

Facilitating Sustainable Innovations: Sustainable Innovation as a Tool for Regional Development

Co-organized by The Greening of Industry Network,
The Cartesius Institute, and The Province of Fryslân
June 26-28, 2008, Leeuwarden, The Netherlands

Implementation of sustainability in global industrial supply chain networks
a system innovation perspective

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Abstract

This paper presents an overview of the recent literature about the implementation of sustainability in global product (supply) chains and industrial networks and addresses a possible research agenda.

The notion that improvement of the sustainability aspects related to production and consumption of products (and services) can only be achieved by integrating these aspects in the different phases of the life cycle has widely been recognized.

Many different stakeholders stimulate companies more and more to manage sustainability throughout the whole supply chain of their products.

This practice is in literature found as the “greening” of supply chain management (GSCM). A lot of research has been published on the question why “greening” takes place and which practices are found. How the process of “greening” takes place related to the different aspects and characteristics of the specific chains is less documented. Literature was found mainly from an environmental perspective but in recent years more publications are found from a more social (corporate social responsibility) and business (logistics, operation management) perspective.

As the economy develops from an international economy towards a global economy the question rises how this influences the implementation of sustainability in these global supply chains. The World Bank concluded that “the “existing” system of implementation of CSR in global supply chains may be reaching its limits and a new approach is needed. The current practices are based on a series of ad hoc and isolated decisions and therefore collaboration and a systematic approach are lacking.

Implementation of sustainability needs understanding the systems used for managing supply chains and networks. Systems developed to deliver products in time, of the right quality and at the lowest price. Different supply chain management theories, methods and concepts are found in literature in relation to sustainability. The awareness that supply chains are in reality not chains but complex networks is increasing and therefore chains and networks theories are combined in so-called network theories.

The implementation process can be seen as a process of system-innovation and research based on innovation theories might be very useful to make us better understand the complex processes related with the implementation of sustainability in supply chain networks.

These developments were the reason to start a PhD research that will describe and analyze the process of implementation of sustainability in global industrial supply chain networks from an innovation perspective. Besides a literature review the research will contain an empirical case study that is focusing on the textile sector. This sector is selected because it is a very good example of a global industrial supply chain network, many sustainability aspects are relevant and a lot of implementation activities related to sustainability are put into action in this sector.

A conceptual framework for the research of innovation in chains and networks will be used to analyze the processes from a system innovation perspective.

The empirical research will analyze the processes in the textile chain and network from both the Asian and the European side including the interaction between them.

Introduction

Originally companies mainly from an internal perspective paid attention to sustainable development. In recent times many different stakeholders stimulate companies more and more to manage sustainability throughout the whole supply chain of their products.

The practices used for managing sustainability throughout the supply chain have been growing instantly. Different plans, strategy's, negotiations, management-systems, audit-schemes, eco-labels and trademarks, codes of conduct and network management structures are being developed. To support these practices information, communication, dialogue, knowledge transfer, training and education and joint development projects are mentioned as being important for the implementation.

This practice is in literature found as the "greening" of supply chain management (GSCM). A lot of research has been published on the question why "greening" takes place and which practices are found. How the process of "greening" takes place related to the different aspects and characteristics off the specific chain is less documented. Literature is found from environmental, social and business perspective. Most literature starts from the environmental perspective. The word "greening" is used as a synonym for "environment". Less research focuses on an integral sustainability approach.

The tools used for implementation of sustainability in supply chains seem to be adopted from other related topics like quality, safety etc. The need for managing these aspects throughout the supply chain has been asking for attention already some decades so using this experience can be very useful. Looking at sustainability in a wider sense means that also topics that are not (directly) related to the product itself have to be considered. These topics cannot be measured, checked and controlled looking at the product. For example the product doesn't show if it has been produced by use of sustainable energy, child labor etc.

Therefore the question rises if the tools used for managing the product related sustainability aspects are suitable for the sustainability aspects that are not (or indirect) related to the product.

Because supply chains have become more and more international in supply chain research this international dimension has been addressed frequently. As the economy (including the supply chains) develops from an international economy towards a global economy the questions rises how this will influence the implementation of sustainability in these global supply chains.

The awareness that supply chains are in reality not chains but complex networks is increasing. Relations within the complex networks are changing easily and therefore more frequently. Managing these networks (including sustainability aspects) is becoming very complex and understanding these processes asks for new research strategies.

Products, globalization and sustainability

As globalization of the world economy is a process that is continuously going on materials, products and their markets are more and more following global patterns.

So are materials used to produce a mobile phone mined in Africa, the production takes place in China and the consumption in Europe. The location of the materials, availability of cheap labor forces and the position of the consumer groups determine the development of these global patterns. A lot of transport is needed to connect these different parts of the global patterns and make them work effectively. International supply chains are changing more and more into global industrial networks. Managing these networks, on many relevant aspects, is a very complex matter and asks for a systematic approach. Many actors are involved and often it is not easy to determine who is responsible for the different aspects. It seems that the process of globalization is an ongoing process that can and will not be stopped by means of the free economic world market. But the pressure from different stakeholders involved to put more effort in managing the side effects of this ongoing process on society is increasing. These sustainability aspects can be classified as being social/economical and environmental aspects. Even though it is sometimes said (Rock. M. et al, 2008) that globalization can also hold some promise for sustainability. It will not happen automatically. Sustainability

transitions as part of the globalization of the economy are therefore defined as hard slogs and not leap frogs.

Supply Chain Management perspectives and theories

Theories on supply chain management are mainly developed from logistics as the basic discipline but have become a more interdisciplinary field of study. So can a supply chain be described from the following three perspectives (Scheinewind, 2003):

- engineering like perspective; flow of materials and information
- economic perspective; economical/rational actors maximizing individual profit
- social/cultural perspective; social system with normative and interpretive schemes

Recently the third perspective by the use of social capital has become more important in supply chain literature. The awareness is rising that the social/cultural perspective needs more attention. In the case of, the often social/cultural related, sustainability aspects this might even be leading in the further development of this third supply chain management perspective. The environmental aspects within the sustainability aspects seem to have changed from a more social/cultural approach in the past towards a more technological/engineering type of approach at this moment. This doesn't apply for the social aspects. These aspects are very much seen from a social/cultural perspective and if they also will be looked at from a more engineering or economic perspective in the future is hard to say.

Three ways of looking at supply chains (Halldórsson et al, 2003) are a Resource-Based View (RBV), a Transaction Cost Analysis (TCA) or from a Network Perspective (NP). While the RBV focuses on resources and capabilities and the TCA on transactions the NP focuses on relations in the supply chain. As the sustainability aspects (as mentioned) are very much related with the social/cultural perspective the focus on relations of the Network Perspective seems to fit very well with this social/cultural perspective.

This Network Perspective within the supply chain management literature is bridging the gap between supply chain management and industrial networks theories.

Industrial Networks and Netchains

An industrial network can be defined as follows: "*All of the actors within one industrial sector, or between related industrial sectors, which can (potentially) cooperate to add value for the consumer*" (Håkansson, 1995).

Within this definition of an industrial network three components and their relations for analyzing industrial networks are included. These components are: activities, actors and resources.

Activities are the commercial, technical and administrative functions of individual firms. In the network these activities from the different firms are linked together. The performance of the network is relying on the quality of the activities and the links between them.

Actors are in this approach organizations and also individuals. Within supply chain management theories very often the organizations will be chosen to focus on although the individuals might have much more influence (by their decisions) on the interactions between the different actors. Trust is recognized as being a very important element of successful interorganizational relationships. Because trust is very often based on individual relationships the influence of individuals on the management of industrial networks in research might therefore be underestimated.

Besides the activities and the actors the *resources* are seen as the relevant third aspect of an industrial network. It seems that the supply chain structure is very much influenced by the resource structure. Therefore the way control over resources is selected also determines the relevant actors and their activities.

Supply chain and industrial network theories seem to be conflicting with each other because they choose very different approaches. In fact they are both important while they focus on different types of interdependencies in the so-called chains and networks. The study of *netchains* (Lazzarini, 2001) interprets supply chain and network perspectives on interorganizational relations. The framework presented on analyzing netchains and the use of netchain configurations might be very useful for analyzing the implementation of sustainability in chains and networks.

Innovation in Supply Chain Networks

Based on the netchain theories (Lazzarini, 2001) a theoretical framework for research on innovation in chains and networks is being developed within the same research group (Omta 2002, 2004). Innovation in this perspective follows the definition of the well-known economist Schumpeter who described innovation as the development of new combinations. These new combinations can be related to a product, a technology, a new market or the introduction of a new organization structure and/or strategy.

Innovation can be a process within one individual company but in practice nearly every innovation process will influence the supply chain and network partners. Therefore these innovations are called institutional or system innovations. The processes are very complex because many actors are involved. Besides the business sector also the government, NGO's and the (organized) consumers take part in the innovation process of the netchain system.

The conceptual framework for the research of innovation in chains and networks contains two groups of characteristics and one group of critical success factors for innovation at company level. Successful innovation in chains and networks begins with innovation at company level. The critical success factors at company level mentioned in the framework are related to strategy, culture and systems.

The cooperative characteristics also cover strategy, culture and systems while the set of context characteristics contain the elements: market and technology, chains and networks.

Implementation of sustainability in chains and networks

Already in the nineties research on the implementation of sustainability in the supply chain was published. This was known as "integral chain management" and was defined as supply chain management that takes environmental and social issues into account. Based on a literature review (Seuring, 2006) in Germany three "integral chain management" schools were defined; material and information flow school; strategy and cooperation school; regional industrial network school. As a comment it was noticed that, even though they are an integral part of the definition, the social aspects were not found as being part of the "integral chain management" practices. The implementation of sustainability in chains and networks seemed to focus mainly on the environmental aspects (Forman, 2004). Using life cycle assessment methods for selecting management priorities on environmental aspects (Pesonen, 2001) and the upgrading of Environmental Management Systems from "site-level" to "supply-chain level" has been discussed frequently (Bommel, 1998).

In literature Green Supply Chain Management (GSCM) replaced the term integral chain management and showed even more that indeed the environmental aspects were dominating above the social aspects. Publications in the nineties on integral chain management and green supply chain management were mainly found in environmental journals. The environmental researchers (often being biologists, chemists, engineers etc.) used within this environmental approach mostly the engineering perspective and the resource-based view.

It was only in the beginning of the 21st century that the logistic, operations management and supply chain management research groups recognized questions about the implementation of sustainability in supply chain management. At first they also focused mainly on the

environmental aspects but together with the change in society from the Environmental Management approach towards a wider Corporate Social Responsibility (Cramer, 2007) approach the social aspects became more important. The process of globalization of industrial product chains and networks has resulted in many developing countries becoming the production site for the developed countries. Besides responsibility on the environmental impacts (planet) the societal values (people) asked for attention as part of the public debate on corporate social responsibility. Aspects like child labor; human rights, fair trade and poverty were being addressed and asked for management throughout the whole supply chain.

Nowadays several publications within the operations management literature are found about how to make supply chains more sustainable (Carter, 2002 and 2004, Kleindorfer 2005, Vaidyanathan Jayaraman et al, 2007). The awareness about the need has grown but the expertise and knowledge how to organize and facilitate the implementation of CSR aspects in complex global industrial networks is poor developed.

The CSR Practice in the Investment Climate Department of the World Bank Group (World Bank, 2003) concluded that “the “existing” system of implementation (CSR in global supply chains) may be reaching its limits in terms of its ability to deliver further sustainable improvements in social and environmental standards”. The current practices seem to be based on a series of ad hoc and isolated decisions and therefore collaboration and a systematic approach are lacking.

Research agenda

Concluded is that a more systematic approach is needed for the further implementation of sustainability in global supply chain networks. To develop such an approach more insight is needed about the way the implementation process is influenced by the different factors and actors involved.

This leads to research questions like:

- How can the implementation-process of sustainability in global supply chain networks be analyzed and described?
- How influences the (configuration of) characteristics of a global industrial network the implementation process of sustainability?

The implementation process can be seen as a system-innovation process and therefore theories and concepts from innovation research might be very useful to analyze the implementation processes.

Also concluded is that the academic research groups from the environmental discipline are working on implementation of environmental aspects in supply chains already for some time. Concerning the social aspects and from the logistic and operation management discipline the attention paid to the implementation of sustainability in supply chains and networks is from recent years.

The challenge for better understanding the implementation process of sustainability in complex global industrial supply chains and networks is to bridge the gap between the social and environmental dimension and integrate the different disciplines in an integral system-innovation approach. Environmental supply chain management expertise should be combined with expertise from innovation in industrial chains and networks in general and include the social and economic dimension.

A beginning of this challenge will be tried to emphasize in a research project from 2007-2011. In this research the conceptual framework for research of innovation in chains and networks (Omta, 2002) will be used. This framework was not developed for the implementation of sustainability but for innovations in chains and networks in general. Therefore the framework

will be adjusted for sustainability by selecting general accepted social and environmental standards and include the relevant aspects in the framework.

The research focuses on the relation between actors and factors in the supply chain networks and will therefore not look into consumer related and legal aspects concerned. Implementation of sustainability in the supply chain networks might, for example, lead to conflicts with the EU cartel legislation and policy but this will not be considered in the research.

Analysing processes in complex networks asks for a holistic view and therefore a configurational approach (Neher, 2005) is considered. A configuration is defined as a commonly occurring cluster of strategy, structure, process and context.

Case studies are seen as a good methodology to understand complex social phenomena. It allows researchers to retain the holistic and meaningful characteristics of real-life events (Yin, 2003)

Because the implementation of sustainability in global supply chain networks can be seen as a complex social phenomena and the proposition asks for a holistic approach a case study methodology seems to be very appropriate in this research. Recent literature about case study methodology in business research (Dul and Hak, 2008) will be used to prepare the data collection strategies and methodologies.

The textile sector is selected for the case study because:

- it is a global industrial supply chain network
- the supply chain network faces many different sustainability aspects
- several initiatives for implementation of sustainability in the supply chain network are present
- it seems possible to obtain relevant empirical data by cooperation with the sector and intermediate organisations

The sector is known as a very complex network of many small and medium sized companies. While for example the “chemical industry” and “consumer electronic industry” show a less complex structure of chains and networks with a small number of bigger companies (multinationals) dominating the chain/network.

Initiatives from different actors in the supply chain on implementation of sustainability will be described and analysed. After studying the relevant documents also interviews will be held with selected actors on the dutch/european part of the chain/network.

Collecting empirical data from the production-phase of the chain is not easy because this part of the chain is very often situated in Asia. Cooperation with organisations that run projects on implementation of sustainability in the textile industry in Asia will be used for collecting empirical data there.

The research will be carried out as a part-time PhD project from 2007-2011.

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