useful in shifting the sustainability focus to the product's entire life cycle.

Cultural Barriers and Relationships

The unique culture of society in which a company's suppliers operate may determine how they begin the process of implementing SSCM. The authors recommend further research into the links between cultural relativism and sustainability. More specifically, how different cultures approach sustainability and how that knowledge can help companies implement SSCM more effectively.

Similarly, the relationship between supply chain managers and suppliers was identified as an area with great potential and worth researching within the global context of SSCM.

Downstream SSCM

The last member in a supply chain is the consumer of a product or service. With this in mind, it can be inferred that the sustainable management of any company's supply chain must involve their customers in the effort to achieve sustainability. From the focal company's perspective, working with suppliers involves upstream thinking, while involving the final customers is a downstream strategy. An example of a downstream strategy for sustainability is to use recyclable packaging materials to minimize the waste associated with a product. However, recycling is in the hands of the last actor of the supply chain, the consumer. Consequently, in order to incorporate the consumer into this SSCM initiative, the focal company should also implement an education effort to teach consumers about the benefits of recycling and the role this action plays in creating a sustainable society.

From a systems perspective of SSCM, all actors—up *and* downstream—must be considered. Currently, SSCM research focuses on the upstream side of the supply chain. The authors recommend further research is conducted on the downstream end of SSCM.

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Appendix A: Interview Questions

1. Tell me about your job.
2. Why did you choose to partner with TNS?
3. How many suppliers do you have?
4. When did you first start working on sustainable supply chain management?
5. Can you briefly describe your company's efforts to "green" your supply chain?
6. How does the device fit into your larger supply chain initiative?
7. Describe the process of developing the tool? Were suppliers involved? Was TNS involved?
8. Did you allocate a budget for developing the device?
9. How much time did developing the device take? Do you expect that this will be a good financial investment?
10. How do you measure the payback, either financial or non-financial?
11. How did you present this device to your suppliers? In what context did you deliver it?
12. How many (total number) and what percentage of your suppliers use (or have used) it?
13. Which suppliers are using the device? Are you planning on using it with all your suppliers? Why or why not?

14. Describe any challenges during the device's development, implementation or follow up?
15. Did any of your suppliers refuse to participate and stop doing business with you? If yes, did they explain why?
16. What is your goal for the device? What is your progress toward achieving it?
17. How do you measure the device's success?
18. How do the suppliers communicate their progress towards sustainability to you? Is it voluntary or do they report to you regularly?
19. What feedback have you gotten from your suppliers on the device?
20. What have been your successes regarding the device?
21. Do you have any advice for a company just starting out with sustainable supply chain management?

Appendix B: Template

Go to next page.

Sustainable Supply Chain Management

A Template for Initiating a Dialogue with Suppliers



CONTENTS

PAGE I

OUR COMMITMENT

This section describes your company's sustainability vision and goals. Be specific and honest about what you're trying to achieve and how.

SUSTAINABILITY PRINCIPLES

This section articulates a clear definition of sustainability to your suppliers. A definition based on scientific principles is offered.

PAGE 2

SUSTAINABILITY VALUES

This section helps your suppliers understand why your company is committed to sustainability. The Brundtland definition of sustainability is included as an example.

OUR PARTNERSHIP

This section communicates how the supplier fits in to your plan and what you will be doing to help them understand this new initiative and move forward.

OUR EXPECTATIONS

This section explains the purpose of the initiative and what you expect from your suppliers. Be clear about how they will be held accountable.

Our Commitment

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Sustainability Vision

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Sustainability Goals

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SUSTAINABILITY PRINCIPLES

WHEN [COMPANY] IS SUSTAINABLE, WE WILL NOT:

- ✦ Contribute to systematic increases in concentrations of substances mined from the Earth's crust.
- ✦ Contribute to systematic increases in concentrations of substances produced by society.
- ✦ Contribute to systematic physical degradation of nature.
- ✦ Contribute to the systematic undermining of people's capacity to meet their needs.

(The Natural Step)

SUSTAINABILITY VALUES

[COMPANY] strives to meet the needs of the present without compromising the ability of future generations to meet their own needs.

(Brundtland Commission, Our Common Future, 1987)



OUR PARTNERSHIP

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OUR EXPECTATIONS

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