Full title: Innovation in sustainable supply chains – A reflection on resources and SME collaboration with supply chain stakeholders

Short running title: Innovation in sustainable supply chains

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Abstract

Supply chain management is increasingly challenged to integrate environmental (e.g. recyclability of products) and social issues (e.g. sound working conditions), that is, establish sustainable supply chains. If small and medium sized enterprises (SMEs) view these sustainability issues as an opportunity to develop sustainability-oriented innovations and, at the same time, engage in supply chain innovation they can realize competitive advantages. To do so SMEs may collaborate with supply chain stakeholders (e.g. customers, NGOs) whereby they gain access to additional resources such as material, capital and information. Little research, however, has been dedicated to the question with which stakeholders SMEs can collaborate to innovate for sustainability while taking the entire supply chain into account. For this purpose this research presents a framework that discusses types of resources and partners in and related to sustainable supply chains. To take an SME perspective is important as they make out the majority of companies worldwide and as a group play an important role to realize sustainable development. This conceptual paper contributes to still preliminary research on an SME's role as a focal company in sustainable supply chains and is informed by the resource based view. From the literature study propositions for future research are put forward.

Keywords

sustainable supply chain management, sustainability-oriented innovation, SME

1 Introduction

Supply chain management (SCM) is increasingly discussed with regard to environmental and social issues (e.g. Carter, Ellram and Ready 1998; Carter and Rogers 2008; Seuring and Müller 2008) as recent systematic literature reviews document (Carter and Easton 2011; Sarkis, Zhu and Lai 2011). The integration of these issues into conventional SCM is also termed as *sustainable supply chain management* (SSCM) (e.g. Carter and Rogers 2008; Seuring and Müller 2008; Bai and Sarkis 2010; Gold, Seuring and Beske 2010) which can be a result of opportunity recognition as well as requirements and pressures from diverse company-external and internal stakeholders (Hall 2000; Walker, Di Sisto and McBain 2008). Although SSCM research incorporates the perspective of large, multinational companies that use global sourcing and have to deal with a vast number of suppliers and diverse sustainability challenges across the supply chains (Beske et al. 2008, Reuter et al. 2010), it is necessary to direct more research to SMEs. First, they play a considerable role economically as figures for the EU-27, for instance, demonstrate where SMEs make out 90% of all businesses and contribute to an estimated 60% of the industrial pollution (ECEI 2010; Schmiemann 2008). Secondly, SMEs are attributed with innovation propensity for sustainability (e.g. Noci and Verganti 1999; Bos-Brouwers 2010; Darnall, Henriques and Sadorsky 2010), and, thirdly, even though SMEs are less socially exposed (Hall 2000, 2006), they may be particularly responsive to supply chain, internal and regulatory stakeholders (e.g. Darnall, Henriques and Sadorsky 2010).

Stakeholders are characterized as “any group or individual who can affect or is affected by the achievement of the organization’s objectives” (Freeman 1984, p. 46). Relevant stakeholders are, one the one hand, members along the supply chain, so called “primary supply chain stakeholders” (Cetinkaya 2011; i.e. suppliers, customers), and on the other, “nontraditional chain members” (Pagell and Wu 2009, p. 39 with reference to Johnston and Linton 2000) – also termed “secondary supply chain stakeholders” (Cetinkaya 2011). For instance, to collab-

orate with secondary stakeholders who can be associated with the management of sustainable supply chains (e.g. competitors, non-governmental organizations (NGOs), or science partners) is helpful if these stakeholders improve cooperation and innovation along the entire supply chain.

The present research is interested in two perspectives on how SMEs can translate environmental and social issues into innovations. First, companies can develop *sustainability-oriented innovations*, i.e. enhanced or new products/services (e.g. life-cycle orientation) that are or in comparison to a prior version environmentally or socially superior as well as refined processes to increase their sustainability performance (Hockerts 2003; Schaltegger and Wagner 2008; Hansen, Grosse-Dunker and Reichwald 2009; Wagner 2011). Thereby, companies can realize competitive advantages through product differentiation to unlock new markets or by establishing new networks to exchange resources such as information with diverse stakeholders (e.g. Roome 2001; Schaltegger and Wagner 2008; Bos-Brouwers 2010). Secondly, companies can develop *supply chain innovations* (SCIs) which refers to additional value creation for stakeholders as a result of collaboration between them or the adoption of sustainability-oriented innovations by suppliers (e.g. Franks 2000; Hall 2000, 2006; Arlbjørn, de Haas and Munksgaard 2011). This paper combines these two perspectives (e.g. Roome 2001; Liao, Hong and Rao 2010; Arlbjørn, de Haas and Munksgaard 2011; Sarkis, Zhu and Lai 2011) and asks how innovation for sustainability in SMEs comes about if they collaborate with stakeholders in and beyond the supply chain. This is important, because, if innovations are life-cycle oriented it is reasonable to assume that SMEs not only have to develop a new design or improved services, but also need to think of stakeholder collaboration in and beyond the supply chains in order to exchange necessary resources such as material, capital and information (Seuring and Müller 2008). Furthermore, as SMEs experience resource scarcity (Bianchi and Noci 1998) and sustainability issues are considered to be interconnected and often complex

(Roome 2001; Schaltegger 2011) a collaborative approach to innovation for sustainability is beneficial (Clarke and Roome 1999; Roome 2001; Van Kleef and Roome 2007). Hence, the exchange and access to resources along the supply chain is crucial for innovation and, thus, for a theoretical underpinning of the conceptual work, we deem the resourced-based view as introduced by Wernerfeld (1984) and Barney (1991) as appropriate to discuss the linkage between the exchange of resources and stakeholder collaboration.

Although quite a number of papers has discussed the SME's role in sustainable supply chains (e.g. Wycherley 1999; Jorgensen and Knudsen 2006; Andersen and Skjoett-Larsen 2009) the focus is often on its position as a supplier to a larger company. Few research is dedicated to an SME's role as a focal company, i.e. it governs the supply chain (Seuring and Müller 2008 with reference to Handfield and Nichols 1999; Schary and Skjøtt-Larsen 2001), which has to deal with sustainable supply chain issues because of its own range of products and services on offer and as a supplier of goods to its end customers (e.g. Jorgensen and Knudsen 2006; Ciliberti, Pontrandolfo and Scozzi 2008).

Hence, it remains unclear with which types of primary and secondary supply chain stakeholders SMEs may collaborate, particularly in a business-to-consumer (B2C) context, in order to access a diversity of resources to innovate for sustainability. In order to address this gap, we aim to answer the following research question: *How can collaboration in and related to sustainable supply chains contribute to the development of sustainability-oriented innovations in an SME?*

The argument is developed in five steps. After the introduction, the second section gives an overview on the literature on SSCM and SCI which is put into the context of SMEs. As we focus on collaboration with *primary* and *secondary* supply chain stakeholders and the exchange of resources we argue from a resourced-based view (Wernerfelt 1984, Barney 1991). The third section develops a conceptual framework of SME collaboration with partners in and

related to supply chains and discusses associated resources. The subsequent section puts forward propositions for future research which leads to the conclusion in the last section.

2 Literature review

The present research aims to provide insights into the types of stakeholders SMEs can collaborate with to exchange resources in and beyond the supply chain when they develop sustainability-oriented innovations that are offered to customers. In this B2C context an SME can be regarded as a focal company. First, it governs the supply chain, secondly it has direct contact to customers, and, thirdly, an SME designs the product or services offered (Seuring and Müller 2008 with reference to Handfield and Nichols 1999; Schary and Skjøtt-Larsen 2001). Consequently, an SME has to manage its supply chains to ensure the supply of resources and goods.

As our research question is related to SSCM, collaboration, innovation for sustainability as well as SCIs, and SMEs, we consulted literature in all four areas to better grasp how they may be linked. Throughout the literature review we adopt the resource-based view which is one of the most important theoretical approaches in SSCM literature (Carter and Easton, 2011). Moreover, Sarkis, Zhu and Lai (2011) identified in their literature review that the resourced-based view implies a broad set of resources and capabilities leading to a company's competitive advantage. They refer to Lai, Cheng and Tang (2010), for instance, who found that knowledge about green issues across the whole supply chain can be understood as a resource itself.

Barney (1991, p. 101) describes firm resources as those which

> "include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness."

According to explanations by Barney (1991), Halldórsson, Skøtt-Larsen and Kotzab (2003), Carter and Rogers (2008) as well as Gold, Seuring and Beske (2010) and Sarkis, Zhu and Lai (2011) the main characteristics of the RBV can be summarized as follows:

- The *goal* is to gain competitive advantages by the possession and employment of company-specific resources and capabilities that are valuable, rare, imperfectly imitable, and not strategically substitutable; such as flexibility (e.g. Liao, Hong and Rao 2010) or in the context of SSCM greening the supply chain (e.g. Gold, Seuring and Beske 2010; Lai, Cheng and Tang 2010)
- The *problem orientation* focuses on competence development.
- *Relationships* are established to have access to complementary resources.
- The *assumption* is that strategic resources are heterogeneous across companies and that there is bounded rationality, i.e. a necessity of trust between the collaborating partners.

The following four sub-sections of our literature analysis discuss collaboration and exchange of resources in and related to supply chains, in particular.

2.1 Management of sustainable supply chains

For several years, SCM has also been discussed with regard to environmental and social issues (e.g. Carter, Ellram and Ready 1998; Carter and Rogers 2008; Seuring and Müller 2008; Carter and Easton, 2011, Sarkis, Zhu and Lai 2011). Referring to Jayaraman, Klassen and Linton (2007) and Cruz (2008), Pagell, Wu and Wassermann (2010, p. 58) argue with regard to SSCM that

> "evidence is growing that the field is reaching a critical tipping point where wide-scale adoption of sustainable sourcing practices may potentially become a dominant dynamic in the supply chain context".

The motivation for SSCM can result from pressures and requirements of various company-external stakeholders (e.g. customers, NGOs and governments; e.g. Hall 2000) as well as internal stakeholders (e.g. top management, employees, sustainability manager; e.g. Walker, Di Sisto and McBain 2008) to improve the sustainability performance of products, services and processes (e.g. Jorgensen and Knudsen 2006). In an SME and B2C context external pressure by NGOs and media might not be the first and foremost reason for implementing SSCM since smaller companies are less socially exposed (Hall 2000, 2006). Nevertheless, SMEs may be stimulated by customer requirements to develop environmentally friendly and socially responsible products and services that can be considered as a market-opportunity.

When a company as a focal company implements SSCM in order to offer products and services that fulfill sustainability requirements across its supply chains and that are or in comparison to a prior version environmentally or socially superior the company has to handle the complexity that arises from the integration of all three sustainability dimensions. The following definition by Seuring and Müller (2008, p. 1700) implies that SSCM can be rather complex regarding the different requirements and stages of the supply chain

> "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements. In sustainable supply chains, environmental and social criteria need to be fulfilled by the members to remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria".

As the definition highlights, on the one hand, resources such as material, information and capital – as in traditional SCM – have to be managed when sustainability issues are integrated in SCM. On the other, partners along the supply chain as well as other stakeholders and their

requirements play a crucial role in implementing SSCM. Regarding collaboration with other stakeholders, Pagell and Wu (2009, p. 39) suggest the "reconceptualization of supply chain" meaning that stakeholders which do not form part of the traditional supply chain can help the supply chain members (i.e. focal company, suppliers, customers) to collaborate.

When collaboration in and related to sustainable supply chains is analyzed in the context of SMEs developing innovations, diverse stakeholders appear *in* (e.g. suppliers, customers) and *related* (not part of the traditional such as NGOs; Pagell and Wu 2009) to the supply chain. To reduce the complexity of the supply chain, stakeholders can also be categorized into primary and secondary supply chain stakeholders (Cetinkaya 2011). Whereas primary supply chain stakeholders have direct and more formalized relationships to the focal company, secondary supply chain stakeholders are influential without being directly linked to the company's core business (Cetinkaya 2011).

These stakeholders can be further distinguished into different types of stakeholders based on their relationship to the focal company. Originally introduced by Henrique and Sadorsky (1999, p. 89) four types of stakeholders can be differentiated:

- *Organizational stakeholder*: With a tight link to the focal company these stakeholders "have the ability to impact [an organization's] bottom line directly" (Henrique and Sadorsky 1999, p. 89). Across the supply chain, on the demand side customers and on the supply side suppliers are the stakeholders which directly impact the company's downstream and upstream supply chain processes (e.g. Klassen and Vachon 2003). Moreover, the company's employees and shareholders are directly linked as they make resources such as knowledge and capital available (e.g. Klassen and Vachon 2003; Zhu and Sarkis 2006).
- *Regulatory stakeholders*: They "either set regulations or have the ability to convince governments to set standards" (Hall 2006, p. 235). Typical regulatory stakeholders are

governments, (national and international), the legislative, or standardization organizations (e.g. Carter and Dresner 2001; Walker, Di Sisto and McBain 2008) that introduce rules, laws, standards and norms. Moreover, competitors, trade associations or informal networks (e.g. Henrique and Sadorsky 1999) can influence how the regulations are set and adopted.

- *Community stakeholders*: NGOs, local communities, advocacy groups as well as local residents are stakeholders "who can mobilize public opinion" (Hall 2006, p. 235). This leads to both external pressure as well as motivation for the company to seize the opportunity to develop and offer sustainability-oriented products and services (e.g. Wycherly 1999; Hall 2000).
- *Media*: For several years press and media's interest in the company's sustainability-oriented business, products and services as well as in their supply chain activities has become notable (e.g. Walker, Di Sisto and McBain 2008). Although, as mentioned above, SMEs are less socially exposed due to their size, a smaller company may overall be stimulated by increased media interest on corporate sustainability to develop environmentally friendly and socially responsible products and services that can be considered as a market-opportunity.

Whereas this typology already provides a clear distinction between diverse stakeholders in and related to the sustainable supply chains, this paper proposes to consider an additional type of stakeholder, that is, "science partners" (e.g. higher education institutions, universities, research institutes; cf. e.g. Pittaway et al. 2004; Cetinkaya 2011). If universities, for example, form more collaborative relationships with industry (Perkman and Walsh 2007) they turn into key sources of knowledge (Etzkowitz and Zhou, 2006; Huggins and Johnson 2009) and may positively impact the innovation capacity of companies (Laursen and Salter 2006; Bishop et al. 2011).

Against this background the possible primary and secondary supply chain stakeholders are represented in *Figure 1*. All these stakeholders can enter a relationship with the focal company with regard to sustainability issues.

Insert Figure 1 about here

Due to the fact that over the last years the amount of stakeholder requirements has increased for corporate responsibility as well as for environmentally friendly and socially responsible products and services (Carter and Jennings 2004; Seuring and Müller 2008; Sarkis, Zhu and Lai 2011), collaboration with the various stakeholders in and related to sustainable supply chain deserves further attention.

2.2 Collaboration with supply chain stakeholders to exchange resources

Collaboration can be defined as *"an interactive process* among *multiple participants* to combine *complementary resources"* (Hartono and Holsapple 2004, p. 6). Collaboration facilitates companies to identify issues needing to be addressed in innovation for sustainability (Van Kleef and Roome 2007). Moreover, it enables access to new or complementary resources (material, capital and information) and enhances an SME's problem solving capacity (e.g. Roome 2001; Lozano 2007; Jenkins 2009). For instance, if SMEs establish comprehensive stakeholder networks through partnerships with primary and secondary supply chain stakeholders, they can share and exchange information, search for innovation through joint problem identification, seek legitimacy for innovations, or secure and identify future markets (Van Kleef and Roome 2007). Based on this and in accordance with the above mentioned SSCM definition by Seuring and Müller (2008), SMEs do not just have to deal with a multitude of stakeholders in and related to the supply chain when they develop sustainability-oriented in-

novations, but they also have to manage the resources *material, capital and information*. More precisely these resources have to be transferred between the partners.

Material, in particular, may not only be described as feedstock or a physical (intermediate, finished or waste) product, but also by its characteristics with regard to its environmental or social impact (e.g. Hau and Billington 1993). Aspects such as an improved eco-efficiency – defined as the ratio of value added (monetary measure) to environmental impact added (ecological measure, Schaltegger and Sturm 1990) – recyclability of a product, or manufacturing criteria (e.g. adequate working conditions with reasonable wages) also play a crucial role for first the innovation and design process when developing new products and, secondly, for supply chains that follow sustainability requirements (Lamming and Hampson 1996; Preuss 2005; Michelsen and Fet 2010). Additionally, as already discussed above, environmental issues, such as eco-efficiency, are now recognized as sources of strategic change in terms of eco-innovation or green technologies, also for SMEs (e.g. Noci and Verganti 1999). Nevertheless, the design of innovative products and services does not just imply to consider new or different types of material, these innovations also need to have a sound financial concept.

Therefore, *capital* is the resource necessary to invest in further development such as new products and services, advanced infrastructure, or SCIs (Klassen and Vachon 2003; Hall 2006). Moreover, capital is an integrated part of daily business between the focal company and its suppliers and customers (i.e. sellers and buyers), since money represents a value as well as a medium of exchange of offered products and services (e.g. Simmons 1947). Although this just mentioned characterization of capital seems simple, it has to be considered that the assessment of value may differ, for instance, between distinct organizations, countries, or industries. As a consequence, negotiation about price and value of products and services are standard practice in SCM and purchasing. Such negotiation takes place between the primary supply chain members as well as between the focal company and its stakeholders that

are related to supply chains. However, for collaboration in supply chains not every transfer/service is purely related to capital because the exchange of information can also be of value although it is not necessarily charged for.

The management of the resource *information* can, according to Schaltegger and Burritt (2000, p. 404), be understood as "the creation of purpose-oriented knowledge". Although there are various definitions of knowledge and of associated concepts (e.g. for a typology of knowledge management, cf. Geisler, Lavergne and Earl 2007) this paper refers to the understanding of knowledge provided in Grant's knowledge-based view where *knowledge* is considered an important strategic resource that can lead to competitive advantage for the firm (Kogut and Zander 1992; Grant 1996; Gold, Seuring and Beske 2010). Information and knowledge transfer is not only necessary within the SME's internal structure but also with external stakeholders. For instance, while Foster and Green (2000) focus on the information flows and links for sustainability-oriented innovation processes they also refer to consultants and universities as possible external collaboration partners for innovation. In addition to the sheer quantity of information, the variety of information and knowledge flows from the different stakeholders should be taken into account. For the purpose of transferring knowledge, collaborative partnerships can be built between a company and its external stakeholders in and related to the supply chain (Matos and Hall 2007). These cross-boundary spanning activities stimulate the combination of expertise and exchange of ideas. This, however, is foremost beneficial if an SME's scarce resources (e.g., capital) are not consumed exceedingly. Furthermore, successful collaboration relies on a partnership where similar goals are shared with equal power; otherwise collaboration can lead to repression, unfairness and asymmetrical power relations (Hardy and Phillip 1998).

On the whole, collaboration may be one fruitful engagement strategy to develop sustainability-oriented innovations along sustainable supply chains. For a better understanding of how

innovative approaches can be linked to SSCM, the key characteristics of supply chain innovation with regard to sustainability are presented next.

2.3 Supply chain innovation

The notion of *supply chain innovation* has been adopted in the SCM (e.g. Franks 2000; Walker, Bovet and Martha 2000; Sanders 2005) and SSCM literature (e.g. Hall 2000, Zaklad et al. 2004; Hall 2006). Nevertheless, little comprehensive research exists (e.g. Arlbjørn, de Haas and Munksgaard 2011). According to Walker, Bovet and Martha (2000, p. 4) companies that are leading in the design of supply chain innovations are characterized by five attributes: aligning costumers, long-term collaboration with their suppliers, agility, fast flows and use of digital technology. Based on a review of the present literature Arlbjørn, de Haas and Munksgaard (2011, p. 8) define SCIs as

> "a change (incremental or radical) within the supply chain network, supply chain technology, or supply chain processes (or combinations of these) that can take place in a company function, within a company, in an industry or in a supply chain in order to enhance new value creation for the stakeholder".

Hall (2006) also emphasizes the inter-organizational character of SCI because resources such as information have to be exchanged. Moreover, he defines environmental supply chain innovation as "when a supplier, under the advice, coercion or direction of a customer firm, adopts an environmental innovation" (Hall 2006, p. 234)

As sustainable supply chains incorporate environmental, social and economic performance dimensions (e.g. Carter and Rogers 2008; Seuring and Müller 2008) sustainable supply chain innovations can also be viewed in the light of the above mentioned stakeholder relationships. Cetinkaya (2011, p. 129), for instance, indicates with regard to larger firms that "it is non-regulatory pressures rather than regulations that have proved to be the key drivers of sustaina-

ble supply chain innovations". With regard to SMEs and traditional SCM, Tumaini and Zheng (2011) find that SMEs are still not as capable to utilize SCM practices in comparison to larger companies.

When SCIs are characterized according to the above definitions by Hall (2006) and Arlbjørn, de Haas and Munksgaard (2011) further attention should be directed to the different resources that are exchanged between the focal SME and its primary and secondary supply chain stakeholders. For this purpose, the following sub-section elaborates on SME specificities in the context of innovation for sustainability and the resource-based view.

2.4 SME specificities in the context of innovation for sustainability

Even though past research has found that SMEs are faced with a range of disadvantageous characteristics, such as difficulties in attracting venture capital, resource scarcity, initial inhibition for radical innovation (failure may prove fatal), or limits in their capacity to monitor technological knowledge (Spence 1999; Del Brio and Junquera 2003; Jenkins 2004; Bos-Brouwers 2010), research also recognizes that SMEs may be able to capitalize on advantageous characteristics, such as less structural inertia, flexibility, or entrepreneurial nature due to owner-manager structure (Jenkins 2009; Darnall, Henriques and Sadorsky 2010). For instance, with their ability to respond quickly to customer demands, SMEs may develop innovative products and services to exploit and dominate niche markets (Simon 1992; Noci and Verganti 1999; Jenkins 2009).

From an SME perspective the resourced-based view is relevant in order to explain the unique resources, or more precisely, capabilities SMEs deploy in order to develop proactive environmental strategies, for instance (Aragón-Correa et al. 2010). Moreover, as mentioned above resources play a central role as SMEs are characterized to have resource scarcity (e.g. Bianchi and Noci 1998; Bos-Brouwers 2010), thus resource allocation is a central theme. Whereas

resource scarcity may restrict SMEs in their innovation behavior, at the same time it may push SMEs to use their resources differently in order to seek competitive advantage (Noci and Verganti 1999; Darnall, Henriques and Sadorsky 2010). Hence, SMEs can use their rare and valuable resources, such as flexibility to respond to an increase in market demands for sustainable products.

Moreover, SME's proximity to supply chain members such as customers (McAdam 2000) facilitates an SME to consider the whole life cycle of sustainable products. The life cycle-orientation of innovations may require companies in a B2C context to re-think the supply chain from a sustainable supply chain perspective in terms of stakeholder collaboration and material, capital and information flows (e.g. Seuring and Müller 2008).

Having outlined the relevant literature related to the paper's research objective, in the following section we integrate both perspectives, that is, collaboration with primary and secondary supply chain stakeholders as well as the deployment of resources. The result is a conceptual framework which incorporates partners and resources in and related to sustainable supply chains from an SME perspective.

3 Framework of partners and resources in and related to sustainable supply chains

The collaboration with stakeholders in and related to the supply chain from a resource based view can be structured first according to the different *collaboration partners* and secondly with regard to the exchanged *resources* (*Table 1*). For this purpose, the collaboration partners are classified as primary and secondary supply chain stakeholders and, furthermore, by the five different types of stakeholders (cf. 2.1). The categorization of resources is derived from the SSCM definition (e.g. Seuring and Müller 2008) and from a similar approach presented by Giannakis and Croom (2004) in their proposition of a SCM paradigmatic framework.

Insert Table 1 about here

The matrix in *Table 1*, distinguishes six categories (rows) of collaboration partners in connection with the resources (columns) that are exchangeable. In order to relate these categories to existing literature and practical application, each set is discussed by using appropriate examples where possible.

(1) Primary supply chain *& organizational* stakeholder

Customers and suppliers can be one key stakeholder for SMEs to develop new products/services (e.g. Qualey 2003; Hong and Jeong 2006) which also applies for sustainability-oriented innovation development. On the one hand, customers can pressure SMEs to avoid harmful substances in products and on the other hand innovative SMEs with more radical innovations can push customers towards more sustainable consumption (e.g. Walker and Preuss 2008).

In this set all three kinds of resources are important to improve the sustainability performance of products, services and processes, since SCIs can have an effect on the exchange of material, capital and information. With regard to the development of a new product with sustainable materials of a consumer good, for example, an SME can build a boundary-spanning team together with a number of selected suppliers and retailers/end consumers in order to get a common understanding of what the market is demanding and the suppliers are able to provide. This may also lead to innovation across the entire supply chain since new processes or techniques have to be developed. In a study on environmental performance in SMEs, Lefebvre, Lefebvre and Talbot (2003), for instance, find that learning for sustainability occurs along the supply chain with an SME's sustainability activity linked to processes of it suppliers and cus-

tomers. However, such collaboration with primary supply chain partners can also be difficult as the SME may not have the financial resources or power (e.g. Hardy and Phillips 1998) to initiate and push the whole SCI process.

(2) Secondary supply chain *& organizational* stakeholder

Stakeholders such as the SME's employees or shareholders that are not directly linked to supply chain management but are connected to the company may be of high relevance for developing innovations for sustainability by providing resources such as knowledge and capital. In SMEs capital funding by shareholders is not as common as in larger companies as an SME is typically owner-managed (Spence 1999; Jenkins 2004). Employees, in contrast to shareholders, not providing capital but the resource knowledge are important, as knowledge is a crucial company resource and essential for innovation (Kogut and Zander 1992; Grant 1996), both with regard to sustainability-oriented innovations as well as SCIs. If, for instance, an employee has acquired experiences with sustainability issues such as carrying out an eco-audit, this knowledge residing within the individual employee can be transferred through knowledge management processes or through the typical informal and at times more efficient communication channels within SMEs. Although the acquired knowledge is provided by external stakeholders (e.g. training institutions), this supplements a company's internal knowledge base. Overall, even though resources provided through secondary supply chain stakeholders and organizational stakeholders may be more difficult to access, less proximity may be of advantage for disruptive, that is, more radical innovations (Boschma 2005).

(3) Secondary supply chain *& regulatory* stakeholder

As regulatory stakeholders are regarded as collaboration partners that establish or can influence the setting of regulations (Henriques and Sadorsky 1999; Hall 2006) their impact on sus-

tainability-oriented innovations and SCIs can be viewed from the knowledge and financial perspective. On the one hand, collaboration with the local government bodies can lead to knowledge transfer of sustainability issues between the SME and public bodies (e.g. Bos-Brouwers 2010). For instance, public-private partnerships that aim at waste reduction or the introduction of eco-innovations can contribute to the sustainable development of the overall region. Furthermore, if a fit between an SME's buying conditions (instead of national or international) and a local government's public procurement policy is established (e.g. Walker and Preuss 2008) local sourcing may become more common. This may be favorable for at least two reasons: first, if SMEs source locally the CO_2 emissions are reduced and secondly, a geographic proximity may be accompanied with a similar interest in developing SCIs that are of advantage for the SME, its suppliers and the local government. Apart from the described exchange of knowledge with a regulatory stakeholder, SMEs' competitors can also contribute indirectly to the development of sustainability-oriented innovations by moving the whole sector forward, that is, a technology becomes sustainability standard (Henriques and Sadorsky 1999) and making it easier for individual SMEs to realize second mover advantages, which may minimize the risks of capital investments.

(4) Secondary supply chain *& community* stakeholder

An SME can benefit from the collaboration with community stakeholders, e.g. NGOs, as they can share resources such as information and material in order to innovate for sustainability and SCIs. NGOs cannot be considered as conventional business partners in terms of buying or selling goods, but their competencies in sustainability may be of help for an SME with scarce resources. With respect to information an NGO can monitor an SME's suppliers and provide the data to the focal company which facilitates an SME to be informed about possible non-compliance in terms of environmental or social requirements. Another example for NGO-

SME collaboration may be linked to farming. Here an SME as well as an NGO aiming to develop new methods and technologies can share necessary material such as different kinds of seeds or equipment as a common resource (Farrington and Biggs 1990). Input from NGOs, may also support SMEs in diffusing more radical innovations, as knowledgeable local stakeholders can support to adapt innovations to the local context (e.g. Van Kleef and Roome 2007). Nevertheless, collaboration with community stakeholders such as NGOs can be difficult since these types of stakeholders may pursue other, non-economic goals.

(5) Secondary supply chain stakeholder *& media*

Although SMEs are less socially exposed compared to larger companies (Hall 2000, 2006) media may be of marginal relevance for smaller businesses. An SME can exchange information with press and media, on the one hand, in order to diffuse its offered products and services, and, on the other, to be informed about current debates and future trends in sustainability. This, however, would require SMEs to set free additional resources that engage with media stakeholders which may prove to be strenuous.

(6) Secondary supply chain *& science* partners

Science partners such as research institutes and universities are another option for SMEs' to collaborate for sustainability-oriented innovation development because they are considered as key sources of knowledge and are able to generate and disseminate it. Furthermore, science partners may have the resources and capital at their disposal to innovate if they have access to research funding. Such a transdisciplinary approach may be advantageous for both partners as joint problem solving through diverse stakeholders is aimed for. On the one hand, an SME can counterbalance its shortage of resources. On the other, the science partners have access to real-life business problems in order to pursue rigorous and relevant research. A challenge lies

in making SMEs attractive partners to science partners, in that, financial funding of for example collaborative research projects may need to come from a third party, e.g. governments.

4 Discussion

This section will elaborate on how an SME can collaborate with primary and secondary supply chain stakeholders to exchange the resources material, capital, and information to innovate for sustainability and SCI development linked to sustainable supply chains. The framework refers to the SSCM characteristics defined by Seuring and Müller (2008) and adopts the RBV proposed by Barney (1991). From the literature discussed above this section also derives two propositions for future research. In a final step limitations of this study are presented.

Primary and secondary stakeholder collaboration to exchange traditional and non-traditional resources in and beyond the supply chain

According to the SSCM definition by Seuring and Müller (2008) sustainability demands by customers and stakeholders require SMEs to integrate environmental, social, and economic issues into their supply chain for which purpose they can develop SCIs as well as innovate for sustainability. Here, collaboration with primary and secondary supply chain stakeholders is one engagement strategy. This is also reflected in research on open innovation (e.g. Chesbrough 2006; Wagner 2011) where a multitude of stakeholders is considered important. The idea of open innovation refers to “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough 2006, p. 1). In addition, sustainability issues are considered to be interconnected and often complex (Roome 2001; Schaltegger 2011) making a collaborative approach to innovation for sustainability beneficial (Clarke and Roome 1999; Roome 2001; Van Kleef and Roome 2007). Traditional supply chain management, however, refers

above all to collaboration with suppliers and customers (or within a larger company to collaboration with other departments; e.g. Harland 1996). Cetinkaya (2011), for instance, expands this view by analyzing which secondary supply chain stakeholders, such as science partners, or NGOs are of relevance for SSCM. This analysis is not exhaustive because stakeholders such as consultants or recycling firms are not considered, for example. However, it has to be questioned if a general, all-encompassing landscape of relevant stakeholders in SSCM is useful. Moreover, the impacts of the various stakeholders and related action fields of SSCM need further investigation, before an SME actually manages its sustainable supply chains and collaborates with its stakeholders (Cetinkaya 2011). Here, the resource dimension holds additional explanatory power. Traditionally, in the SCM literature, an SME's management of sustainable supply chains is discussed with regard to the resources material, capital, and information. The present research, however, attempted to analyze these resources with regard to different stakeholder types. Thereby, we were able to demonstrate that most of the resources are relevant in the context of an SME's supply chain collaboration, with information being of particular importance. However, literature on sustainability issues also discusses other resources, such as natural resources and energy (e.g. Schaltegger 2002) as well "personnel-based resources (e.g. organizational commitment and learning)" (Blanco, Rey-Maquieira and Lozano 2009, p. 478) which may add to the discussion in SSCM. This becomes even more salient, when referring back to Barney's (1991) suggestion that competitive advantage can be achieved through unique and heterogeneous resources. Flexibility, for instance, attributed to SMEs, can also be considered as a resource (e.g. Liao, Hong and Rao 2010) crucial to innovate for sustainability. With regard to our proposed matrix (cf. Table 1) and the two dimensions, namely, the supply chain stakeholders dimension (P1) and the resource (P2) dimension, we propose:

P1: The complexity of sustainability requirements along the supply chain and the life cycle perspective on innovation for sustainability requires SMEs to collaborate with both primary and carefully select from a multitude of secondary supply chain stakeholders. In order to select from the range of secondary stakeholders, SMEs should analyze which additional resources, that is, besides the traditional resources material, capital and information, associated with sustainability are exchangeable with these stakeholders.

Supply chain innovation and innovation for sustainability

When an SME develops innovations that are life-cycle oriented investments and changes are not just limited to the mere product or service but also to the development of attributes across the supply chain. Given this, stakeholders such as customers, NGOs, or science partners may not just show interest in a company's sustainability efforts, but they can also become part of the innovation. Changes within supply chains with the aim to increase new value creation for the stakeholder are meant by SCIs (Arlbjørn, de Haas and Munksgaard 2011).

With regard to suppliers, however, SMEs with their owner-manager structure are rather selective in relationship building which is foremost based on trust (e.g. Spence and Lozano 2000; Perrini, Russo and Tencati 2007). These trustful relationships enable SMEs to disclose their sustainability strategy to suppliers which in turn can lead to supplier-development (e.g. Perrini, Russo and Tencati 2007). Here, Perrini (2006) points out that supply management should be based on a partnership approach, that is, a focal company should spread sustainability along the entire supply chain. In collaboration with supply chain stakeholders information and knowledge are crucial resources for innovation for sustainability (cf. *Table 1*). An SME may benefit from exchange with stakeholders that at first glance have less in common with the company, such as universities, in order to receive new ideas, novel information, and

resources as the information flows are more distant to the company's own environment (e.g. Granovetter 1983; Boschma 2005). This can lead to more radical innovations and initiate learning along sustainable supply chains. Research on learning-action networks (e.g. Clarke and Roome 1999; Roome 2001), for example, provide another means to innovate for sustainability through collaboration as here links between multiple stakeholders are developed that go beyond and complement organizational structures (Clarke and Roome 1999). With regard to the two dimensions, namely, SCIs and innovation for sustainability we put forward the proposition:

> *P2: SMEs that are able to integrate different stakeholder requirements into core business and at the same create value for primary and secondary supply chain stakeholders are facilitated in their attempt to develop innovation for sustainability across the supply chain. This requires SMEs to engage in multiple stakeholder collaboration where traditional and non-traditional resources (e.g. legitimacy) are exchanged.*

5 Limitations and further research

Finally, some limitations of this paper should be highlighted. The present research builds foremost on a literature review and would therefore gain from further empirical studies. Future research, should challenge the developed propositions with real-life data, for instance, by building a cross-case analysis of SMEs acting as focal companies in their supply chain and who have failed or have successfully collaborated to innovate for sustainability. Furthermore, we did not apply the method of a systematic literature review which may have resulted in a more structured and even broader literature basis for our analysis. Also by underpinning the framework with the RBV less attention is given to individual SME characteristics with regard to sustainability strategy, owner-structure, history, or industry. Here, a link to the resource dependency theory (e.g. Pfeffer and Salancik 1978; Carter and Rogers 2008) could further

expose the employment of resources with regard to sustainability-oriented open innovation processes in and related to sustainable supply chains. With the classification of supply chain stakeholders as well as resources based on SSCM research, not all resources relevant for innovation for sustainability, e.g. organizational commitment and flexibility, were included in the framework. In addition, and as many studies in the context of sustainable development will encounter, sustainability issues have a value-laden character, meaning every individual will have his or her own perception of sustainability and related knowledge (Seelos 2004; Linnenluecke, Russel and Griffiths 2009) with difficulties to generalize findings.

With regard to these limitations further research may provide a more detailed analysis of current SSCM practice of SMEs when they develop SCIs and innovate for sustainability. Here, in-depth case studies which analyze various supply chain flows of sustainability-oriented companies (e.g. ecopreneurs or sustainable entrepreneurs; e.g. Schaltegger and Wagner 2008) across diverse industries could greatly develop the understanding of barriers and opportunities encountered. Future research could elaborate on an SME specific stakeholder analysis for sustainability-oriented innovation development. Also the role of micro and smaller companies for developing sustainable supply chains is a promising avenue for future research. For practitioners a thorough actor analysis based on quantitative or qualitative research could help SME managers to design collaboration strategies that quickly identify the most relevant stakeholders for innovation development. In transdisciplinary workshops with SMEs, for instance, practitioners and academics could develop a "collaboration-roadmap" for sustainability-oriented innovations. To invest more research to identify links between SSCM and innovations in SMEs would be beneficial. Such a discussion could establish links to research that has identified SMEs as so called "hidden champions" (e.g. Simon 1992), that is, companies that generate innovative breakthroughs with strong competence in export and the ability to command markets.

6 Concluding remarks

Based on a literature study the present paper proposes collaboration with diverse stakeholders in and related to sustainable supply chains as one feasible strategy for SMEs to engage in innovation. Here, SCIs and sustainability-oriented innovations present opportunities to go beyond traditional ways of developing products, services, and processes. From the RBV, SMEs can hereby access complementary resources, let knowledge permeate organizational boundaries to overall nurse their innovation capacity, and develop new capabilities. Of course, this positive view on collaboration with stakeholders in and related to supply chains are also associated with risks and costs, if, for instance, power is unequally distributed. Overall, SMEs are challenged to design collaboration strategies that enable innovation for sustainability and secure a balance of benefits and costs of collaboration in and related to sustainable supply chains.

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Figure and Table

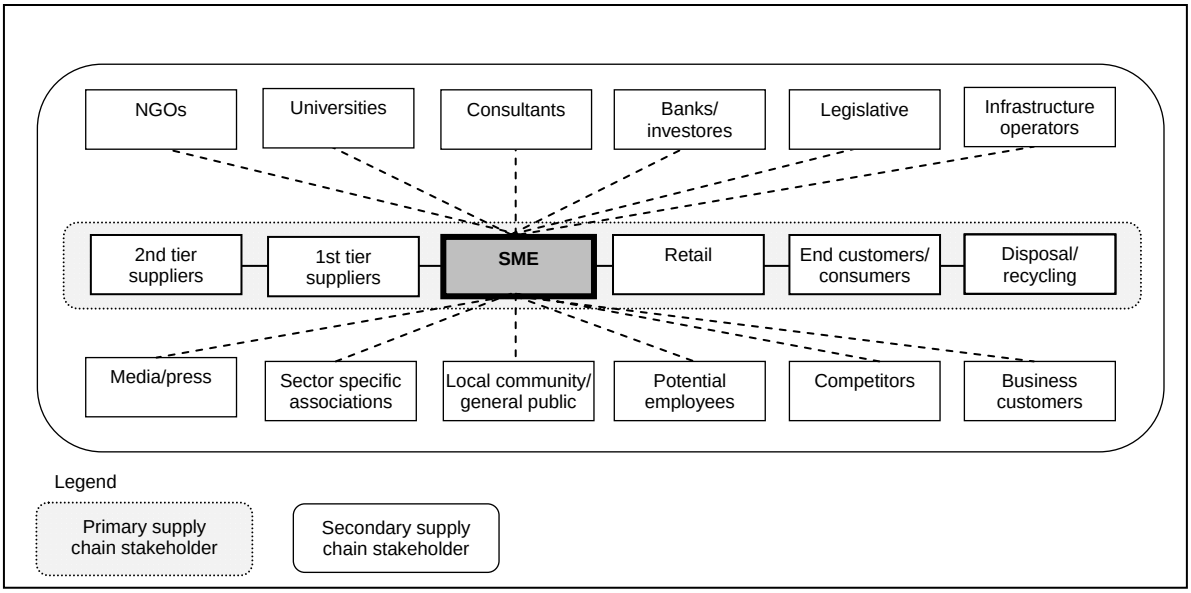

Figure 1: Collaboration in and related to sustainable supply chains (according to the understanding of Harland, 1996, p. S63; Henrique and Sadorsky 1999, p. 89; Cetinkaya 2011, p. 120).

Relation	Resource / Collaboration Partner	Material	Capital	Information	References
Primary stakeholder; i.e. *in* sustainable supply chains	*1) Organizational* stakeholder; e.g. suppliers and customers	Joint development of new material that meet sustainability requirements	Establishment of new processes, e.g. leasing instead of buying	SCI with regard to improved access to real-time data on product characteristics by using the same information technology	e.g. Walker, Bovet and Martha 2000; Hansen, Grosse-Dunker and Reichwald 2009; Bos-Brouwers 2010
Secondary stakeholder; i.e. *related to* sustainable supply chains	*2) Organizational* stakeholder; e.g. employees	./.	Dependent on owner structure in SME, incentive systems may motivate e.g. employees to co-invest in product development	Employee involvement to harness internal knowledge by e.g. company-internal workshops on assessing SOIs and SCIs	e.g. Perrini, Russo and Tencati 2007; Darnall, Henriques and Sadorsky 2010
	3) Regulatory stakeholder; e.g. governments, competitors	Public procurement of sustainable materials; inter-firm cooperation to achieve economies of scale	Competitor investments can facilitate SMEs to realize second mover advantages with innovation for sustainability (i.e. indirect capital funding)	Information exchange between SME and public bodies to increase knowledge base and promote regional development	e.g. Hartman, Hoffman and Stafford 1999; Henriques and Sadorsky 1999; Walker and Preuss 2008; Pagell and Wu 2009; Bos-Brouwers 2010
	4) Community stakeholder; e.g. NGOs, local community	Share materials with NGOs, e.g. in organic farming; support adoption of more radical SOIs through knowledgeable local stakeholders	Co-finance sustainability initiatives with e.g. NGOs, local stakeholders	NGOs monitor information about environmental and social conditions at the sites of the SME's suppliers	e.g. Hartman, Hoffmann and Stafford 1999; Spence 1999; Van Kleef and Roome 2007; Ciliberti, Pontrandolfo and Scozzi 2008; Darnall, Henriquesa and Sadorsky 2010
	5) Media	./.	./.	Media/press provide information about future trends, current debates on sustainability issues	e.g. Walker, Di Sisto and McBain 2008 (not SME specific)
	6) Science partners	Joint R&D on sustainable materials	Indirect funding through university-government funded programs, such as incubators or science parks	Innovation intermediaries support process of information seeking and processing for SSCM practice and SOIs	e.g. Pittaway et al. 2004; Howells 2006; Perkman and Walsh 2007; Archer, Wang and Kang 2008

Table 1: Relevant partners and resources in and related to sustainable supply chains when collaborating for sustainability-oriented innovation (here SOI is used as an abbreviation) (adopted from Henrique and Sadorsky 1999; Giannakis and Croom 2004; Hall 2006; Seuring and Müller 2008 and expanded).