A comprehensive literature review of green supply chain management

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Abstract

The aim of this paper is to provide a summary of the role of small- and medium sized enterprises (SME) in green- and sustainable supply chains using a comprehensive review of the literature. After introducing the most important notions relating to sustainable supply chains and the survey methodology, a detailed analysis of scientific publications describing various issues related to SMEs and their role in green/sustainable supply chains will be presented. Results show the most important focus areas addressed and methodologies used in the literature, as well as a list of potential research questions still unanswered in this important topic.

Keywords: SME, sustainable supply chain, literature review

Introduction

Sustainable development has gradually entered the agenda of business organisations from the end of the 1980's (largely influenced by the Brundtland Report,"Our Common Future" published in 1987) and as a result companies have undergone significant changes over the past thirty years.

In a society dominated by the global economy the sustainability implications of industries become significant (Nousala, 2009). Companies are facing more and more complex and rapidly changing market environments, particularly SMEs, the competitiveness of which depends more and more on the early identification of new customers and market needs (Rogalski, 2013). Nowadays, SMEs are increasingly integrated into global value chains, where they have to face the social and environmental requirements of their multinational customers (Jorgensen, 2006). As large companies improve their environmental performace and governments pass increasingly demanding environmental regulations responding to the expectations of different social groups, SMEs must also reduce the environmental impact of their operations (Mathiyazhagan, 2013). The growing concern about the natural environment has prompted manufacturing companies to adopt and apply green procurement practices in their business processes, the importance of which is underlined by the fact that supply chain management is more and more often one of the key elements of a company's competitive edge (Coté, 2008). The role of SMEs in global supply chains is important not only from an economic, but also from an environmental point of view. Global supply chains can also ensure that SMEs comply with environmental regulations. If large customers define environmental criteria during their purchasing activities, then SMEs also need to meet these

requirements to succeed on the market (Nulkar, 2014). The green supply chain requires coordinated action on behalf of participating companies from different countries (Liu, 2014). The greening of the supply chain does not only pose a threat to SMEs, but also provides them with opportunities in their national, European and international markets (Frey, 2013).

From another perspective, SMEs can also be seen as bottlenecks influencing the environmental performance of an entire supply chain as a result of their lack of information, infrastructure and expertise (Ramakrishnan, 2015). SMEs often lack the capabilities and resources to contribute to a green supply chain. (Lee, 2008)

The scientific literature has dealt with the role of SMEs in green or sustainable supply chains and numerous articles have been produced on this subject since the second half of the 1990s. The aim of this paper is to summarize the position of small- and medium enterprises (SME) in the green- and sustainable supply chain (GSC, SSC) in light of a review of the literature. In the first part of the paper I will shortly introduce the most important concepts relating to the topic, which have also served as the basis of the search for the relevant literature. Then I introduce the search method used and the findings of the review of the literature including the most important focus topics covered, the evolution of research questions and the methodologies used. Finally I will identify potential research questions to be addressed by the experts of the field in the next couple of years.

Conceptual overview and methodology

The literature agrees that cooperation along the supply chain has a positive impact on the competitiveness of companies along the supply chain (CiGolini et al., 2004). The definitions of supply chains use two different – often confused –interpretations: one approaching the chain as a group of organizations and the other as a complex process (Gelei, 2010).

On the one hand, the supply chain can be seen as a group of companies through which raw materials and final products flow (Lalonde and Masters, 1994). According to Lambert, the supply chain is a group of companies that jointly sell products or services (Lambert et al., 1998). As reported by Gelei the supply chain can be interpreted along the flow of materials among affiliated companies (Gelei, 2009). Furthermore, Mentzer et al., define the concept of supply chain as follows: "Three or more organizations or groups of individuals directly involved in the inward and outward flow of products, services, funds, information from the procurement to the consumer." (Mentzer, 2004)

Pursuant to the process based interpretation a supply chain is "a series of economic activities that are connected vertically and across corporate boundaries in order to satisfy consumer demand" (Chikán, 2008). In line with other definitions, the supply chain is a network of organizations that incorporate both inward and outward connections, different processes and activities that add value to the product or service delivered to the final consumer (Christopher, 1992).

Supply Chain Management aims to increase competitiveness and improve cooperation between partners and harmonize consumer expectations and material flows of suppliers, which can help balance a range of contradictory goals such as high customer service levels, low inventory levels and unit costs (Stevens, 1989). Supply chains are usually organized around one central company, which is typically the engine of the operations along the chainchain (Gelei, 2003a).

Supply Chain Management (SCM) definitions can be differentiated just as whether their author emphasizes the supply chain management as a management philosophy or rather focuses on specific activities aimed to implement this leadership philosophy. The

management philosophy approach seeks the opportunity to coordinate and approach operational and strategic capabilities within companies and among companies in order to get a unified and strong market share. SCM as an integrative driving philosophy directs members of the supply chain to develop innovative solutions to create a unique customer value. In this regard, it is essential to share and serve consumer expectations and values as a common goal (Gelei and Nagy, 2005). Strategic integration is needed in supply chain management to avoid overlaps and allow members to become more efficient at lower cost levels. Mutual risk and profit sharing creates a competitive advantage. Risk and profit sharing reflects the commitment of the parties, which can only be achieved within the framework of long-term cooperation. Supply chain operations can only be successful if, in addition to coordinated processes, chain members have the same goals and focus on customer service. Stabilizing these key elements is essential not only for the process but for the strategic integration among members as well (Nagy, 2006).

Green Supply Chain Management can be defined as integrating environmental thinking into supply chain management, including product design, purchasing and selection, manufacturing processes, end-product delivery, the use of products and their end of life disposal (Miskolcziné, 2017). While green suplly chain management deals with products and services that reduce health and environmental impacts compared to similar products and services used for the same purpose, *sustainable supply chains* also integrate social aspects into the supply chain While 'green' supply chains consider only immediate effects of products and services on the environment, sustainability is a much wider term that addresses the consequences of longer-term use of products and services and considers social and financial impacts as well. In the present study, I analyse both the green supply chain and the sustainable supply chain at small and medium-sized companies (Gelei, 2008).

A difference between the concepts of *purchasing and procurement* should also be noted. Procurement is a key term that includes several core business functions thus it must be considered as a central element of the organization's corporate strategy. Procurement is the "process of acquiring goods, works and services, covering both acquisition from third parties and from in-house providers. This process spans the whole cycle from identification of the needs, through to the end of a services contracts or the end of the useful life of an asset. It involves options appraisal and the critical 'make or buy' decisions, which may result in the provision of services in-house in appropriate circumstances" (NPS, National Procurement Strategy, 2003). Purchasing is a subset of procurement, it usually refers only to the purchase of goods or services.

Using the concepts introduced above, a review of the literature was carried out using the Scopus database to identify relevant scientific work. The search terms used are introduced in Table 1 along with the number of hits in the database.

Table 1 – Searching methods

Search no.	Search term 1	Search term 2	Search term 3	Hits in: article title/abstract/keyword
1	green	SME	supply chain	24
2	sustainable	SME	supply chain	60
3	green	Small and medium enterprise	supply chain	28
4	sustainable	Small and medium enterprise	supply chain	44
5	green	SME	purchasing	4
6	sustainable	SME	purchasing	2
7	green	Small and medium enterprise	purchasing	2

8	sustainable	Small and medium enterprise	purchasing	3
9	green	SME	procurement	5
10	sustainable	SME	procurement	8
11	green	Small and medium enterprise	procurement	6
12	sustainable	Small and medium enterprise	procurement	11

The 12 different searches resulted in 197 articles. Removing the duplicates from the result lists, the final sample consisted of 139 articles, which I analyze in the next section.

Results of the literature review

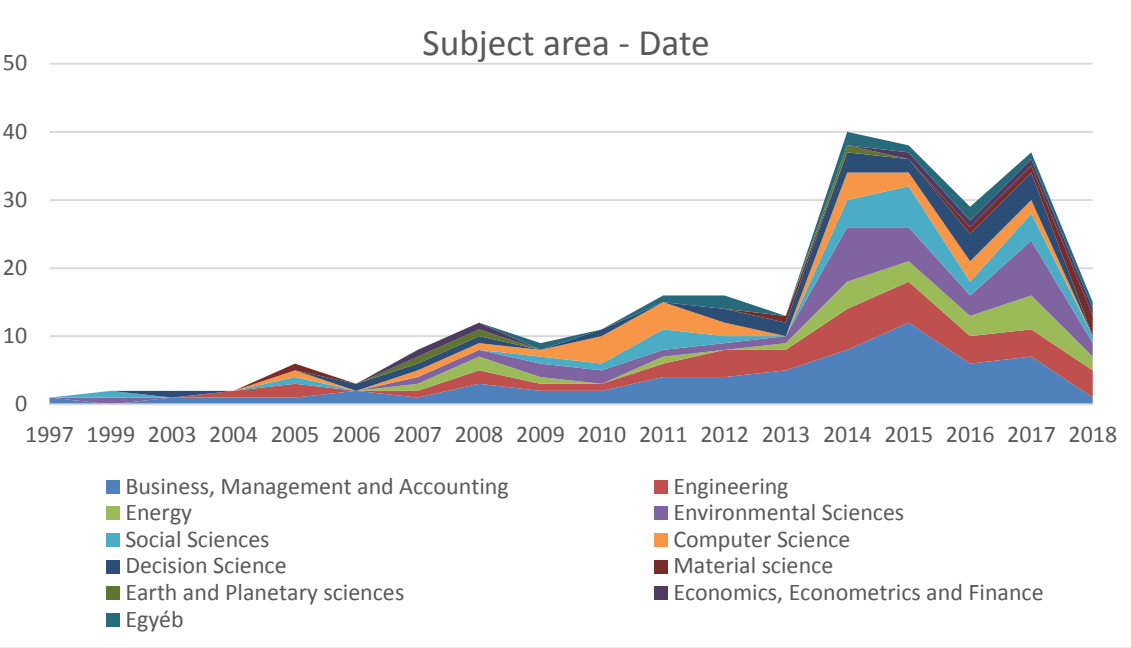
Green supply chains were first mentioned in the literature in 1996 (Handfield, Robert B., looking at best practices from the furniture industry and Sarkis, Joseph, introducing a systemic evaluation model for environmentally conscious business practices and strategy), but neither of these articles reflect on the role of SMEs in green supply chains. The first studies describing sustainable supply chains were published only four years later in 2000 (see Nagel, M.H,: Environmental supply-chain management versus green procurement in the scope of a business and leadership perspective and Zhou, Z. Cheng, S. Hua, B. : Supply chain optimization of continuous process industries with sustainability considerations), but these also lack an SME perspective.

The 1990s show a significant increase in the literature regarding the environmental practices of SMEs, but most of the research aimed at either concrete technological solutions or their application in small and medium enterprises or took the perspective of cleaner production and environmental management systems. It is only in 2003 that Chambra refers to sustainability as a strategic competitive advantage for SMEs along the supply chains. In 2004 Bevis and Ratchev illustrated the importance of knowledge management and lack of know-how at SMEs, while Macherson emphasized the importance of infrastructure development for SMEs in 2005. Most studies found from 2006 examined the importance of knowledge management to build on competitive advantage, while supply chain strategies, such as load sharing initiative, supply chain collaborations and transport sharing, gained more emphasis as well (Martin, Wagner). Green approaches, organizational developments to reduce life cycle impacts and improve environmental performance and new and more accurate sustainability indicators for SMEs were the main topics discussed in 2007 (Rao, Beynon, Woolman, Bridges). Later, the examination of barriers has gained more and more importance in the context of case studies. A significant number of studies deal with the motivation factors in SMEs, as well as new business models available to them, while questions of infrastructure development, opportunities for future digital commerce provided by Internet were also raised as other relevant factors in the literature. Research has mainly emphasized the importance of IT infrastructure to engage in supply chains, while articles mostly analyzed the environmental behaviors of SMEs, the need to create a sustainable business cycle and the development of new techniques for the selection of suppliers from large companies in 2012. In Hungary, Orsolya Diófási-Kovács also dealt with the tools and strategies of green procurement (Diófási-Kovács, Valkó, 2017), but she studied the subject in the study more from the point of view of the Hungarian public and private organizations, thus affecting not primarily the role of SMEs. More recently CSR and the approaches of eco-innovation, eco-efficiency and eco-design, as well as the infrastructure and technology aspects of Industry 4.0 have been considered by the authors of relevant research papers.

The sample has covered the literature from 1997 to the present. Most of the studies were published within the domain of ‘business, management and accounting’, but several

articles have been published within the topic area of engineering and environmental science. The time distribution of topics in articles is given in Figure 1.

Figure 1 – Subject area of relevant publications by date of publishing



The studies in the examined sample were primarily generated in the following countries: United Kingdom, India, Malaysia, Italy, United States, China, Indonesia, Poland, Taiwan, Spain, Brazil, Canada, Denmark, France and Netherlands.

The following table shows the types of publications and the methodology used by the articles in the sample.

Table 2 – Types of publications and the used methodology

	Article	**Conference paper**	**Book chapter**	**Sum.**
Case study	13	5	2	20
Questionnaire survey	8	2	1	11
Review of literature	6	6	4	16
Conceptual paper	58	31	3	92
Total	85	44	10	139

From the beginning (from 1997 to 2007) journal articles appeared and the role of SMEs in GSC and SSC has been in the agenda of the rapidly growing conference papers since 2007. Case studies are most likely dealing with sustainability practices as a long-term investment opportunity (Cambra, 2003) from 2010, load sharing as a supply strategy for sustainable growth of SMEs (Wagner, 2006), but the third most quoted article on the subject will be discussed later (Lee, 2008). The survey method has only been used since 2012 since when article using this method appear every year.

Case studies are usually concentrated around the development of a new method, business model and sustainability indicator that aims to improve the performance of the given SME in the viewpoint of its economic, organization and sustainability. In addition,

several case studies have been devoted to the study of knowledge management, IT structure and logistics, and the relationship between supply chain actors. Case studies are typically made in Switzerland, Sweden, Spain, Italy, Scotland, USA, and United Kingdom).

The first striking difference between case studies and questionnaires is that case studies focus consistently on countries of the Western or developed regions, while questionnaire surveys focus generally on the eastern or developing provinces (Korea, Taiwan, Malaysia, China, Nigeria, India). The main topics of the questionnaires are GSCM in business and environmental performance, SME motivation for GSCM acceptance, assessment of information and communication technology level, identification of innovation links, development of new sustainable development indicators and building existing organizational models.

It is worth to observe similarities and differences between the examined case studies and questionnaires and presented industries (conceptual paper). Studies in steel and mechanical industry (including automotive industry) initially focused on the crucial importance of knowledge management, including lack of expertise (Bevis, 2004, surveyed region: United Kingdom), while a new study looked at the situation of automotive SMEs in the green supply chain five years later, whereby according to the author new business models were needed for SMEs to survive. (Nousala, 2009, Australia). Following this Liu analyzed the role of 2014 GSCM in the environmental performance in Taiwan five years later. He found that SMEs mostly used reactive approaches to respond to external pressures. Peruzzini (2014) also worked on the definition of a new and unique product life cycle, looking at risk management of SMEs in Sunjka, 2015. He considered limited management and business knowledge, lack of financing, and exposure to cumbersome regulatory and bureaucratic requirements as major obstacles in this regard. He also referred to the rapidly changing economic environment surrounding SMEs as a major obstacle, since if unforeseen disturbances arise, SMEs may be more sensitive than their larger counterparts. Li, in 2017, developed the industry's sustainable development indicators for the Indian automotive industry. Finally, according to Ashton, who examined green motivation of SMEs in 2017, most companies behave in response to green practices as internal motivation. However, these internal motivations are primarily driven by cost and competitiveness concerns rather than social responsibility. As far as the oil and natural gas industry is concerned, Araujo described the importance of organizational development and the implementation of a more efficient management system that can be applied without endangering resources. Suppliers in mining- and mineral industries consider ISO14000 certification as decisive in SSCM practice for SMEs (Jia, 2015). Jia notes that environmental certification is indispensable for increasing the sustainability performance of Indian mining and mineral industries. The studies on construction and timber industry focus primarily on eco-efficiency, the analysis of raw material suppliers (Charmondusit, 2014) and the development of a conceptual model for company performance that attempts to explain how GSCM performance is different from companies depending on the type of GSCM practice and the SME character (Susanty, 2016). Han's new model has shown that all technology determinants in the study have a significant impact on the acceptance of green production in 2017. De Coster experimented with a new business model in the textile industry in 2009, which aimed to improve both economic and environmental performance. Kachba highlighted the significant technological failure of the textile industry SMEs in 2015, while Ashby looked at the interactions between network actors through social network theory in the same year. In the food industry, Cambra first introduced sustainability practice as a long-term investment in 2003. Little highlighted

the need for strengthening the available knowledge base of SMEs in 2009. Chambra further argued his earlier statement that sustainability practices should be treated by companies as long-term investments, not as an immediate cost. Svensson focused on the need to create a sustainable business cycle in 2012, while Tsekouropulos wanted to develop a new organizational model responding more efficiently to the needs of consumers in 2014.

Comparing industries, it has become apparent that the biggest external pressure is exposed to the steel and automotive industries that is why most of the studies deal with these industries.

I expected a significant difference between the studies in the examined regions, so my sample was broken down separately for the developed and developing regions. However, studies turned out to focus on the same issues in both of these regions: the importance of developing knowledge management, the necessity of the infrastructure, financing shortages, developing new supply chain strategies and new business models. One possible reason for the similarity may be that SMEs face similar difficulties worldwide when joining global supply chains. Since joining global supply chains is the primary goal, culture as a determining factor is less significant.

The Journal of Cleaner Production as an outlet of research publications is dominating the field with a total of 16 articles from 2008 to the present. It is worth noting that 6 out of the 10 most frequently quoted articles were also published in this journal (Mathiyazhagan, 2013; Klewitz, 2014; Moore, 2009; Coté 2008; Santolaria, 2011). The second journal publishing most of the articles dealing with the connection of GSC, SSC and SMEs is the Supply Chain Management Journal. The first article was published in 2006 looking at a qualitative case study of Scottish companies. Articles in both the Supply Chain Management Journal and the Journal of Cleaner Production focus on SMEs primarily from the viewpoint of the area of business, management and accounting.

According to Scopus, the most frequently cited article (213 citations) in the research topic is Lee's 2008 article title "Drivers and enablers that foster environmental management capabilities in small and medium-sized suppliers in supply chains". This article examined the suppliers of two large companies within a case study and explored factors that help support environmental issues in small and medium-sized enterprises. The second most frequently cited article (with 169 citations) is Mathiyazhagan (2013): "An ISM Approach for Barrier Analysis in Implementing Green Supply Chain Management". Klewitz approached in his article in 2014 "The Sustainability-oriented Innovation of SMEs: A Systematic Review" (137 citations) SMEs from the aspect of sustainable business models and furthermore he highlighted the importance of eco-innovation and sustainability-oriented innovation (SOI). His main theoretical contribution was to develop an integrated framework for SME sustainability-oriented innovation. Moore analyzed the importance of using fast-growing communication technologies and the essential role of internal incentive forces in his study on sustainable strategies for small and sedium-sized snterprises for sustainability and increased value creation in 2009. Following this Lee examined the role of GSCM in SME business performance through a questionnaire survey in Korea, in his article on green supply chain management and organizational performance in 2012. In Walker's study 2008 „Fostering sustainability through sourcing from small businesses: public sector perspectives" explores opportunities for promoting sustainable development through the procurement of small and medium-sized enterprises by the public sector. Jorgensen examined the concept of governance in the global value chains from a SME point of view in his article "Sustainable competitiveness in global value chains: How do small Danish companies behave?" in 2006. Camarinha looked at the organizational sustainability aspect of the basics and mechanisms for creating

advanced network-based industries in his "Ecolead and CNO base concepts" in 2008. According to the article "Influences, Practices and Opportunities for Environmental Supply Chain Management in Nova Scotia SMEs" written by COTE in 2008, "GSCM's most restrictive factors are the lack of funding and resource allocation problems. Santolaria explained sustainability as one of the most crucial factors in corporate innovation in his article "Eco-design in innovation driven companies: Perception, predictions and the main drivers of integration the Spanish example " in 2011.

Main focus areas and questions for future research

Overall, the most important focus areas of the research in the field are: Corporate Social Responsibility, Environmental Management Systems, logistics, information and communication technologies, motivational factors and barriers to implementation, and business models supporting green supply chains. Four issues related to CSR (2013, 2014, 2017) dealt with the integration of CSR in large corporations into small and medium-sized companies, the key factors in CSR adoption, CSR tools developed and applied by SMEs, and furthermore with comparing CSR tools developed by large companies. In the studies, it was commonly found that in most cases CSR was taken over by small and medium-sized companies having obviously positive effects on the companies involved. The role of ISO certification in the SME supply chain practice is also considered as a positive factor. According to Rao (2007) ISO-certified SMEs perform better both in the environmental and economic terms, while Jia highlighted that ISO14000 certification practices play a decisive role in SSCM practice in his study in 2015. However, similarly to the introduction of CSR, Ramakrishnan's research claims that EMS IS0 14001 is typically used by SMEs for external pressure and compliance with governmental standards in 2015, while its positive returns can be measured as well. The issue of logistics is primarily addressed to government and policy regulation, but backlog logistics and the expected logistical effects of industry 4.0 are also considered as important factors in the life of SMEs supply chains. Studies consider logistics as a field needing infrastructure and technology development but having significant strategic importance. Another critical issue is the development of communication technology and infrastructure in the green supply chains, especially for SMEs, if they want to enter the global supply chain markets. The importance of infrastructure and communication technology is emphasized by several authors (Macpherson, 2005, Singh, 2010, Plotner, 2010, Jevtic, 2013, Iffah, 2015, Fuza, 2015). The authors also agree on the importance of knowledge management in the issue of green and sustainable supply chains for SMEs considering it as one of the barrier factors in the first instance. The same obstacle in the studies is the lack of fundings. These problems will probably be exacerbated by the industry's 4.0 expansion. Limited capacities and resources of SMEs also counterwork the impact of effective environmental responses.

Due to the financial constraint faced by SMEs new entry-level costs are high. A good solution for these questions is the development of various synergistic, supportive customer-supplier relationships between large companies and SMEs. In contrast, motivations include government incentives and support programs as well as access to new business markets. Considering all examinations a number of studies have been devoted to the organization, value network, business and relationship development model helping SMEs optimize supply networks and examine structural relationships in the past 10 years. However, examining these studies in chronological order shows clearly that the main obstacles mentioned above are still the main barrier factors in the life of SMEs. In Hungary, Gyöngyi Vörösmarty and Imre Dobos addressed the motivation and ethical issues of green procurement, though they did not focus on the focus of SMEs.

Conclusion

Overall, the operation of green and sustainable supply chains can be only successful if, in addition to coordinated processes, the chain members have the same goals and focuses with regard to customers. This requires a strategic integration between the participating members of the supply chain. This review of the literature demonstrated that several aspects of green and sustainable supply chains relating to SMEs has been uncovered by research to date, but still more knowledge is needed in order to foster the integration of sustainability into SME practice.

Questions to be further explored include a better understanding of the motivation factors of SMEs and how they can be influenced by environmental and economic policy, as well as how new technological innovations, including the implications of the 4th industrial revolution can be used by SMEs to take advantage of greening supply chains.

New forms of cooperation should also be discovered, as well as the overall impacts of emerging business models, and how SMEs can implement them in their daily operations.

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