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► **To cite this version:**

Handson Pimenta, Peter Ball. Environmental and Social Sustainability Practices across Supply Chain Management – A Systematic Review. Bernard Grabot; Bruno Vallespir; Samuel Gomes; Abdelaziz Bouras; Dimitris Kiritsis. IFIP International Conference on Advances in Production Management Systems (APMS), Sep 2014, Ajaccio, France. Springer, IFIP Advances in Information and Communication Technology, AICT-439 (Part II), pp.213-221, 2014, Advances in Production Management Systems. Innovative and Knowledge-Based Production Management in a Global-Local World. <10.1007/978-3-662-44736-9_26>. <hal-01387869>

HAL Id: hal-01387869

<https://hal.inria.fr/hal-01387869>

Submitted on 26 Oct 2016

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Environmental and social sustainability practices across supply chain management – a systematic review

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Abstract. This paper explores the sustainable manufacturing knowledge in the field of supply chain management in order to understand the best practices to diffuse sustainability across supply chain network. A systematic literature review was conducted, covering six databases by combinations of key-words between the periods of 1992 to November of 2013. A total of 92 peer-reviewed papers in English are reviewed. A lack of integration of the core SCM activities (purchasing, performance and collaboration) was found in the diffusion of environmental and social sustainability practices across supply chain. Thus, more studies are needed to cover the adoption of environmental and social practices into supply chain management activities and the process to diffuse them across the supply network. In addition, environmental issues have received more attention than social ones in both upstream and downstream supply chain management activities. Using the outputs of the literature review, a conceptual framework is proposed covered: 1) the interrelationship between the core upstream SCM activities (purchasing, suppliers' performance assessment and collaboration with suppliers) and 2) the effect of internal cross function in upstream SCM activities.

Keywords: Environmental sustainability practices, social responsibility, supply chain management.

1 Introduction

Sustainable supply chain management (SSCM) is a broad subject itself; hence it covers three dimensions of sustainable development, i.e. economic, environmental and social. In addition, the diversity of activities involved in the cross-organisational functions as well as inter-organisational processes in supply chain management become the subject more complex regarding to promote sustainability. Despite the growth in the body of SSCM knowledge, it is still difficult to understand the effect of sustainability practices involved in supply chain activities to engage suppliers and to promote improvements.

Seuring and Müller [1] is one of the first papers that covered a full view of sustainability (triple bottom line – environmental, social and economic dimension) across supply chain management (SCM). They focused on triggers and barriers for SSCM and presented a framework including strategies for suppliers' management of risks and performance and for sustainable products. However, there was less attention on specific supply chain management activities and on sustainability practices.

A comprehensive view of the purchasing process is presented by Igarashi et al.[2]. This covered a specific activity of the SCM and takes some environmental sustainability practices and focused on one dimension of sustainability (green). Govindan et al. [3] also described some environmental practices, such as Environmental Management System (EMS) and Design for environment (DFE), from papers that involved multi-criteria decision making for supplier evaluation and selection. Zhu et al. [4] conducted a survey in 89 Chinese automotive supply chain companies and assessed one particular company responsible for engines by interviews with key-managers. Even though this study covered plenty of SCM activities (purchasing, cooperation with customers and cross-functional cooperation), environmental practices (e.g. ISO 14001, DFE, audits) were the main focus in this study.

Therefore, there has been no review of SCM activities involved in the adoption and diffusion of environmental and social sustainability practice across supply chain. This paper addresses the gap by examining environmental and social practices adopted in supply chain activities. In this context, sustainable manufacturing knowledge in the field of SCM will be explored in order to understand the practices to diffuse sustainability across supply chain network.

Using the outputs of the literature review, a conceptual framework is proposed. The novelty of this conceptual framework is the inclusion of the interrelationship between the core upstream SCM activities of purchasing, suppliers' performance assessment and collaboration with suppliers. The effect of internal cross function in upstream SCM activities for diffusion of environmental and social sustainability across supply chain network is also taken into account in the conceptual framework.

2 Method

A Systematic Literature Review (SLR) was conducted based on Tranfield et al. [5] and Denyer and Tranfield [6]. SLR enables the researcher both to map and to assess the existing intellectual territory and to specify a research question to develop the existing body of knowledge further [5]. This systematic review follows a protocol made up of four steps: planning, searching, screening, and content analysis, as described below.

The following research question guided this SLR: how might a focal company diffuse environmental and social sustainability practices across the supply chain and in which context?

In order to encompass a representative number of materials more related to the research question, two groups of key-words in line with social and environmental sustainability issues "sustainab*", "environment*", green, "closed loop", "industrial

ecology”, “social responsibility”, reverse, governance) and SCM (“supply chain”, “value chain”, network, relationship, "collaborat*", “co*operation”, performance, purchasing, procurement) was used to construct search strings with the Boolean connectors “and”. The strings were then used to search materials between the periods 1992 to 2013 in electronic databases. Six databases were selected, namely Scopus, Web of Science (Isi), EBSCO (Business Source Complete, Environment complete and GreenFILE) and ABI. The main criterion to choose a database was that it needed to be related to the field of manufacturing, sustainability and supply chain management and index well-rated journals.

Between October and November 10th 2013, papers were searched using the “all fields”. This search was based on all possible combinations between those two groups of keywords in order to take into account papers more representative with the research question. 20,059 papers were found. Taking into account the high volume of materials it was considered reasonable to narrow the search due to quality of contribution just to include only peer-reviewed scientific papers in English, resulting in 10,814 papers. Removing duplicates reduced the papers found to 4,131.

The title and abstract were read using explicit inclusion and exclusion criteria in order to select relevant papers. Specifically, the paper needed to provide any insight to the relationship between the focal company and member(s) of the supply chain of the manufacturing base in terms of the diffusion of environmental and social sustainability practices. Papers were excluded when they did not cover this relationship within SCM domain. Other exclusion criteria were: ethical and humanity issues, opinion of stakeholders on sustainability and outsourcing, public purchasing and services supply chain (bank, hotel, supermarket, hospital, education, supply of water, e-market) and supply chain security.

A total of 80 papers were resulted from the screening process. Finally, cited references were used as a secondary source (Citation tracking). A further 12 papers were included. Therefore, these three approaches resulted in a total of 94 studies, which were then coded and analysed. Thus, the final sample was 92 papers.

In order to identify the relevant issues related to sustainability across supply chain network, the content of papers selected was analysed, taking into the following aspects, namely: the dimension of sustainability covered (e.g. TBL, Green or Social), the scope of SCM (e.g. upstream – focus on suppliers, downstream – focus on clients, life cycle view) and SCM activities involved.

3 Results and discussion

3.1 Environmental and social sustainability practices across supply chain management

The body of the literature covered in this systematic review is still a young field; hence the majority was released in the last 10 years. According to Seuring and Muller [1] and Srivastava [7], the most research related to SSCM has been published after 1990. In this context, the start year was chosen based on these facts. By 2000, a total

of seven papers were published. The first paper identified was done by Roy and Whelan [8]. From 2001 to 2010, 47 papers were released. Finally, more than 40% of the papers identified (38 papers) were published between 2011 and 2013, showing a significant interest in environmental and social sustainability practices across supply chain. Indeed, this subject received great attention mainly in the first 9 months of 2013, when 20 papers were published.

Although it is expected that the three dimensions of sustainability (e.g. economic, environmental and social) integrally work together, it is more common to find research covering just one or two aspects, i.e. just environmental or environmental and economic issues or just social (e.g. [1,9]). This is confirmed in this systematic literature review, with 53 papers (57%) focusing just on environmental dimension of sustainability. Triple bottom line (TBL) and society are covered in 15 and 11 papers, respectively. In addition, there was some overlap between environmental and society (nine papers), environment and economy (three papers) and society and economy (one paper). Papers on pure economic issues across supply chain are not included in this literature review.

To date various authors have investigated different ways to diffuse sustainability across supply chain. These approaches include both direct and indirect activities of SCM. The selection of supplies that achieve minimal requirements and the collaboration with existing or new suppliers in order to reach higher levels of sustainability are identified by several authors as a direct action of SCM activities responsible for diffusing sustainability (e.g. [10,11]). Another study suggests indirect actions [12]. In this approach a focal company can implement measures that are not directly related to its own sourcing or management, such as supporting of NGO's, philanthropy, or compensation schemes.

Direct actions are wide and cover a plenty of issues. Not only cross-functional aspects (internal function integration) are involved in diffusing environmental and social sustainability across supply chain but also cross-organizational (external integration - direct actions with suppliers and other partners located in downstream). Both integrations are essential for environmental and social collaboration addressed for competitive advantage [13]. In this regard, this systematic literature review found 64 papers that focused on upstream, seven papers focused on downstream and 12 papers both upstream and downstream. In addition, six papers took into account the perspective of lifecycle view through life cycle assessment (LCA) or carbon footprint studies (Figure 1). Considering the papers that covered upstream SCM activities, the majority were related to purchasing (44%) (e.g. [14]), followed by supplier's performance assessment (14%) (e.g. [15]) and collaboration (14%) (e.g. [16]).

To diffuse sustainability across the supply chain it is necessary to adopt the appropriate performance measurement system to identify what actions are needed [17]. In this context, suppliers' performance management allows focal companies to evaluate a supplier's performance, compare it with the performance of other suppliers, and provide suppliers with direction for improvements [18]. Finally, there is a huge variance of environmental and social KPI's to assess supplier's performance.

Some environmental and social sustainability practices are adopted in collaboration with suppliers were observed. The focus given was to implement some improvements

into process, product and general activities. Pollution prevention and EMS - ISO 14001 were the most common practice reported with focus on process. In terms of collaboration with focus on product, LCA and DFE were substantially reported. Finally, training with purchasing staff of focal company and suppliers staff was a common practice in general activities. Interestingly, social sustainability practices were only briefly mentioned, specifically SA 8000 and code of conducts.

The combination of these activities was also observed, highlighting - purchasing and collaboration (17%) (e.g. [17]). An example of purchasing and collaboration developed by Sony Corporation was reported by Handfield et al. [19]. This company implemented its green procurement policy to ensure the adoption of minimal requirements by suppliers. However, at same time, designers from key suppliers worked together with Sony engineers to find improvements in products and processes in terms of environmental impact control and disposal solutions. Finally, with respect to sustainability dimension in upstream, the majority of papers covered environmental issues with 52%, followed by TBL and social, 14% and 12%, respectively (Figure 1).

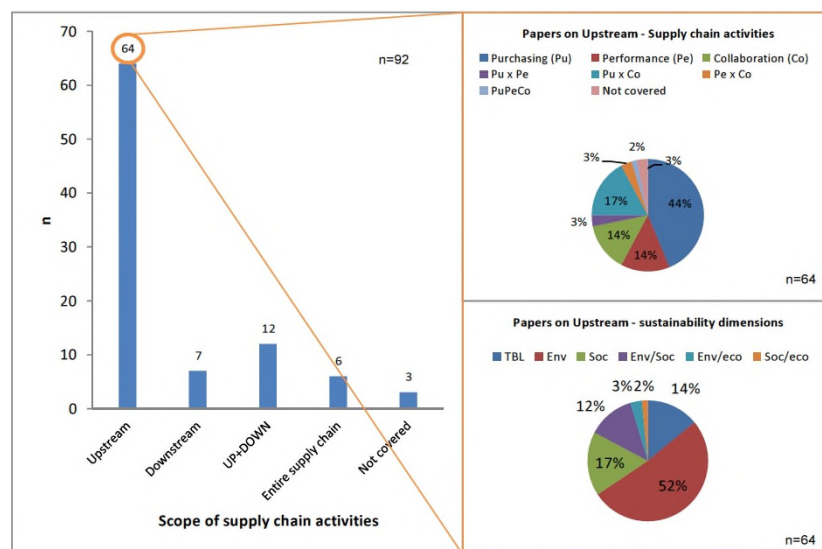


Fig. 1. Scope of sustainable supply chain concepts.

The focus of papers that covered downstream activities were related to transportation (two papers) (e.g. [20]), warehousing (1 paper) (e.g. [21]) and the management of product end-of-life (4 papers) (e.g. [8]). Specifically, concerning product end-of-life management, only environmental issues are covered. More attention was given to reverse logistics, product recovery, recycling and remanufacturing. In transportation and warehousing, environmental practices identified aimed to control environmental impacts mainly in terms of energy efficiency (e.g. [22]) and GHG emission control [23]. Specifically, in transportation, two particular practice were covered; the design of vehicles to reduce fuel consumption and routing (e.g. [20]). Finally, with regard to

product end-of-life, two main activities are involved: reverse logistics (reuse, dismantled and recycling) (e.g. [24]) and close loop supply chain (remanufacturing) (e.g. [25]). Social practices with focus on safety issues were identified just in transportation and warehouse activities.

A total of 12 papers encompass upstream and downstream supply chain management. In the papers a diversity of SCM activities, such as performance assessment and purchasing were covered. Two papers highlighted the combination of performance and collaboration. For example, Lee and Cheong [26], through a collaboration with 15 key-suppliers, collected in situ details of energy consumption, CO₂ flow and fuel consumption in order to measure the performance and the carbon footprint (raw material, manufacturing and distribution) of a Korean automotive OEM. Finally, the environment was the main sustainability dimension covered by up- and downstream-papers (eight papers), followed by TBL (two papers) and two papers that combined two dimensions of sustainability, one environmental and social and other environmental and economy.

3.2 Towards a conceptual framework

As it could be seen in the previous section, in terms of upstream supply chain activities, purchasing (including minimal requirements, final selection and monitoring), supplier's performance assessment and collaboration have received more attention to diffuse environmental and social sustainability across supply chain. However, these three core activities have been covered separately by the current literature, given more attention on purchasing and performance assessment. In addition, few papers have considered the adoption of environmental and social practices together in specific supply chain management activities. Therefore, few studies simultaneously embrace and integrate these three core SCM activities in order to diffuse environmental and social sustainability practices across supply chain.

In addition, internal departments (e.g. operation management, design, R&D, environmental management, quality, etc.) have played an important role to support the definition of specification and select requirements for supplier's selection as well as metrics for suppliers' performance assessment and alternatives for improvements. In this sense, the rigor of environmental criteria select for suppliers' selection is associated to the maturity level of focal company's environmental management function. However, empirical studies for better understand the relationship between the inclusion of environmental and social practices across supply chain activities and the role of internal functions are poor.

The understanding of the interrelationship between these core upstream SCM activities and the effect of internal cross function might be useful for a better assessment and monitoring of suppliers and identify priority and make sound decisions in terms of spreading environmental and social sustainability.

Therefore, a framework for diffusion of environmental and social sustainability across supply chain network will be presented taking into account these issues. Firstly, upstream supply chain activities, particularly the integration of purchasing, suppliers' performance assessment and collaboration with suppliers, will be the focus of the

framework. Secondly, the framework will consider the interaction of the internal functions with the upstream SCM activities (Fig. 2).

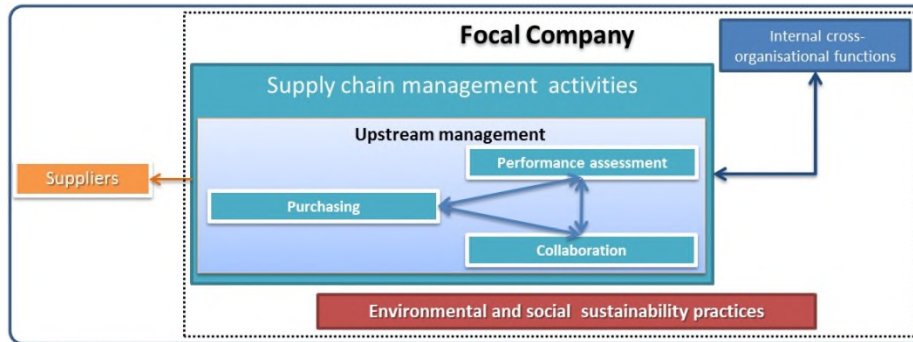


Fig. 2. Conceptual framework for diffusion of environmental and social sustainability practices across supply chain

4 Concluding Remarks

This paper has examined works related to diffusion of environmental and social sustainability practices across the supply chain. It has been observed that the diversity of activities involved in the cross-organisational functions as well as inter-organisational processes in supply chain management become the subject more complex regarding to diffusion of environmental and social sustainability. Despite the growth in the body of SSCM knowledge, it is still difficult to understand the effect of sustainable manufacturing practices involved in supply chain activities to engage suppliers and to promote improvements in terms of sustainability. In addition, the body of the literature analysed on environmental and social sustainability practices across supply chain is still a young field.

The adoption of environmental sustainability practice is more commonly reported both in upstream and downstream SCM activities than social practices. For example, Environmental sustainability practices have received more attention in collaboration activities than social practices, especially prevention pollution, EMS, LCA and DFE.

In order to understand how to strengthen the relationship with suppliers through spreading sustainability practices, future work might focus on empirical studies of upstream SCM particularly the integration of purchasing, suppliers' performance assessment and collaboration with suppliers. For example case studies can be conducted to validate the conceptual framework.

Acknowledgments The research is conducted in collaboration with the EPSRC Centre for Innovative Manufacturing in Industrial Sustainability. This work is sponsored by the Brazilian government (CNPq) through the programme "Science without Borders".

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