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A REVIEW ON GREEN SUPPLY CHAIN MANAGEMENT FOR PROCESS INDUSTRY

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Abstract: *Many businesses around the world have exploited the environment with impunity, without any thought of sustainability. In absence of regulations, companies tend to create products and services based in part on the cost of the public goods, namely the environment. Air and water are polluted and forests are degraded. So far, there are no effective tools to include these additional real costs of a product into its end-price. Green Supply Chain Management is the new emerging technique in modern age of automation and computerization. The term GSCM is frequently used interchangeably with the term "environmental supply chain management" (ESCM) (Han dfield, Sroufe, & Walton, 2005; Kogg, 2003), which merely considers how supply chain management may be considered in the context of the environment. In this paper, an outline of the most important green approaches in each company is given. Then the findings of the analysis of the interviews and the supplemental documents are arranged considering the main themes of the developed framework.*

Keywords: *GSCM, ESCM, Green Practices, Decision Making.*

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I. INTRODUCTION

Green Supply Chain Management (GSCM) is an Environment Sustainability Practices. Green manufacturing deals with technologies and solutions that provide Green Products or Environment friendly products. Green Manufacturing consists of Recycling, Reuse and Remanufacturing (Chung and Wee, 2011; Gungor and Gupta, 1999; Gilbert, 2000; Ilgin and Gupta, 2010).

GSCM fits into what Jackson & Clift (1998) call Industrial Ecology and they define the goal of GSCM as the attempt to mimic the natural eco-system to establish sustainable industrial systems. However there is an almost irresolvable tension in industrial ecology. Profit, the underlying motive in industrial ecology, pushes on the one hand towards improved production efficiency, and on the other hand towards increased production output. That means that a higher output outweighs measures taken against pollution to make the product cheaper, according to the market mechanism of supply and demand. Related to GSCM is Environmentally Conscious Manufacturing (ECM). It "involves developing and implementing manufacturing processes that minimize or eliminate waste, reduce energy consumption, improve materials utilization efficiency, and improve operational safety" (Lin, Jones, & Hsieh, 2001). So, GSCM is not merely a detached approach in one part of a company, but requires concerted efforts throughout the company and is more than simply putting some green practices in place, but a consistent, holistic improvement of the environmental performance on all levels of management and shop-floor (Davies & Hochman, 2007).

II. LITERATURE REVIEW

Different researchers have approached GSCM from diverse disciplinary and theoretically different angles. These include such diverse areas as (re-)engineering, management, logistics, network analysis, human resources, and GSCM measurement (Sarkis, 2003). These approaches have a different view on the field of GSCM and therefore define it in different ways. In order to implement GSCM practices successfully, a company needs to know exactly what GSCM is. Thus, the literature review starts with a GSCM framework deduced from the vast literature. Then it reviews why it is important for companies to introduce GSCM, followed by a description of current GSCM practices and what the barriers for an implementation of GSCM are. Zhu, Sarkis & Lai (2008) state that the scope of GSCM

depends on the goals of the researcher and the given problems. Some researchers focus just on the procurement stage, whereas others investigate the complete logistics channel. An alternative term “sustainable supply chain management” expands the field properly to social and ethical issues as well ("Implementing a Sustainable Supply Chain," 2004; Mahler, 2007; Markley & Davis, 2007; Piplani, et al., 2008).

These latter efforts are termed “Triple Bottom Line”-approaches, and they indicate the attempt to deliver economic, social, and environmental benefits simultaneously (Markley & Davis, 2007) In its broadest sense, Triple Bottom Line captures the spectrum of values that organizations must embrace to stay in business as these issues are becoming increasingly important (Eklington, 1997; Elkington, 1994). However, this paper will not focus on social issues. One novel approach is seen in the book Cradle to Cradle by William McDonough and Michael Braungart (2002). The authors envision a world without waste, a world without poisons, and a world in which all materials are continuously recycled. It already exists. We call it nature.

In the natural system there is no waste and the same materials have been recycled for billions of years. The new industrial revolution is all about absorbing the lessons we should have learned from nature long ago. The key to sustainability is making the market work for the environment instead of against it (Webster, 2007). The industrial application of cradle-to-cradle design creates a cycle for industrial materials. Like the Earth’s nutrient cycles, the flow of materials eliminates the concept of waste (cradle-to-cradle, rather than cradle-to-grave). Each material in a product is designed to be safe and effective, as well as to provide quality resources for subsequent generations of products; in other words, materials are conceived as nutrients and designed to circulate safely and productively. Hervani, Helms & Sarkis (2005) define GSCM simply as the addition of green purchasing, green manufacturing/materials management, green distribution/marketing and reverse logistics. Vachon (2007) brings in the concepts of externalizing and internalizing which originally came from the transaction cost theory. In the environmental context it means when companies conduct environmental procedures through markets they externalize their environmental commitment by employing market-based mechanisms. There is no significant commitment of the organization’s own resources. Companies internalize environmental procedures

through incorporation of those activities within their organizational boundaries or even within their supply chain.

In the end, the present researcher must select from these approaches to form a framework for analysis. Most relevant to the present study are the actual practices of companies that apply GSCM. These practices vary in each company, and the possibilities to apply GSCM efficiently are different. Included in this are the underlying management processes and impacts of the introduction and application of GSCM on strategy, human resources, and decision making.

III. IMPORTANCE OF GSCM

Looked at in this way, the literature gives extensive reasons why GSCM will become increasingly important for more and more companies in the future. The list of stakeholders interested in environmental strategies ranges from customers, competitors, potential investors, employees, neighbours, environmental legislation, and non-governmental organizations (NGOs) (Basu & Wright, 2008; Geyer & Jackson, 2004; Reiskin, White, Johnson, & Votta, 1999; Vachon & Klassen, 2006). The research of Reiskin, White, Johnson & Votta (1999) supports these findings. They see a shift from production-focused to service-focused industries, which are accompanied by outsourcing. Instead of delivering quantity, suppliers are expected to deliver quality and solutions for problems which benefit the environment. Thus, suppliers have to deal with environmental issues of their customers in a more sustainable way. This in turn leads to different prerequisites for the relationship between supplier and customer. The conventional relationship sees conflicting interests. The supplier wants to increase his volume sold (e.g. chemicals), whereas the customer wants to decrease this volume and his costs. In the service-focused industry, both customer and supplier want to increase the value and efficiency of the service (e.g. fewer chemicals, higher output). Regulatory pressure is increasing continuously. Reinhardt (1998) observes that ultimately environmental quality needs governmental regulation, as the environment is a public good. According to him, people and especially companies will not spend any more on environmental issues than is required to achieve their own maximising economic goals, as these investments would not benefit themselves in total. So the need for green practices is often not just out of own choice, but compulsory by law. More motivators for greening the supply chains are reducing the risk of environmental hazards, fear of bad publicity, cost of

non-compliance, governmental penalties and just to demonstrate an image as an environmentally responsible company. Thus, eventually globalization can be identified as a main driver for the development of GSCM. As most products are made by more than one company, there needs to be an alignment of decisions and strategies to use scarce resources effectively.

IV. METHODOLOGY AND IMPLEMENTATION

Zhu & Sarkis (2007) investigate the moderating effects on GSCM. They believe that competitive pressure has the greatest positive effect on economic and environmental performance. This occurs, they say, through the benefits of reciprocal learning in companies. Through benchmarking, business associations, and meetings, companies can mutually improve their capabilities. This is also considered to be the most cost-effective way to implement environmental practices. Companies can learn from other companies and avoid possibly expensive mistakes.

Nevertheless, the diffusion of environmental practices is not unproblematic. Ideas about how to implement and its actual execution change after traversing organizational boundaries depending on the companies' context (Stenberg, 2007). That is, organizations operate in different industries, markets, and regulatory environments. Most important is the difference in the company culture, and the support through top management.

Drawing upon this extensive literature review, the researcher decided to divide the analysis in five areas:

- Current green practices
- Strategic and operational planning
- Management structure, systems, and decision making
- Management of people and company culture
- Relationships with supply-chain members

A comparative study is done in three process industries of Food and Beverage. Although the F&B sector is broad, a common characteristic is the high customer sensibility to the products' attributes. Initially this research just wanted to focus on middle sized companies, from which a greater homogeneity in the organizational structure might be expected. Companies on the same stage of development are likely to have similar organizational structures.

After an initial selection of possible companies with the help of the Sustainable Business Network (SBN) in India, a letter was sent to the respective participants and they were called to give consent for their participation. The preferred interview partners were the plant managers, because they seem to be the best interview partners respective to their knowledge about the companies GSCM practices as proposed by Vachon (2007). Company A is involved in the fruit, vegetable and cut-flower distribution to supermarkets and retailers and has a special department for organic fruit and vegetables. They have approximately 600 employees. Company B is a juice-producer with two main brands which are on a different level of the perceived environmental friendliness. They have 650 employees. Company C is a dairy producer and has no special organic product, but is highly involved in green practices. They have around 16,000 employees.

Semi-structured interviews are the basis for the present research. They allow a directed discussion of the topics of interest to elicit the interviewee's ideas and opinions (Cheney, Christensen, Zorn, & Ganesh, 2004). Most questions were prepared in advance and spontaneous questions might be asked were appropriate, or to get more information on a specific topic. Easterby-Smith, Thorpe & Lowe (1991) mention five situations when semi-structured interviews are appropriate: First, when it is important to understand the construct that the interviewee builds, as a basis for the judgements and views about a specific situation. Further, when the interviewer needs to build a clear understanding of the interviewee's perception of reality and the world, influenced by the interviewer. Third, the step by step logic of a process is inexplicit. Fourth, when the discussed topic is highly confidential or commercially sensitive, and fifth, when the interviewee will not be completely open about the topic unless discussed in a face to face setting.

Due to the openness and interactivity, interview outcomes might suffer from a low reliability, as every interview is different (Cheney, et al., 2004). The aim was to bring the information level of each company onto a similar high level. Therefore some questions served as guideline for the interview. The guideline questions for the semi-structured interview were derived from the reviewed literature concerning the factors for an effectively working environmental commitment of a company: Management structure, systems and decision making; Strategic and operational planning; Management of people and company culture; and relationships with supply-chain members. More details were

gathered through company documents, like reports, internal guidelines, and protocols. The interviews took place in July and August 2009 and some follow-up questions were posed in September 2009.

All interviews were audio recorded on tape and transcribed. The software package NVivo 8 from QSR International was used to support the analysis of the data. The transcribed interviews were read repeatedly and continually coded as proposed by Creswell (1994). After the coding of the material, some nodes were created and categorized following the already established framework from the literature review. The established nodes were again refined and sub-categories formed. This foregoing work was the foundation of the findings section, and helped to clarify and connect the statements of the interviewees.

The following Table gives an overview of the examined companies, their main business, and the key which respondent has which position in the respective company.

Table: Characteristics of respondent companies and respondents

Company A		**Company B**		**Company C**	
Fruit and vegetable distributor		Juice- producer		Dairy producer	
Respondent AA	Marketing Manager	Respondent BA	Operation Manager	Respondent CA	Eco- Efficiency Manager
Respondent AB	Trading Manager	Respondent BB	Sales Manager	Respondent CB	Manager Natural Resources

V. RESULT AND DISCUSSION

(i) Current green practices

To give a better understanding about the dimensions of the environmental endeavours in each company, this section shows the main efforts in terms of executed and continuous green practices. None of the examined firms used the term 'GSCM' for their approach.

Company A:

- Organic products alongside conventional products
- Degradable plastic bags
- Recyclability of panel-material
- Decision for more sustainable chiller-option despite cost-disadvantage.

Company B:

- Use of glass bottles for the organic brand
- Use of biodegradable, wood-cellulose based labels
- Green waste is utilizes, rather than land filled.

Company C:

- Reducing and minimizing waste
- Optimizing processes (e.g. use of hot water for other purposes)
- Own research on improving sustainable production
- Sophisticates recycling system.

(ii) Strategic and operational planning

This category presents all findings concerning strategic and operational planning in terms of the companies' environmental approach.

Table: Comparison of strategic and operational planning

Different Factors	Company A	Company B	Company C
Specific environmental guidelines from external organisation	√	√	√
Specific internal environmental guidelines	(√)	X	√
Specific environmental goals	x	X	√
Economic reward for environmental practices paramount	√	Partly	X
Environmental practices focused on one product	√	√	X
Importance of being environmentally friendly for the general strategy	Not so much	More important	Very important
Pay-off period for environmental practices	Short	Short	Middle
Green practices are source of competitive advantage	Partly	√	√
Key: Yes = √; No = x; In development = (√)			

Similar above comparison is also done with Management structure, systems, and decision making, Management of people and company culture, Relationships with supply-chain members.

V. CONCLUSIONS

The research was focused on factors companies have to consider when implementing a workable GSCM approach. The research has shown that each examined company is in a different situation with different factors influencing their environmental approach. Nevertheless one core characteristic should be to include the environmental strategy in the general company strategy to achieve consistency. This ensures the aim of the companies to gain a competitive edge over their competitors. Flat hierarchical structures might be of help to have a successful GSCM approach, but this is not mandatory. The company culture is serving as a tool to facilitate a supportive environment. The foundation of staff involvement is an environmental vision and/or mission from which all practices can be derived. Companies should pursue this strategy first with suppliers where the environmental improvement would be the biggest.

REFERENCES

[1] Angel Del Brio, J., Junquera, B., & Ordiz, M. (2008). Human resources in advanced environmental approaches-a case analysis. International Journal of Production Research, 46(21), 6029-6053.

[2] Basu, R., & Wright, J. (2008). Total supply chain management. Oxford: Elsevier.

[3] Cordeiro, J. J., & Sarkis, J. (2007). Why do some US firms link environmental performance to executive compensation? Does it matter? Academy of Management Proceedings (pp. 1-6).

[4] Heiskanen, E. (2002). The institutional logic of life cycle thinking. Journal of Cleaner Production, 10(5), 427.

[5] Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance measurement for green supply chain management. Benchmarking: An International Journal, 12(4), 330-353.

[6] Vachon, S. (2007). Green supply chain practices and the selection of environmental technologies. International Journal of Production Research, 45(18/19), 4357-4379.

[7] Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. International Journal of Production Research, 45(18/19), 4333-4355.