

TOWARDS A BUSINESS MODEL FOR SUSTAINABLE SUPPLY CHAIN MANAGEMENT

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ABSTRACT

Designers make decisions that ultimately impact on both the economic, environmental and social performance of the products and process, and many of these costs and impacts occur across the supply chain. This paper aims to show initial elements of a research which aims to develop an integrated business model for sustainable supply chain management in order to facilitate the business management process in terms of assessment of suppliers and collaboration addressed to the sustainable improvements across supply chain. It is noteworthy that it is an imperative in the current competitive market that companies must be able to manage their entire production chain taking into account sustainable issues as an important factor in their decision processes. Therefore, it is believed that this model can integrate and strengthen a company's functions and assist its decision processes as well as implement improvements within its supply chain.

Keywords: sustainable supply chain, business model, environmental management.

1 INTRODUCTION

Businesses have been challenged to recognise that the ecological footprint of their products and services is not limited to the production stage of the final product manufacturer (Nawrocka *et al.* 2009). In fact, all stages of the product lifecycle influence on the environmental burden of a supply chain, including resource extraction, manufacturing, use, reuse, recycling or final disposal (Zhu *et al.* 2007).

According to Hervani *et al.* (2005), the responsibility of the company now spreads over a number of actors along the supply chain. As a consequence, many companies have developed sustainable practices for a huge number of actors along the supply chain (Schmidt and Schwegler 2008) which are not only located downstream but also upstream, including companies responsible for product delivery, and have a reverse logistics system addressed to product recovery or sound final destination (Srivastava 2007).

Sustainable supply chain management (SSCM) practices have emerged in this context. According to Hakke and Seuring (2009), SSCM is a set of actions and relationships in terms of design, procurement, production, distribution, use, reuse and disposal of the firm's goods and services in response to concerns for the environment and social issues. In addition, Seuring and Muller (2008) define SSCM as the management of material, information and capital flow, as well as cooperation among companies along the supply chain, while meeting sustainable goals and taking into account customer and stakeholder requirements.

Both environmental aspects and corporate social responsibility (Gimenez and Tachizawa 2012) are involved in SSCM practices. Social practices have been carried out by focal companies (FCs), which are the most influential organisations in the production chain due to their purchasing power, their direct contact with customers and their influence on adoption of the sustainable standards and features by other members of the supply chain. The most common social practices implemented by FCs are: implementation of supplier code of conduct, market governance mechanisms addressed for extensive collaboration, social management system – SA 8000 (Social Accountability), ISO 26000,

sustainable report (such as Global Report), social audit addressed to check labour conditions or slave and child labour practices and connectedness within and outside the community and quality of life.

However, FCs have focused more on their environmental practices than social as part of their SSCM practices (Hervani et al 2005; Srivastava 2007; Seuring and Muller 2008; Testa and Iraldo 2010; Despeisse et al. 2012; Gimenez and Tachizawa 2012; Ahi and Searcy 2013). This can be justified by driving forces which generally involve more environmental than social issues. For example, the sustainable standards demanded by government are more related to the environmental aspects, such as the restriction of the use of certain hazardous substances in electrical and electronic equipment established by the RoHS Directive 2002/95, eco-design for energy-using products (Directive 2005/32/EC), the take back obligation for electrical and electronic equipment waste (Directive 2002/96) and registration, evaluation and restriction of chemicals (Directive 1907/2006) (Ongondo *et al.* 2009; Wang and Gupta 2011). Consequently, the adoption of selection criteria and assessment of suppliers in purchasing, product performance assessment and improvements (Life Cycle Assessment and Ecodesign) are being increasingly implemented by focal companies. Focal firms can have problems if they do not manage their suppliers in terms of environmental compliance. A specific example is the recall carried out by Mattel in 2007. A total of 20 million children's toys were recalled due to materials found to contain traces of lead used by some suppliers.

In addition, according to Roberts (2003), a non-governmental organisation (NGO) can influence the reputation of the focal company, demanding responsibilities in the upstream and downstream production. For example, Nike, Disney, Levi Strauss, Benetton, Adidas and C&A in recent years have been criticised for problems such as environmental contamination that occurred in their suppliers' production stages (Seuring and Muller 2008).

To sum up, image, reputation, and standards demanded by NGO's, customers, shareholders, governments, or even competitors are all considered major external motivations to a focal company which has adopted SSCM practices. On the other hand, promoting competitiveness in the chain, reducing costs and pressure from workers are examples of internal driving forces for SSCM (Haes and Rooijen 2005; Seuring and Muller 2008; Jabbour and Jabbour 2009).

Therefore, it is imperative in the current competitive market that companies manage their entire production chain, considering environmental and social issues to be important factors in the decision-making process. Thus, this paper aims to show initial elements of a research which aims to develop an integrated business model for sustainable supply chain management in order to facilitate the business management process in terms of assessment of suppliers and collaboration addressed to the sustainable improvements across supply chain.

This research has been conducted in collaboration with the EPSRC Centre for Innovative Manufacturing in Industrial Sustainability. The centre has outlined a number of Grand Challenges for a number of PhD students to research under; namely, Eco-efficiency, Eco-Factory and Sustainable Industrial Systems. This work will contribute towards the Sustainable Industrial System, which aims to "help companies to explore future configurations of the industrial system, and their implications, and take first step to improve understanding of the long term challenges facing industry". This proposal is sponsored by the Brazilian government through the programme "Science without Borders". The main goal of this programme is to promote the consolidation and expansion of science, technology and innovation in Brazil by means of international exchange and mobility.

2 RESEARCH PROGRAMME

2.1 Research Questions and Objectives

- **R.Q.1.** What are the current practices (approaches, tactics, tools, strategies) in supply chain management for sustainable improvements?
- **R.Q.2.** What are the driving forces and drawbacks to adoption of SSCM practices and their impacts on business management process?
- **R.Q.3.** How can members of an entire supply chain be assessed in terms of the effectiveness of environmental management (practices and performance) and corporate social responsibility (practices) and what data is needed to make the assessment and what is not?

- **R.Q.4.** How to develop collaborative relationships with members of an entire supply chain to achieve sustainable improvements?

Table 1: Objectives of proposal

Objectives	Description	Derived from
O.1	To understand the relationship between members of the entire supply chain and focal company in terms of adoption of sustainable practices, drive forces and drawbacks.	R.Q.1 & R.Q.2
O.2	To analyse and classify the SSCM practices to design the conceptual model to assess members of an entire supply chain	R.Q. 3
O.3	To understand the types of collaboration addressed to sustainability across an entire supply chain, and to analyse and classify them to design the conceptual model to give support to member to improve their sustainable stance	R.Q. 4

2.2 Research approach

a) Phase 1 - Analysis of the "state of the art"

A systematic literature review will be conducted to analyse the "state of the art" sustainable supply chain which will take into account the entire supply chain, both environmental and social elements of SSCM, and sustainable approaches for the supply chain.

Interestingly, a systematic review is a specific methodology that allocates existing studies, selects and evaluates contributions and reports on the evidence from a specified question (Denyer and Tranfield 2009).

This systematic review (A.1.1) will be guided by research questions R.Q.1 and R.Q.2 and conducted by steps described below, which are based on Seuring and Muller (2008), Denyer and Tranfield (2009) and Gimenez and Tachizawa (2012).

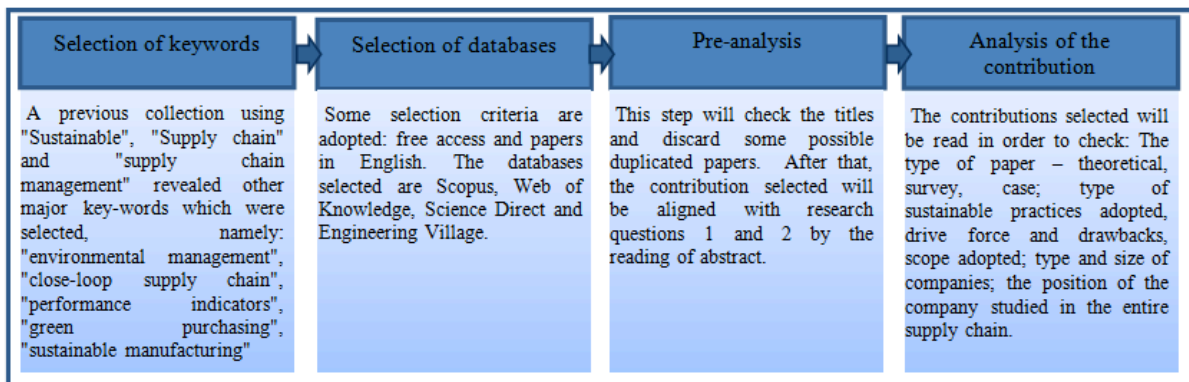


Figure 1: Steps of a Systematic review

Furthermore, interviews will be conducted with research experts (from Cranfield University and Centre for Innovative Manufacturing in Industrial Sustainability, and other universities) and expert practitioners (from, for example, Toyota and Unilever) (A.1.2). This phase also includes initial visits to the "focal company" (that needs to be selected and contacted for developing this proposal) in order to recognise its sustainable practices and mapping of its extended supply chain. For this reason, based on previous activities, a survey form will be designed to guide the initial data collection (A.1.3).

The activities A.1.2 and A.1.3 will explore the real sustainable practices (tools/tactics/strategies/approaches) which have been used by industries in terms of supply chain management.

Therefore, the literature will be critically reviewed in order to identify more gaps in research. Also, reported practice will be analysed to understand if these gaps have been addressed in industry. The stage seeks to understand the relationship between sustainable approaches in supply chain

management which have been developed by academics and their real implementation across the companies.

b) Phase 2 – Model Development and Refinement

This stage is guided by R.Q.3 and R.Q.4. Also, the model will be designed to take into account the results of activities 1, 2 and 3. The essence of the model will be addressed to the assessment and collaboration with suppliers in terms of sustainable improvements.

It is intended in this stage to refine the model (A.2.2) through contact with managers of the focal company and its suppliers to identify possible improvements and adaptations of the model.

It is expected that the outputs from this phase will be submitted to conferences (such as Global Conference on Sustainable Manufacturing, International Conference on Sustainable Intelligent Manufacturing, International Conference on Industrial Engineering and Operations Management) and journals (e.g. Journal of Cleaner Production, Journal of Supply Chain Management; European Journal of Operational Research) are expected. Therefore, other researchers and practitioners could comment on the model proposed and that can be included in the refinement.

c) Phase 3 – Model application and validation

This phase is guided by R.Q.5 and is aimed at the application of the model (A.3.1) and model validation. Thus, the model will be applied and its outcomes will be interpreted, analysed and discussed, including aspects like benefits and limitation of the model.

To process the model validation (A.3.2), submissions are expected both to journals and conferences in order to receive feedback from researchers and practitioners. In addition, a final workshop will be held with managers who are involved and members of the Industrial Sustainability Centre.

3 DELIVERABLES

It is expected the development of a business model, which will take into account some possible elements in the design process, such as:

- Limits and scope (selection of a product and selections of member of entire supply chain);
- Variables that should be addressed in this study (social and environmental variables);
- The development of a classification system of sustainable maturity level of members of an entire supply chain;
- The development of modelling to calculate environmental performance of the member of the supply chain (which will include the definition of indicators, data collection, validation, simulation and definition of the burden of suppliers);
- The design of a system to support the decision-making process and collaboration with suppliers to improvements related to environmental management and corporate social responsibility.

This model can be used by focal companies in order to measure their supply chain in terms of environmental performance and tactics adopted as well as social tools adopted. Thus, it will be possible to assess the level of maturity of member of an entire supply chain and develop partnership with suppliers in order to improve the sustainable stance of supply chain. Therefore, this research can lead the organisation to further sustainable manufacturing position, strengthening members of supply chain partnership, supporting sustainable improvements and the decision process in organisations.

Figure 2 illustrates some principles of the model: the scope and type of interaction with suppliers. The scope will take into account the entire supply chain including upstream and downstream interaction. In addition, not only environmental aspects (performance and practices adopted) but also social aspects (practices adopted) will be considered in the type of interaction.

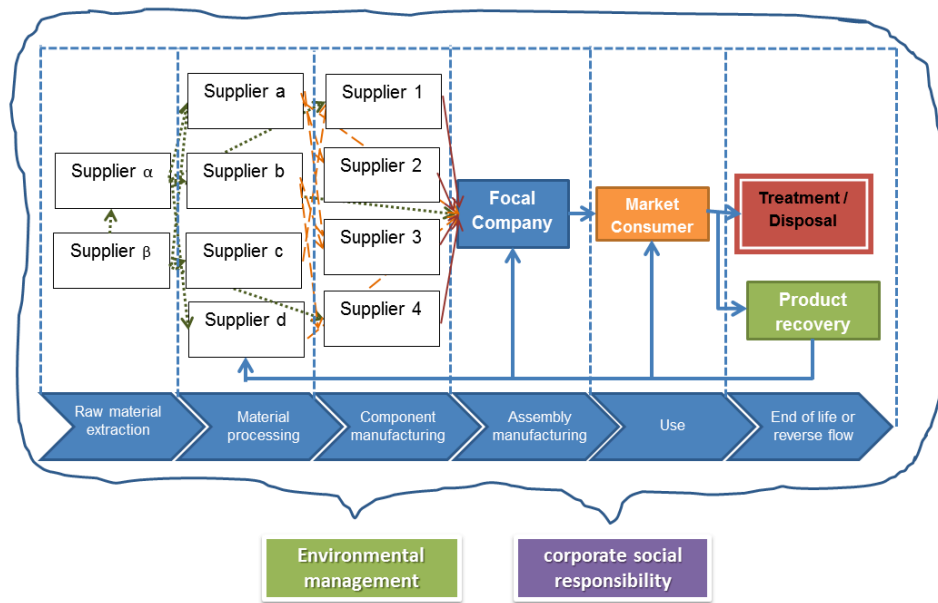


Figure 2: Principles of the business model of sustainable supply chain management

The analysis of the literature revealed some gaps related to sustainable supply chain management in terms of the type and the scope of the interaction between a focal company and members of the entire supply chain. The type of interactions is related to the practices used by FCs to analyse and improve sustainable issues across the supply chain. The scope in turn means where (upstream / downstream) and which member are involved by SSCM practices adopted by FCs.

The concept of sustainable supply chain management encompasses the entire lifecycle perspective, i.e., raw material extraction, pre-manufacturing (material processing and components manufacturing), manufacturing, market, and final destination or recovery of product as well as the transportation between these steps. Interestingly, it was seen in the literature that many companies have just focused on upstream flow. Focal companies have extended sustainable criteria for first-tier suppliers. This is generally conducted by an assessment of sustainable standards demanded during purchasing, such as eco-labeling of materials/products, management systems certificated (ISO 14001, SA 8000), sustainable reports, etc.

It was observed that many focal firms have carried out Life Cycle Assessment (LCA) in an attempt to evaluate the environmental impact of a product across its entire lifecycle. However, it cannot point out how each member of the supply chain contributes to the environmental burden of the product assessed. In addition, the complexity of conducting an LCA in terms of money, time and data collection effort can be considered a limitation for its full implementation (including all steps of life cycle).

In terms of the type of interaction with suppliers, the first practice is already mentioned; assessment of suppliers. This approach by itself does not guarantee a good sustainable performance or contributes to increasing suppliers' sustainable commitment. Basically, this assessment might sort a firm if it has a minimal sustainable stance to be a supplier. According to Gimenez and Tachizawa (2012), firms need to engage in collaborative practices in order to improve the sustainable stance of their suppliers. In addition, collaboration includes direct engagement between the various levels of the supply chain, in which the focal company commits itself to the improvement of its suppliers (Simpson and Power, 2005). Assessment may be the first step to identify what actions are needed. Therefore, despite the growth in sustainable supply chain research, it is difficult to find out how to evaluate members of an entire chain as well as to use this information to support sustainable improvements in the production chain.

4 CONCLUDING REMARKS

This article discusses the potential application of environmental management and social responsibility across the supply chain. This research will have as deliverables the development of a validation

process for sustainable strategies and a mapping of environmental along extended supply chain; it includes the presentation of elements that can help companies to promote changes within the chain contemplating a more environmentally friendly view, creating conditions for meeting sustainable stance.

We believe that this research can encourage the organisation to further sustainable actions, strengthen supply chains, support environmental life cycle management of products, and improve the decision processes in the organisations. In this context, this research looks to bridge the gap in the sustainable supply chain management in terms of assessment and collaboration with suppliers. This research also takes into account the entire supply chain and includes the environmental burden of members, sustainable tools, tactics and models implemented and a system to help focal firms focus on sustainable improvements across the production chain.

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