Since the Brundtland report in 1987 a wide debate has emerged on eco-innovation (e.g. eco-design, cleaner production) and sustainability-oriented innovations (SOIs), that is, the integration of ecological and social aspects into products, processes, and organizational structures. While prior research has often dealt with SOIs in large firms, the last decade has begun to generate broad knowledge on the specificities of SOIs in small and medium sized enterprises (SMEs) as they are increasingly recognized as central contributors to sustainable development. However, this knowledge is scattered across different disciplines, research communities, and journals. Therefore, this paper analyzes the heterogeneous picture of innovation research and draws within the past 20 years with a focus on the innovation practices including different types of SOIs and strategic sustainability behaviors of SMEs through an interdisciplinary, systematic review in a time frame between 1987 and 2010. By consulting major research databases we have analyzed 84 key journal articles bibliographically and thematically. We find that first SME strategic sustainability behavior ranges from resistant, reactive, anticipatory, and innovation-based towards sustainability-rooted. Second, we identify innovation practices at the product, process, and organizational level. Third, our review shows that research is still strong on eco-innovation rather than on innovation from a triple bottom line perspective (economic, social, and environmental dimension), that is, SOIs of SMEs. Our main theoretical contribution is the development of an integrated framework on SOIs of SMEs where we delineate how distinct strategic sustainability behaviors can explain contingencies in types of innovation practices. Furthermore, for the more proactive SME behaviors we argue that they possess higher capabilities for more radical SOIs with the innovation process itself changing. Therefore, we propose that interaction between external actors (e.g. customers, authorities, research institutes) can ultimately increase the innovative capacity of SMEs for SOIs. Finally, we identify major research gaps with regard to radical SOIs, streamlined innovation methods, the role of SMEs in industry transformation and in sustainable supply chains, as well as a need for a stronger theoretical debate on SOIs of SMEs.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

How do firms successfully compete in changing markets and environments while contributing to sustainable development? One increasingly important way for firms to do so are their sustainability-driven innovation practices (Paramanathan et al., 2004; Roome, 1994; Schaltegger, 2011; Sharma, 2002). While the term sustainable development was first coined at the United Nations Conference on the Human Environment in 1972 (Hall et al., 2010), the opportunities to innovate for sustainability received wide attention with the Brundtland report in 1987. It pointed to the importance of firms to create, redesign, adapt, and diffuse environmentally sound technologies (WCED, 1987: 70). Increasingly, environmental issues were recognized as sources of strategic change (Aragón-Correia et al., 2008), ecological factors became part of innovation research (Noci and Verganti, 1999; Roome and Hinnells, 1993; see also Schiederig et al., 2012), and eco-innovation practices such as cleaner production, life cycle assessments, and eco-design found their way into firms (Huber, 2008; van Hemel and Cramer, 2002). From this initially eco-innovation driven debate evolved a stream of research on sustainability-oriented innovations (SOIs) with a broader focus on environmental, social and, economic dimensions (e.g. Fichter and Paech, 2004; Hall, 2002; Paech, 2007; Schaltegger and Wagner, 2011; van Kleef and Roome, 2007; Wüstenhagen et al., 2008). SOI in our understanding describes a 'direction' which follow requires the deliberate management of economic, social, and ecological aspects (Hansen et al., 2009; Paech, 2007) so that they become integrated into the design of new products, processes, and organizational structures (Rennings, 2000).
While both large and small companies can engage in SOIs, small and medium sized enterprises (SMEs) will innovate differently (e.g. Bos-Brouwers, 2010; Hansen and Klewitz, 2012a,b). To conduct more systematic research in the area of SMEs is important because they build a large group internationally (ECE, 2010; OECD, 2002), contribute as a group to a large share of overall pollution (cf. ECE, 2010; Hillary, 2000), and are attributed with innovation propensity for sustainability (Aragón-Correa et al., 2008; Bos-Brouwers, 2010).

However, research on SOIs of SMEs is strongly scattered across different disciplines and research communities (e.g. innovation management; sustainable entrepreneurship; cleaner production; sustainability management) as well as journals (e.g. sustainability vs. mainstream journals). Therefore, we do not have a clear picture because little prior research aimed at aggregating this knowledge systematically. While some earlier literature reviews cover a large number of studies (e.g. Del Brío and Junquera, 2003), only a few more recent reviews use the methodology of the systematic review (Tranfield et al., 2003), which aggregates knowledge by using clearly defined processes and criteria. Prior reviews that have focused on barriers and drivers (Walker et al., 2008) and on policy interventions to facilitate eco-innovation in SMEs (Parker et al., 2009) provide a clear picture of the antecedents of SOIs of SMEs, but the SOI practices at the product, process, and organizational level are not dealt with in detail. Therefore, we will analyze the innovation practices of SMEs with a focus on different types and strategic sustainability behaviors. Furthermore, we will show the primarily used analytical and methodological approaches, highlight well explored SOI topics, and propose issues for future research. Accordingly, the main research question is: which practices of sustainability-oriented product, process, and organizational innovations occur of SMEs and how do they interact?

To achieve this goal we have employed the method of an interdisciplinary, systematic review of 84 key journal articles in a time frame between 1987 and 2010. We find that first SME strategic sustainability behavior ranges from resistant, reactive, anticipatory, and innovation-based to ‘sustainability-rooted’. Second, we identify innovation practices at the product, process, and organizational level. Third, research is still strong on eco-innovation rather than on innovation from a triple bottom line perspective (economic, social, and environmental dimension). Based on our results we develop an integrated framework on SOIs of SMEs where we delineate how distinct strategic sustainability behaviors can explain contingencies in types of innovation practices.

To the knowledge of the authors, no systematic review exists focusing on innovation practices of SMEs to date. Also, we think that this is the first systematic approach of joining previously separate literatures on environmental or sustainability management in SMEs and eco- or sustainable entrepreneurship.

The remainder of this article is structured as follows: section two explains our understanding of SOIs in the context of SMEs and thus serves as a basis for the systematic review in the sense of a positive inclusion list. Relevant prior systematic reviews are also presented. Section three presents the employed method. We show the results of the systematic review in section four and five, where we address the research question. Section six discusses the results. Suggestions for future research are also provided and the limitations of the study are shown in our conclusion.

2. Background and terminology

To deduce relevant key words for the systematic review, it is necessary to first specify the terminology which here results from the intersection of sustainability, innovation, and SMEs.

2.1. Sustainability and innovation

The concept of sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 54). Based on this political concept, the organizational-level concept of corporate sustainability can be understood as systematic management efforts by corporations to balance environmental and social with economic goals in order to minimize harm to and increase benefits for natural environments and societies (e.g. Dyllick and Hockerts, 2002). Though we refer to sustainability in this paper, we also allow for narrower approaches dealing with a selected sustainability dimension, particularly ecology, as companies often focus on or start with improvements in either environmental or social dimensions in their journey toward sustainability.

To contribute to sustainability, innovation is an important means (Hansen et al., 2009; Schaltegger and Wagner, 2011). Innovation, in general, is the implementation of a new or significantly improved product (e.g. change in product properties), process (e.g. changed delivery methods), marketing method (e.g. new product packaging) or organizational method (e.g. changes in workplace organization) in business practices, workplace organization, or external relations (OECD, 2005: 17, 46). It should be emphasized that innovations need to be successfully diffused in the market (e.g. products) or implemented (e.g. processes) to achieve an economic impact, that is, go beyond inventions (OECD, 2005: 17). An innovation has to have a significant degree of novelty for the firm (be it self-developed or adopted) and can also be new to the market or world (OECD, 2005: 58). The latter understanding of innovation and sustainability allows us to better define SOIs which are explained in detail next.

2.2. Sustainability-oriented innovations

The debate on companies directing their business activities toward sustainability through innovation was initially focused on eco-innovations. For instance, environmental issues were recognized as sources of strategic change (Aragón-Correa et al., 2008) and drivers for innovation strategies (Noci and Verganti, 1999). Eco-innovations represent new or enhanced processes, organizational forms, as well as products or technologies that are beneficial to the environment in that they reduce or avoid negative environmental impacts (Beise and Rennings, 2005; OECD, 2005; Rennings, 2000). Each of these three general types is further elaborated with regard to the environmental dimension:

- **Process innovations** relate to the production of goods and services, often with the aim of increasing eco-efficiency or metabolic consistency (sometimes referred to as eco-effectiveness; Huber, 2008). They are further differentiated into end-of-pipe solutions and cleaner production technologies (Rennings et al., 2006). SMEs engaging in cleaner production, for example, can alter their way of using resources, manage non-product outputs through schemes of closed loop production or industrial symbiosis, and improve the overall eco-efficiency of business operations (Altham, 2007).

- **Organizational innovations** entail the reorganization of routines and structures within the firm and new forms of management, which all usually “deal primarily with people and the organization of work” (OECD, 2005: 55). This also includes more formalized management systems such as environmental management systems (Rennings et al., 2006).

- **Product innovations** are improvements or entirely new developments of products and services. For instance, eco-design may improve products through more eco-benign materials.
(e.g. organic, recycled materials), high durability, low energy consumption while the development of environmental or sustainable technologies (e.g. renewable energy technologies) represent entirely new products (Hart and Milstein, 2003; van Hemel and Cramer, 2002).

Gradually, this debate developed into one with a more holistic view on sustainability by covering both environmental and social dimensions, consistently providing us with a myriad of terms such as sustainable development innovation (e.g. Hall, 2002), sustainable innovation (e.g. Hockerts, 2003; Wüstenhagen et al., 2008), CSR-driven innovation (e.g. Hockerts, 2009), sustainability-related innovation (e.g. Wagner, 2008), and sustainability-driven innovation (e.g. ADL, 2005). We build on the idea that innovation for sustainability is about relative improvements in comparison to a prior or other entity. Therefore, we think of it as a process or direction toward sustainability which calls for deliberate management and consequently find the term sustainability-oriented innovation (Fichter and Paech, 2004; Hansen et al., 2009; Hansen and Klewitz, 2012a; Hansen and Große-Dunker, 2013; Paech, 2005, 2007) most suitable. By becoming successful in the marketplace in niches or even mass markets, SOIs create more sustainable production methods, market structures, and consumption patterns (cf. Schaltegger and Wagner, 2011: 223).

Additionally, SOIs can be differentiated into radical and incremental innovations, which refers to a general theme in innovation research (Benner and Tushman, 2002; Hall, 2002). Radical innovations have more potential to influence the sustainable development of whole industries (e.g. Höffrén and Apalajäti, 2009; Hansen et al., 2002) as they depart from current practice (Dewar and Dutton, 1986; Ettlie et al., 1984; Massa and Testa, 2008). However, instead of clearly differentiating into either radical or incremental SOIs, we would agree that they occur on a continuum as “the distinction between radical and incremental innovations […] is not one of hard and fast categories” (Dewar and Dutton, 1986: 1423).

2.3. SMEs

The second focus of the literature review lies on a specific type of organization, that is, SMEs. They are a heterogeneous group in terms of size and sector diversity (Hillary, 2006) and overall, it is difficult to clearly define what an SME is, because countries adopt different criteria (e.g. employment, sales, turnover) for definition purposes. However, mostly SMEs are defined by the amount of employees with a threshold between 100 and 500 (Ayyagari et al., 2007). To systematically review literature on SOIs of SMEs makes sense for several reasons. First, SMEs build a large group internationally which, for example, figures for OECD economies show where SMEs make out between 96% and 99% of the total number of enterprises (OECD, 2002). Second, SMES as a group contribute to a large share of overall pollution (cf. Hillary, 2000) — in the EU SMEs account for approximately 64% of pollution (ECE, 2010). Third, SMEs are not simply smaller versions of their larger counterparts (Tilley, 2000; Welsh and White, 1981) and fourth ‘SME peculiarities’ (Noci and Verganti, 1999) imply that they will innovate differently for sustainability (e.g. Moore and Manning, 2009; for overview see Bos-Brouwers, 2010). On the one hand, literature highlights SMEs’ disadvantages (e.g. resource constraints, lack of formalized planning, difficulty to attract finance) which may prevent them from engaging proactively in the innovation process (e.g. Del Brio and Junquera, 2002). From this perspective — emphasized by most research — SMEs are considered to display ‘reactive’ behavior toward environmental and social issues. On the other hand, literature suggests that SMEs have advantages in that they are often characterized by an entrepreneurial style with lean organizational structures (e.g. Bos-Brouwers, 2010; Darnall et al., 2010) dominated by their owner-managers (e.g. Jenkins, 2004; Spence, 1999), and can hence also be strongly value-driven (e.g. Jenkins, 2009). Thus, smaller companies may be in a better position, than, for example, large companies to innovate radically and compete successfully in niche markets with SOIs (e.g. Schaltegger and Wagner, 2011). We argue that SMEs will innovate differently than larger companies, because they possess distinct organizational structures and capabilities for SOIs (cf. Aragón-Correa et al., 2008). This is further supported by literature that shows different innovation degrees in SMEs as a result of their strategies (Hansen and Klewitz, 2012a; Noci and Verganti, 1999; Sharma and Sharma, 2011). SMEs founded on the basis of sustainability, which develop and successfully spread SOIs (often in niche markets) are also termed ecopreneurs and sustainable entrepreneurs (Hockerts and Wüstenhagen, 2010; Larson, 2000; Parrish and Tilley, 2010; Pastakia, 1998; Schaltegger and Wagner, 2011; Schaltegger, 2002; Tilley and Parrish, 2009) and are thus also covered by our definition of SMEs.1

2.4. Previous systematic reviews

A range of (systematic) reviews related to our research focus have been published earlier, however, they only partly overlap. Systematic reviews that address conventional innovation management in SMEs, for example Pittaway et al. (2004, see also Thorpe et al., 2005), take a knowledge perspective on innovation and review 209 articles. Hörte et al. (2008) systematically review 149 papers and focus on product development in SMEs. Systematic reviews dealing with eco-innovation and broader sustainability issues in SMEs predominantly focus on drivers and barriers or on public policy levers for facilitating eco-innovation (see Table 1). One review by Hall et al. (2010) analyzes the development of the sustainable entrepreneurship literature. Whilst these prior reviews deal with the antecedents of SOIs, as to the knowledge of the authors, no systematic review exists on the SOI practices and their interaction in SMEs2 — which this paper will address.

With the definition of the key terminology on eco-innovation, SOIs, and SMEs as well as the presentation of prior systematic reviews done, we will present the applied method.

3. Method

This paper is based on a systematic review (Fink, 1998; Thorpe et al., 2005; Tranfield et al., 2003), a methodology which differs from conventional reviews in that it aims at “synthesizing research in a systematic, transparent, and reproducible manner” (Tranfield et al., 2003: 207). The rationale behind systematic reviews is characterized as: being transparent, focused, equal, and accessible, providing clarity, allowing for unification of research and practitioner communities, and overall leading to synthesis (Thorpe et al., 2005). It provides adequate evidence to inform policy and practice, as the diversity of knowledge is systematically managed (Thorpe et al., 2005; Tranfield et al., 2003). To enhance reliability of the

1 A further stream of literature in this line is on social entrepreneurship which was excluded from this analysis because it deals with organizations operating primarily not-for-profit (e.g. Zahra et al., 2009) with the foremost aim to solve social needs (Hall et al., 2010).

2 An exception is the study report on SOI by Bertels et al. (2012) which considers product, process and systems innovation in more detail, though not in the context of SMEs. Moreover, as the study was only published at the very end of the review process of the present paper, it was not further considered (but it should be mentioned that Bertels et al. themselves borrow from an earlier version of the present paper; cf. Klewitz and Hansen, 2011).
present research, two researchers (i.e. the co-authors) were involved in the analysis.

The aim of our systematic review is to structure the research field on SOIs in the context of SMEs, identify emergent themes, point out the most important gaps, and thus contribute to theory development (Tranfield et al., 2003). A systematic review includes both a quantitative, bibliographical analysis and a more qualitative thematic analysis (Tranfield et al., 2003). With reference to the process used in a study by Seuring et al. (2005, based on Mayring, 2003), our literature review will consist of six procedural steps illustrated in Table 2. Each step is described in further detail below.

### 3.1. Search process: steps 1 to 4

**Step 1:** The keywords (see Table 3) for the search were deduced from the above definition of eco-innovation, SOIs, and SMEs (Section 2.1 and 2.2). The domains of SOIs and SMEs were operationalized through three clouds of keywords, including innovation (e.g. product development, process improvement, diffusion, sustainable entrepreneurship), sustainability (e.g. environment, ecology, green, societal), and SMEs (e.g. small business, medium-sized firm). Overall, a total of 35 keywords were used (Table 3). Target articles needed to match at least one keyword in each cloud. These clouds demonstrate again our objective to cover research at the intersection of sustainability, innovation, and SMEs. In other words, we aim to cover articles dealing with innovation practices in SMEs linked to sustainability (or, as explained earlier, partial environmental) performance improvements and distinct strategic sustainability behaviors. Therefore and by no means does this review claim to cover all publications dealing with either the encompassing concept of sustainability and environmental management (including systematic approaches such as management systems or certification schemes) or innovation management in SMEs. For example, our sample only gives a brief overview of the overall broad literature on environmental management systems (EMS) such as ISO 14001 and Eco-Management and Audit Scheme (EMAS) in SMEs (e.g. Burke and Hall et al., 2010).

### Table 2

**Individual steps of the systematic literature review.**

<table>
<thead>
<tr>
<th>Overall process</th>
<th>Individual steps</th>
<th>Analysis</th>
<th>Resulting #no articles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Search process</strong></td>
<td>Step 1: Identification of keywords (35 key words)</td>
<td>Previous research and reviews</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>Step 2: Development of exclusion and inclusion criteria (e.g. cleaner production, eco-design, CSR innovation, diffusion, life-cycle-analysis)</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>Step 3: Specification of relevant search engines and execution of search (5 engines)</td>
<td>Title and abstracts (automated based on keywords)</td>
<td>1996</td>
</tr>
<tr>
<td></td>
<td>C-list</td>
<td>.</td>
<td>1996</td>
</tr>
<tr>
<td></td>
<td>B-list</td>
<td>Title and abstracts (manual)</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>A-list</td>
<td>Full text</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Narrative inclusions (e.g. Anderson, 1998; Moore and Manring, 2009; Pastakia, 1998; Schaltegger, 2002; Hall et al., 2010)</td>
<td>Full text (+13)</td>
<td></td>
</tr>
<tr>
<td><strong>Descriptive and Thematic Analysis</strong></td>
<td>Step 5: Descriptive categories (e.g. journals covered, methodologies applied)</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Step 6: Deductive and inductive categories to identify central themes and interpret results (e.g. EMS, life cycle analysis)</td>
<td></td>
<td>84</td>
</tr>
</tbody>
</table>

### Table 1

**Related (systematic) literature reviews.a**

<table>
<thead>
<tr>
<th>Reference and method</th>
<th>Method</th>
<th>Innovation perspective</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hall et al., 2010</td>
<td>Literature review through Business Source Complete and of Special Issue (Journal of Business Venturing, 25, 2010).</td>
<td>Connects sustainable development with entrepreneurship</td>
<td>Research stream on sustainable entrepreneurship relatively young field (prior 2002 few publications; majority of papers in relatively new sustainable development/environmental journals). Major gaps: conditions for SOIs (e.g. entrepreneurial ventures vs. incumbent firms, welfare-creating vs. welfare-destroying etc.). Four different types of SMEs: profit, compliance, advantage, and environment driven SMEs. Seven types of policy interventions: voluntary regulations/standards, compulsory regulation, financial penalties, financial support, self-directed/facilitated education, environmental audits/reviews, business advice/help lines. → A tool kit of intervention strategies is proposed. From government perspective two main barriers: communication and means to engage SMEs. → Education of SMEs as facilitator for eco-innovation. Determinants of SMEs’ environmental strategy alternatives: financial resources, organizational structure, management style, human resources, environmental management status, manufacturing activity, technological approach, innovative capacity, and external cooperation. → Due to SME peculiarities specific actions from policy initiatives are necessary.</td>
</tr>
<tr>
<td>Parker et al., 2009</td>
<td>Systematic review of peer-reviewed journal articles between 2003 and 2008 with a focus on empirical results. 50 articles were reviewed.</td>
<td>Environmental improvements</td>
<td>→ Multiple perspectives to improve understanding of how and why SMEs generate environmental improvements. → Avoiding effects of small sample bias.</td>
</tr>
<tr>
<td>Walker et al., 2008</td>
<td>Literature review of 113 publications with additional snowballing method.</td>
<td>Environmental improvements</td>
<td>→ Identified six main drivers for SME engagement in environmental improvements: voluntary engagement, stakeholders, legislation, compulsory regulation, financial support, and policy initiatives.</td>
</tr>
<tr>
<td>Del Brío and Junquera, 2003</td>
<td>Review of the literature through combination of economic literature with a focus on SME peculiarities.</td>
<td>Eco-innovation management from a strategy perspective</td>
<td>Determinants of SMEs’ environmental strategy alternatives: financial resources, organizational structure, management style, human resources, environmental management status, manufacturing activity, technological approach, innovative capacity, and external cooperation. A tool kit of intervention strategies is proposed.</td>
</tr>
</tbody>
</table>

---

a These reviews were not further included in the sample analysis as they are dealt with in this section and primarily focus on the antecedents of SOIs rather than the innovation practices. Only the studies by Del Brío and Junquera (2003) and by Hall et al. (2010) were included in the sample as strategies and sustainable entrepreneurship literature is analyzed as separate themes (see Sections 5.1.1 and 5.1.2).
Table 3
Keywords operationalized for search.

<table>
<thead>
<tr>
<th>Sustainability</th>
<th>Innovation</th>
<th>SMEs</th>
<th>Exemplary search string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainab*, environ*, eco*, green, social, societal, ethic*, CSR, eco-efficiency, corporate sustainab*, sustainable development</td>
<td>Improvement, enhancement, diffusion, innovation, product stewardship, cleaner production*, ecopreneur*, bioneer, sustainable entrepreneurship, process improvement, corporate sustainability innovation, eco* innovation, sustainability oriented innovation, environ* strategy, R&amp;D, research and development</td>
<td>Small business, medium business, small and medium sized business, SME, small firm, medium firm, SMEs</td>
<td>Innovation OR “product stewardship” OR “product development” OR “process improvement” OR improvement OR enhancement OR diffusion OR “eco efficiency” OR “cleaner production” OR ecopreneur* OR bioneer OR “sustainable entrepreneurship” OR entrepren* OR “environmental strateg” AND sustainab* OR environn* OR eco* OR green OR CSR OR social OR ethic* OR “corporate sustainability” OR “sustainable development” OR “sustainability oriented” AND “small and medium sized enterprise”* OR SME OR “medium business” OR “small business” OR “small firm” OR “medium firm”</td>
</tr>
</tbody>
</table>

a Cleaner production was considered as innovation term, as it covers many articles focusing on process innovations.

Gauchran, 2007; Halila, 2004; Yiridoe and Marett, 2004), as we only included articles that fit our positive inclusion list, that is, articles with a specific innovation perspective on EMS (e.g. Halila, 2007).

Step 2: Though systematic reviews can also include other types of publications, to guarantee quality and to reduce the sample to a manageable amount, we followed other scholars and concentrated on peer-reviewed academic journal papers in English language (e.g. Seuring and Müller, 2008). With regard to the timeframe covered, we argue that SOIs have received prominent attention within practice and international research since the publication of the Brundtland report “Our common future” (WCED, 1987). Therefore, this review covers academic papers in the period between 1987 and 2010. Taking into account the above terminology on SMEs (Section 2.2) we are interested in companies beyond the start-up phase.

Step 3 and 4: This review includes the following major research databases: EBSCO, EMERALD, ISI Web of Science, Scopus, and Wiley Online. The scope of these databases supported our interdisciplinary goal of covering literature from sustainability and environmental management, innovation and technology management, as well as entrepreneurship. Each database and related search engine works with different syntax and thus adapted search strings were necessary in many cases. In our case, four variations of search strings were used overall, but they were all within the range of the key terms. Originally, we started out with a database of 1996 articles which we categorized into A (most relevant), B (less relevant), and C (not relevant). The initial C-list of 1996 articles was first reduced on the basis of title and abstract analysis to 104 relevant articles (B-list). This B-list was analyzed in-depth (title, abstract, full text) in an iterative process and we had to eliminate another 33 articles. The most common reasons for eliminating articles from the initial B-list include a lack of SME focus (instead companies in general, start-up focus), a dominant practitioner’s focus (e.g. training guidelines, management principles, program tools), or a strong focus on drivers and barriers for sustainability management in general, rather than on the innovation practice itself. We manually added 13 highly relevant articles (e.g. Larson, 2000; Moore and Manning, 2009; Parrish and Foxon, 2009; Pastakia, 1998; Schaltegger, 2002) to the A-list that we identified throughout the research process but which were unintentionally eliminated by the “one keyword per cloud rule” due to a problem of the rule’s logic (i.e. entrepreneurship articles often deal with “SME-type organizations without using the term SME”). This was remedied by an additional search (narrative inclusion) and were consequently able to include these articles. The resulting A-list with 84 articles was then further pursued in both the descriptive and thematic analysis.

3.2. Descriptive and thematic analysis: steps 5 to 6

Step 5: For the descriptive analysis we selected categories that describe the papers in terms of e.g. journals covered or methods applied (cf. Seuring and Müller, 2008).

Step 6: For the thematic analysis, we used deductive categories which we gained from prior literature reviews (cf. afore presented Tables 1 and 3) and inductive categories that emerged during the evaluation — hence, an abductive approach (Reichertz, 2010). The aim is to systematically categorize the content of the papers and identify relationships (cf. Lane et al., 2006). This synthesis process is inductive and interpretative, but as Thorpe et al. (2005: 261) point out: “the adoption of an explicit and rigorous approach to reviewing allows others to understand how and why studies were selected and themes build up.”

The results are structured in two parts: first, we provide a quantitative descriptive (bibliographical) analysis to get an overview on the research agenda on SOIs of SMEs. Second, we present a qualitative thematic analysis to provide an in-depth analysis of SMEs’ innovation practices concerning both their strategic sustainability behavior and how this links to product, process, and organizational innovation.

4. Results of the descriptive analysis

The most important journals for SOI research in SMEs (in the sense that more than one article was published by them) identified are those with a sustainability or environmental focus, with the Journal of Cleaner Production taking a dominant role. There are also articles in more mainstream innovation journals such as R&D Management (Fig. 1), but these play, in comparison to sustainability oriented journals, a marginal role in our sample.

With 45 articles, the most important source of empirical evidence in the sample is qualitative approaches where case studies (single, illustrative, and multi-case studies together) are the most frequently applied method. Further qualitative studies used interview studies (7 articles) and action research (2 articles). There were also 7 papers with a multi-method approach, 4 conceptual papers, 2 systematic reviews, and 1 paper based on document analysis. For 2 papers the method was not further specified in accordance to our categories. Studies using quantitative approaches are also of importance with 23 articles. The studies focus on diverse countries from virtually all continents with 16 studies taking a cross-country focus (“multiple”). With respect to single countries, the UK, the Netherlands, Australia, and Canada take the lead (Fig. 2). Most studies focus on a single country.

Please cite this article in press as: Klewitz, J., Hansen, E.G., Sustainability-oriented innovation of SMEs: a systematic review, Journal of Cleaner Production (2013), http://dx.doi.org/10.1016/j.jclepro.2013.07.017
Our analysis shows that SOI research of SMEs is still a young field, which started to evolve in the mid-nineties with a surge of publications from 2008 until present (see Fig. 3).

Overall, the results show that our sample is strong on eco-innovations in SMEs with 60 articles and articles that explicitly deal with SOIs amount to 23 articles with one article in our sample explicitly dealing with social innovation (Joore, 2008). For the subsequent thematic analysis it has to be noted that the majority of articles in our sample are based on a qualitative approach (see above) which requires a more interpretative analysis to SOI practices of SMEs but with 23 quantitative studies we can adequately enrich the picture.\(^3\) In the next section, we will present and discuss our results from the thematic analysis based on the A-list.

5. Results of the thematic analysis

The purpose of the thematic analysis is to identify essential elements and dimensions of SOI practices in an SME context. We identified two major building blocks of SOI practices in SMEs: the SME’s strategic sustainability behavior and the pursued innovation types. In each of these building blocks we employed both deductive codes (e.g. product innovation) and inductive (sub)codes (e.g. life cycle assessment) that emerged from the data. In order to address our research question, we will next analyze the strategic sustainability behavior of SMEs, as they are the basis for the actual innovations pursued.

5.1. Strategic sustainability behavior of SMEs

The present section analyses the sample with regard to, first, different strategic sustainability behaviors of SMEs and, second, the concept of sustainable entrepreneurship.

5.1.1. Existing taxonomies of sustainability strategies

Overall, we identified 11 (from overall 84) articles with an explicit strategy perspective on SOI (Aragón-Correa et al., 2008; Bianchi and Noci, 1998; Darnall et al., 2010; Del Brío and Junquera, 2003; Grávalos et al., 2002; Hansen et al., 2002; Martín-Tapia et al., 2008, 2010; Moore and Manring, 2009; Noci and Verganti, 1999; Tilley, 1999). With strategy taxonomies generally ranging from reactive to proactive behaviors they relate to the continuum from incremental to radical innovation and thus facilitate our understanding of the SMEs’ innovation behaviors and the related product, process, and organizational innovations (see Table 4).

In our sample, Aragón-Correa et al. (2008) find that SME innovation behavior is not restricted to reactions to, for example, regulations. Instead they may aim to proactively achieve environmental performance improvements and even display environmental leadership behavior. Such proactive strategic behaviors can lead to improved or new processes and products and it is largely dependent on an SME’s resources, capabilities, and competencies. For such a strategy SMEs can make use of their

---

\(^3\) For purpose of clarity we will distinguish in Section 5 references to articles from the sample on the one hand, and additional literature used for definition purposes or explanations which are indexed with [!], on the other.
unique strategic characteristics, e.g. flat organization, founder vision, flexibility, and entrepreneurial style (Aragón-Correa et al., 2008). For example, proactive strategies steer SMEs toward SOIs through eco-efficient practices, increased waste and pollution prevention measures, or reduced material use (e.g. Aragón-Correa et al., 2008). Moore and Manring (2009: 280) argue that if SMEs succeed in integrating social and environmental issues into core business strategy “they will expand opportunities for innovation by increasing their opportunities for rapid learning”.

Noci and Verganti (1999) further split strategic sustainability behavior into three behaviors for SMEs: reactive (reaction to external stimuli), anticipatory (time initiatives to realize competitive advantage), and innovation-based. Reactive and anticipatory strategies are more likely to lead to incremental innovations as they mainly respond to external changes (i.e. new environmental regulations, local pressures) (Bianchi and Noci, 1998: 276–277). Innovation-based strategies potentially lead to more radical innovations on a process, organizational, and product level (Noci and Verganti, 1999). Radical innovations by SMEs are of particular interest as they have more potential to influence the sustainable development of whole industries (e.g. Hoffrén and Apalajärvi, 2009; Hansen et al., 2002).

These more radical strategies also reflect the entrepreneurial business that SMEs often are, expressed in the owner-manager’s sustainability vision or commitment as well as their potential positioning in niche markets with SOIs (e.g. Moore and Manring, 2009). SMEs can provide the necessary disruptive and radical innovations outside established and inflexible structures of incumbents (Moore and Manring, 2009). Hence, SMEs can achieve disruptive and radical SOIs based on their strategies, core competencies, and capabilities (Aragón-Correa et al., 2008; Hansen et al., 2002) which are nurtured by an entrepreneurial approach (Moore and Manring, 2009).

A fourth type of strategic sustainability behavior, which goes beyond innovation-based and even environmental leadership behavior, is found in Tilley’s (1999) analysis. Here, the ‘sustainable/ecological strategy’ is introduced which explicitly focuses on radical innovations. This behavior requires a “shift in the dominant worldview” and an “eccentric ‘deep-ecology’ approach” in order to “rethink […] all aspects of business” and pursue “a holistic integration of the environment into the structure and management of the business” (Tilley, 1999: 71). Ultimately, “sustainable/ecological business models” are sought (Tilley, 1999: 76). While Tilley registered that there is “no knowledge on this type of SME, a growing body of literature on entrepreneurial firms pursuing radical innovations – referred to as sustainable entrepreneurship – has emerged and is presented next.

5.1.2. Sustainable entrepreneurship

From an SME perspective, sustainable entrepreneurship (or ecopreneurship) deals with entrepreneurial companies that develop and successfully spread SOIs primarily in niche markets, but subsequently also in mass markets (e.g. Schaltegger, 2002). Their entire business model is based on combining ecological and social issues with economic success (e.g. organic and fair-trade products) meaning that social and/or environmental goals can have the same, sometimes even higher priority than economic goals. In our sample they are characterized as SMEs that are innovative, market-oriented, personality-driven entities that focus on more sustainable offerings in the market (e.g. Anderson, 1998; Crals and Vereeck, 2005; Rodgers, 2010). In contrast to SME innovation efforts discussed in the previous subsection, sustainable entrepreneurship deals explicitly with more radical forms of innovation (Hockerts and Wüstenhagen, 2010). Though not limited to it, existing literature on sustainable entrepreneurship often takes a business-to-consumer perspective (e.g. Kearins et al., 2010).

In our sample, there are 15 articles on sustainable entrepreneurship (Anderson, 1998; Azmat and Samaratunge, 2009; Crals and Vereeck, 2005; De Palma and Dobes, 2010; Hall et al., 2010; Hockerts and Wüstenhagen, 2010; Kearins et al., 2010; Kirkwood and Walton, 2010; Larson, 2000; Parrish and Foxon, 2009; Pastakia, 1998; Rodgers, 2010; Schaltegger, 2002; Schaper and Savery, 2004; Tilley and Parrish, 2009) with a specific SME perspective (or at least covering SMEs together with incumbents).4

Our analysis indicates that sustainable entrepreneurship influences the development of industries toward sustainability through changing consumption patterns and market structures with the supply of products that lead to a reduction of the environmental impact (e.g. Hockerts and Wüstenhagen, 2010; Schaltegger, 2002). They may also develop the necessary institutions (Hall et al., 2010) such as standard and certification schemes and professional bodies and networks.

Furthermore, in our sample sustainable entrepreneurship is often associated with distinct owner-manager values and a specific culture (e.g. Anderson, 1998; Kearins et al., 2010), that is, an entrepreneurial approach to solve environmental and social problems through business activities evolves into a vehicle for social

---

4 It should be noted that some part of the sustainable entrepreneurship literature is interested in the dynamic interaction between small and large firms and the impact thereof on industry transformation and consequently cover both large and small firms in one article (e.g. Hockerts and Wüstenhagen, 2010).
change, with the sustainable entrepreneur as change agent (e.g. Anderson, 1998).

We also identified intriguing issues related to growth strategies. For instance, Schaltegger (2002) argues that it is essential to diffuse SOIs not only in niche but also in mass markets in order to substantially affect the transition toward sustainable development. However, entrepreneurial SMEs may also prefer to stay small rather than grow big as this ensures them higher independence (e.g. in financial independence or with regard to expectations from diverse external stakeholders) and freedom to develop their business in a more value-driven way as an example by Kearins et al. (2010: 539) shows:

“However, a key insight derives from the entrepreneur’s wholehearted association with the new ecological paradigm and thus fundamental drive and commitment to put nature first and to seek to promote human–nature connectedness through her business. Such businesses may struggle to convince others and get the support they need to grow. But, growth of the business may not be seen as important as encouraging wider acceptance of the underpinning vision.”

Hockerts and Wüstenhagen (2010) argue that the transformation of industries toward sustainable development requires the interplay between new entrants (for example SMEs) and incumbents, with the former introducing radical innovations and the latter adapting these to mass markets. While this is often the case through learning from each other, more direct interactions between new entrants and incumbents also exist. Taking into account all these suggested potentials of sustainable entrepreneurship, it should also be mentioned that sustainable entrepreneurship is not a panacea (Hall et al., 2010). Having analyzed the strategies and entrepreneurial orientation of SMEs to engage in SOI we will next present our results on the innovation practices of SMEs and show how they interact.

5.2. SOI practices and innovation types

We identified innovation practices of SMEs on the process, organizational, and product level. For purpose of clarity we categorized these practices into concepts covering broader approaches and methods such as cleaner production or eco-efficiency, tools such as life-cycle analysis or environmental policy, as well as more specific areas of innovation practice, such as logistics or organizational structures. For each innovation level we will analyze first the concepts, followed by the tools and then the areas of practice with a concise overview provided in Table 5.

5.2.1. Process innovations

SOI at the process level challenges SMEs to redesign operations within the value chain to produce goods and services by using less resources, managing non-product output effectively (waste, hazardous materials, sewage etc.), and increasing the eco-efficiency of production activities. Cleaner production in general, is defined as “the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase overall efficiency and reduce risks to humans and the environment” (UNEP, 2002[1]: 5). Even though this definition also covers products and services, it is historically rooted in production processes and is hence dealt with here in this narrower context. In our sample, cleaner production was especially concerned with the adoption of environmentally-friendly technologies, good housekeeping, or input substitution (e.g. Altham, 2007; De Palma and Dobses, 2010; van Berkel, 2007; Luken and Navratil, 2004; Shi et al., 2008; van der Vlist and Holmer, 2009). SMEs engage in cleaner production to speed up production processes and raise productivity through cleaner technologies (Biondi et al., 2002). By achieving greener manufacturing processes SMEs can deal with sector specific environmental challenges (Lefebvre et al., 2001). Cleaner production
SMEs achieve learning effects at the organizational level, asvan innovation potential than just improvements at the process level if industry standards in line with ecological modernization (e.g. cleaner technologies (e.g. Noci and Verganti, 1999) or to raise the enables smaller companies to respond to regulations by adopting cleaner technologies (e.g. Noci and Verganti, 1999) or to raise the industry standards in line with ecological modernization (e.g. Sonnenfeld, 2000). Hence, cleaner production may yield far more innovation potential than just improvements at the process level if SMEs achieve learning effects at the organizational level, as van Berkel (2007: 686) argues:

“Cleaner production aims to achieve a different organisational mindset to environmental management and resource use, and thereby establish a continuous environmental improvement process, or ensure integration of environmental and resource considerations in already existing continuous improvement processes in the organisation.”

Within the code cleaner production, waste handling was an additional subtheme which occurred frequently within the sample without the studies necessarily referring to the broader concept of cleaner production. Waste handling as related to operations within the value chain and production activities in our sample referred to recycling measures, disposal of material, reduced waste water discharges, or improved sewage control (e.g. De Palma and Dobes, 2010). But, cleaner production may turn out to be a demanding tool for SMEs as a study by Howgrave-Graham and van Berkel (2007) finds which may lead to few SMEs actually taking up cleaner production as a means to innovate.

A concept strongly related to cleaner production is eco-efficiency. As for cleaner production, the conceptual understanding of eco-efficiency is today understood much more broadly, however, in the present analysis we consider it more narrowly as related to processes only. In contrast to cleaner production, eco-efficiency places a stronger emphasis on gaining economic benefits (e.g. Côté et al., 2006). This reflects the initial definition in the seminal work by Schaltegger and colleagues that economic and environmental performances are combined to create economic gain while reducing the negative environmental impact (Schaltegger and Sturm, 1990[1]; Schaltegger and Synnestvedt, 2002[11]; also: WBCSD, 2000[1]). With its focus on economic gains, eco-efficiency is also often considered as an entry ticket to environmental and sustainability performance improvements. More specifically, SMEs might be able to reap short-term benefits in terms of picking the low hanging fruits with limited resource commitment (e.g. Côté et al., 2006; Klewitz et al., 2012[11]). Often it is understood as resource and energy efficiency. For example, eco-efficiency may encompass measures such as energy saving projects within the firm (e.g. Bos-Brouwers, 2010), reduced material and resource use (e.g. Côté et al., 2006), or changes in procedures or replacement of inefficient equipment (e.g. Lee and Klassen, 2008). But, Fernández-Viné et al. (2010: 736) also critically analyze in their empirical study the adoption of eco-efficiency in SMEs and find that it may not be perceived adequately as an incentive to improve competitiveness.

Table 5
Subthemes of product, process, and organizational innovations for sustainability.

<table>
<thead>
<tr>
<th>Emergent subthemes</th>
<th>No. of articles</th>
<th>Exemplary authors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process innovations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaner production</td>
<td>29</td>
<td>Ab Rahman et al., 2009; Altham, 2007; Hicks and Dietmar, 2007; Luken and Navratil, 2004</td>
</tr>
<tr>
<td>Waste handling (e.g. recycling, water, sewage, air pollution)</td>
<td>16</td>
<td>Ackroyd et al., 2008; Caird et al., 1994; Fernández-Viné et al., 2010</td>
</tr>
<tr>
<td>Eco-efficiency</td>
<td>23</td>
<td>Aragón-Correa et al., 2008; Côté et al., 2006; Howgrave-Graham and van Berkel, 2007</td>
</tr>
<tr>
<td>Logistics (e.g. efficient transportation)</td>
<td>5</td>
<td>Bos-Brouwers, 2010; Fernández-Viné et al., 2010;</td>
</tr>
<tr>
<td><strong>Organizational innovations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMS</td>
<td>24*</td>
<td>Christensen and Niels, 1996; Cunningham, 2002; Halila, 2007; McKerver and Gadenne, 2005</td>
</tr>
<tr>
<td>ISO 14001/EMAS</td>
<td>20</td>
<td>Balzarova and Castka, 2008; Heras and Arana, 2010</td>
</tr>
<tr>
<td>Environmental policy</td>
<td>4</td>
<td>Fresner, 1998; Tilley, 1999</td>
</tr>
<tr>
<td>Environmental management accounting</td>
<td>1</td>
<td>Stanisits and Stasiakiene, 2006</td>
</tr>
<tr>
<td>Innovation process (e.g. interaction with external actors, biomimicry)</td>
<td>19</td>
<td>Kearins et al., 2010; Larson, 2000; Hansen et al., 2002</td>
</tr>
<tr>
<td>Local sourcing (and production)</td>
<td>3</td>
<td>Kirkwood and Walton, 2010, Rodgers, 2010</td>
</tr>
<tr>
<td>Stakeholder management (e.g. dialog)</td>
<td>11</td>
<td>Aragón-Correa et al., 2008; Jenkins, 2009; Siebenhüner and Arnold, 2007</td>
</tr>
<tr>
<td><strong>Organizational structures (e.g. environmental department/team)</strong></td>
<td>10</td>
<td>Fresner, 1998; Gárdström and Nordrung, 1994; Jenkins, 2009</td>
</tr>
<tr>
<td>Sustainability vision</td>
<td>6</td>
<td>Crals and Vereeck, 2005; Fresner, 1998; Larson, 2000</td>
</tr>
<tr>
<td><strong>Code of Conduct</strong></td>
<td>3</td>
<td>Crals and Vereeck, 2005; Jenkins, 2009; Lee, 2009</td>
</tr>
<tr>
<td><strong>Employee engagement in sustainability/CSR activities</strong></td>
<td>1</td>
<td>Bos-Brouwers, 2010</td>
</tr>
<tr>
<td><strong>Health and safety</strong></td>
<td>3</td>
<td>Jenkins, 2009; Kess et al., 2009; Visser, 2008</td>
</tr>
<tr>
<td><strong>Product innovations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eco-design/design for the environment</td>
<td>17</td>
<td>Bos-Brouwers, 2010; Jimenez, 2005; van Hemel and Cramer, 2002</td>
</tr>
<tr>
<td>Life-cycle-analysis</td>
<td>10</td>
<td>Pesonen, 2001; Zackrisson et al., 2008; Sonnemann and de Leeuw, 2006</td>
</tr>
<tr>
<td>Ecolabel (e.g. organic/fair trade certification)</td>
<td>3</td>
<td>Crals and Vereeck, 2005; Hitchens et al., 2005; Visser, 2008</td>
</tr>
<tr>
<td>Life-cycle-costing</td>
<td>15</td>
<td>Sub et al., 2005; Michelsen and Fjel, 2010</td>
</tr>
<tr>
<td>Materials (reduce, replace, sustainable; e.g. recycled resources, biodegradables)</td>
<td>15</td>
<td>Chen 2008a; Lee, 2009; Rodgers, 2010</td>
</tr>
<tr>
<td>Packaging</td>
<td>6</td>
<td>Fernández-Viné et al., 2010; Noci and Verganti, 1999</td>
</tr>
<tr>
<td>Fair-trade and organic products</td>
<td>5</td>
<td>Blay-Palmer and Donald, 2006; Hitchens et al., 2005; Kearings, 2010</td>
</tr>
<tr>
<td>Not specified</td>
<td>1</td>
<td>Anderson, 1998</td>
</tr>
</tbody>
</table>

* An article could qualify for more than one subtheme (Table 7 gives an overview on the interactions of the single categories within articles).

** Subcodes of main code above (e.g. waste handling as subcode of cleaner production).

---

Please cite this article in press as: Klewitz, J., Hansen, E.G., Sustainability-oriented innovation of SMEs: a systematic review, Journal of Cleaner Production (2013), http://dx.doi.org/10.1016/j.jclepro.2013.07.017
Although we differentiate between cleaner production and eco-efficiency, these two concepts were developed in parallel and thus strongly overlap (WCED, 2000;13). Thus, even though cleaner production emphasizes minimizing environmental impacts and eco-efficiency emphasizes economic gains, the outcome of applying either of the concepts in a business process may be the same (Howgrave-Graham and van Berkel, 2007). While cleaner production and eco-efficiency present overarching concepts, we also identified logistics as a more specific area of process innovation.

Logistics is important for SOI, because it deals with efficient transportation networks, shifts in transportation modes, new distribution channels, or fleet management (e.g. Kirkwood and Walton, 2010). For instance, SMEs may introduce process changes in terms of transportation modes to maximize environmental efficiency of product transportation and delivery (e.g. Fernández-Viné et al., 2010), change from road to water transport (e.g. Bos-Brouwers, 2010), or develop new distribution channels with effects on product recognition (e.g. Blay-Palmer and Donald, 2006).

Overall, SMEs benefit from innovations in their processes in that they reduce energy consumption and waste output. If SMEs manage to move toward cleaner and more eco-efficient production this may yield innovation potential in terms of redesigning, for instance, the packaging system. Through shifts in transportation modes SMEs may also secure their value chains and achieve innovation effects along their supply chain.

5.2.2. Organizational innovation

As already pointed out in Section 2, the differentiation between process and organizational innovations occurs on a fine line as they are borderline type innovations (OECD, 2005). A frequently discussed concept for organizational innovations were EMS as a means to systematically manage environmental issues. This umbrella category contains specific EMS standards such as ISO 14001 (e.g. Bos-Brouwers, 2010; Halilla, 2007) and EMAS (e.g. Mazzanti and Zoboli, 2009; Pesonen, 2001), but also specific tools as elements of EMS such as the environmental policy (e.g. Fresner, 1998) and environmental management accounting (Stanisikis and Sasiskiene, 2006). Though an important theme, the analysis of these articles showed mixed results. The minority of SMEs seems to employ EMS. For example, Fernández-Viné et al., 2010 find in their quantitative study that only 7% of SMEs use ISO-conform EMS and 11% use self-developed systems, while the rest has no EMS at all. In a similar vein, Hitchens et al. (2003: 54) with their multi-method approach conclude that: “Initiatives associated with solvent reduction or EMS were less common and tended to be associated with the better performing firms [...]” Lefebvre et al. (2001) suggest from their quantitative study that a formal EMS is seldom used in SMEs. A reason for low implementation is, for example, the highly formalized process of EMS which stands in contrast to the more informal management systems of SMEs. In light of these mixed results with regard to low implementation rates but at the same time identified innovation potential of EMS, studies in our sample highlight how to facilitate SMEs to adopt an EMS more efficiently through the joint effort of network members (e.g. Halilla, 2007).

Another frequently discussed concept refers to supply chain management. On the one hand, SMEs in their role as suppliers can use tools such as ISO 14001 certification and EMAS to secure competitive advantage and respond to downstream supply chain pressures (e.g. Bos-Brouwers, 2010; Lee and Klassen, 2008; Lefebvre et al., 2003). On the other, SMEs may themselves engage in sustainable supply chain management (i.e. the integration of environmental and social issues in traditional supply chain management; e.g. Carter and Rogers, 2008;11; Gold et al., 2010;11; Seuring and Müller, 2006), to achieve SOIs (e.g. Kirkwood and Walton, 2010).

Through supply chain management that leads to more sustainable products (Seuring and Müller, 2008), SMEs may influence their customers and suppliers, for instance, through cleaner production projects (Gärdström and Norrthon, 1994: 204–205).

Though strongly linked to and heavily influencing supply chain management, still a separate theme is local sourcing (and production). This approach focuses on producing in own local facilities (i.e. in the sense of vertical integration) or procurement from a narrow selection of regional suppliers which can significantly decrease transport emissions but also eliminate social problems in the supply chain (e.g. labor issues in the production in developing nations). Thus, through applying local sourcing and production paradigms, SMEs may radically remodel their supply chain (e.g. Rodgers, 2010). This new approach requires a strategic decision by the management and is thus considered an organizational innovation (in contrast to mere logistics). Local sourcing may prove particularly important if SMEs aim to take into account environmental and social costs of procurement while trying to achieve effects at the product level in terms of (local) branding (e.g. Kearins et al., 2010; Kirkwood and Walton, 2010; Rodgers, 2010).

Other tools for organizational innovations in our sample were stakeholder management, sustainability vision, code of conduct, employee development and training, and employee engagement in sustainability/CSR activities. Stakeholders are broadly discussed in the sample, for instance, as to how they can push SMEs toward proactive strategies (e.g. Bianchi and Noci, 1998; Darnall et al., 2010). More specifically, a range of studies look into the practice of SMEs actively managing their stakeholders (e.g. employees, community; Jenkins, 2009) as an organizational capability (e.g. Arajón-Correa et al., 2008) or through dialogs and means of communication (e.g. Siebenhühner and Arnold, 2007). Other studies (e.g. Lee and Klassen, 2008) show that SMEs may be initially reluctant to engage in stakeholder management (e.g. communication with local communities). Thus, stakeholder management in SMEs is most likely to vary in terms of its systematic approach and the types of stakeholders. This may also vary depending on the business-to-business or business-to-consumer context as well as the type of industry the SMEs are operating in. Designing and implementing a sustainability vision based on owner-manager values can develop into a core driver for overall organizational development (e.g. Kearins et al., 2010; Larson, 2000; Rodgers, 2010; Parrish and Foxon, 2009). To deal with ethics and transparency the code of conduct was also broached (Bos-Brouwers, 2010). Engaging employees in the development of the sustainable business can be supported by tools such as development and training schemes (e.g. Crals and Vereeck, 2005; Jenkins, 2009; Lee, 2009) or supporting employee engagement in sustainability or CSR activities (e.g. Jenkins, 2009).

Areas of innovation practices were matched with organizational structures as well as health and safety. Organizational structures are related to, for example, the introduction of environmental departments, teams, or cross-functional units and committees (e.g. Fresner, 1998; Gärdström and Norrthon, 1994). Health and safety measures or trainings were also mentioned (e.g. Jenkins, 2009; Kess et al., 2009; Visser, 2008).

Last but not least, a final organizational innovation to better facilitate SOI is the redesign of the company’s innovation process itself — which can thus be referred to as a meta innovation practice. We found two major mechanisms: first, through integrating new innovation principles and second interacting more strongly with external innovation actors. Regarding innovation principles, SMEs can begin to recognize the environment itself as a design principle and in that they see nature as a basis for creating a visionary, commercial opportunity, which sought to transcend and transform current industry practice” (Kearins et al., 2010: 537). Such a holistic approach — usually referred to as biomimicry — is also shown in a
case study by Rodgers (2010) where nature design principles affect the entire organization. Hence, rather than improving and adjusting organizational structures to incrementally improve the product portfolio in response to supplier, regulatory, or customer demands, the environment itself is the central pool for innovation in terms of using its materials, microring its processes, and for sourcing ideas (e.g. Kearins et al., 2010; Rodgers, 2010). Another approach to remodeling the innovation process for SOIs can be achieved by increasing the reflexivity of the process through the interaction with external actors from the SMEs’ value chain (e.g. customers, suppliers), regulatory environment (e.g. local authorities), and knowledge network (e.g. universities) (cf. Hansen et al., 2002 for definition purposes). In our sample we identified a range of relevant external actors such as customers or larger buyers (value chain network), governments or authorities (regulatory network), as well as universities and research centers (knowledge network). For example, the interaction with partners from the value chain network in supply chains gives buyers better control over their suppliers, while suppliers are given more planning security and incentives for SOIs (e.g. Biondi et al., 2002; Pesonen, 2001). As partners from the regulatory network, governments or authorities can function as role model, regulator, capability-builder, financial support provider, and disseminator of information, particularly regarding environmental and social challenges (e.g. Clemens and Hansen, 2003; Grávalos et al., 2002; Gombault and Versteega, 1999; Hansen et al., 2002; Hansen and Klewitz, 2012b). In interaction with partners from their knowledge network (e.g. Hansen et al., 2002), in particular universities and research centers, SMEs can receive support in dealing with the multi-dimensional nature and complexity of SOIs (Hansen and Klewitz, 2012a). The interaction with non-traditional (“fringe”) actors in the innovation process can lead to radical innovations and entirely new business models, as a case study by Parrish and Foxon (2009) illustrates. Hansen et al. (2002) show how SMEs make use of interaction with their partners from the regulatory, value chain, and knowledge network to acquire different types of information and how, ultimately, an SME’s innovative capability is influenced by a dynamic triangle of competencies, strategies, and network relations.

5.2.3. Product innovation

In order to improve the sustainability performance of products an overarching concept is represented by eco-design (Lefebvre et al., 2003: 267). While eco-design or design for the environment originally focused on the environmental dimension, it is now often understood more broadly in the sense of ‘design for sustainability’. Eco-design covers all activities from pre-manufacturing to end-of-life, that is, it takes a life-cycle perspective (Lefebvre et al., 2003: 267). It revolves around the concept, architecture, individual components, production, and logistics of a product (e.g. Noci and Verganti, 1999). It includes eco-design principles such as adaptable product structures, energy saving properties, eco-friendly materials, product durability and longevity, refurbishing, recyclability (e.g. Fernández-Viné et al., 2010; van Hemel and Cramer, 2002), product redesign (e.g. Bos-Brouwers, 2010), or reduction of raw materials (Lefebvre et al., 2003). Ultimately, it requires an SME to consider the means to repair, reuse, disassemble, remanufacture, and/or recycle a product (e.g. Chen, 2008a; Lefebvre et al., 2001).

Depending on the complexity of the product, for example in the electronic product sector, SMEs may find it particularly challenging to select environmentally benign raw materials or substantially reduce energy consumption (e.g. Lefebvre et al., 2001) without significantly investing in R&D activities. For instance, Fernández-Viné et al. (2010: 742) find in their survey that SMEs may adopt eco-design practices (44% in their study) but are overall restricted in their activities in that these are not based on product life cycle analysis nor on environmental impact assessments. However, eco-design not only relies on finding alternative technical solutions but also on a range of external (e.g. customer demands, government regulations) and internal stimuli (e.g. innovation opportunities, increase in product quality), and on how SMEs perceive the market opportunities for environmentally superior products (e.g. van Hemel and Cramer, 2002). Furthermore, these eco-design principles need to fit to the business and technological strategy of an SME, require SMEs to build up competencies (e.g. Noci and Verganti, 1999), and engage in major sustainability R&D activities which may yield the highest potential for radical innovations, at the product level.

A central analytical tool in our sample referred to life-cycle analysis which serves to achieve a more environmental-benign product design through improving the entire life cycle of a product (e.g. Pesonen, 2001) by measuring the resource consumption, environmental impacts, and release of waste along the whole life cycle of a product, that is, from raw materials extraction to final disposal (e.g. González et al., 2002). This life-cycle thinking goes beyond traditional life-cycle-costing which analyzes economic aspects in the product life-cycle (e.g. Michelsen and Fet, 2010). As González et al. (2002: 78) suggest from a qualitative study: “Nowadays it is obvious that life-cycle analysis is an R&D tool for improving product design in compliance with environmental issues.” Life cycle analysis, however, is again a resource intensive tool because it requires the use of formal measurement instruments to collect the necessary data and investments in training to build up the competencies to effectively use the tool. Again, it seems questionable if SMEs will be capable to use the tool widely (e.g. González et al., 2002; Lefebvre et al., 2001) even though it is adequate to support decision making in terms of which materials to reduce, replace, or use in product innovation. To enable SMEs with few formalized procedures to use such a resource intensive tool simplified versions are suggested (e.g. González et al., 2002). With a fuzzy logic approach (fuzzy inference, certain degree of variability in the data, qualitative and quantitative variables) the need for in-depth environmental knowledge is lessened and there is leeway for some uncertainty in the accuracy of the input data (González et al., 2002). Thereby, the applicability of the life-cycle analysis is facilitated. Another tool which can support signaling at the product level is (eco) labeling – also to achieve differentiation effects. This sub-theme of ecoling labeling was also, but less frequently, discussed in our sample with regard to dividing products into certain environmental and/or social categories (Blay-Palmer and Donald, 2006; Crals and Vereeck, 2005; Visser, 2008).

Next to concepts and tools we also identified more specific areas of innovation practice such as materials which in SMEs revolved around the issues reduction, replacement, and use of more sustainable materials (e.g. ecological materials). By managing the material side of the product SMEs may aim to reduce its pollution effects, increase its eco-efficiency, or optimize its resource characteristics to overall make a product easier to recycle, reuse, and decompose (e.g. Chen, 2008a; Hitchens et al., 2003, 2005). Moreover, through changing materials SMEs may develop entirely new products to secure competitive advantages by initially identifying and replacing hazardous materials in existing products (e.g. De Palma and Dobs, 2010: 1815; Lee and Klassen, 2008: 577). Another aspect related to materials, but identified as a separate subtheme, were issues related to packaging which included aspects such as reduced or reusable packaging for products (e.g. Bos-Brouwers, 2010; Hitchens et al., 2003; Fernández et al., 2010; Noci and Verganti, 1999), efficient packaging systems to reduce costs (e.g. Blay-Palmer and Donald, 2006), or the use of biodegradable packaging (e.g. Kearins et al., 2010). Fair-trade and organic products in terms of using raw materials from organic farming (e.g. Blay-Palmer...
and Donald, 2006; Donald and Blay-Palmer, 2006; Hitchens et al., 2005), organic cotton (e.g. Kearins et al., 2010), or sourcing on the basis of fair-trade (e.g. Rodgers, 2010) was also identified as a specific area of innovation practice. We are aware that the latter innovations root in changes in the underlying production system and sourcing strategies and thus could also be categorized as process or organizational innovation, however, we think that the product innovation aspect dominates. To redesign their products and comply with fair-trade standards, SMEs may benefit from integrating up-to-date technologies and implementing tools such as life cycle analysis (e.g. Lefebvre et al., 2003) to assess the environmental hazards and opportunities in (re)designing a product.

Overall, in a business-to-business environment, SOI on the product level enables SMEs to stay competitive as a supplier or subcontractor, but also to better meet current and future environmental regulations (e.g. Biondi et al., 2002; Gonzalez et al., 2002; Lefebvre et al., 2001; Michelsen and Fet, 2010; Noci and Verganti, 1999; Pesonen, 2001; Suh et al., 2005). In a business-to-consumer market SMEs can compete with radical product innovations (e.g. certified organic products) in niche markets and achieve competitive advantages through product differentiation by exploiting firm characteristics such as flexibility and their ability to respond quickly to changed market demands (e.g. Bianchi and Noci, 1998; Jenkins, 2009; Noci and Verganti, 1999). One important prerequisite for environmental product innovation is to build up “green core competences” which was only touched upon in our sample (e.g. Chen, 2008a,b).

5.2.4. Interaction between product, process, and organizational innovations

The above analysis explored the details of how SMEs innovate at the process, the product, or the organizational level. It already became visible that these levels show a considerable degree of interaction. Innovation efforts initially aimed at improving cleaner production, for instance, may lead to product innovations in a second step. Therefore, this chapter will pay close attention as to how the individual practices interact, which will allow us to answer our first research question more completely. Overall, we identified 57 articles (see Table 6) that explicitly – although not exclusively – dealt with multiple levels of innovation (e.g. Bianchi and Noci, 1998; Biondi et al., 2002; Bos-Brouwers, 2010; Howgrave-Graham and van Berkel, 2007; Jiménez, 2005).

Most commonly we were able to analyze an interaction between all three levels (e.g. Bos-Brouwers, 2010; Biondi et al., 2002; Hitchens et al., 2003; Jiménez, 2005). For example, van Berkel (2007: 689) argues cleaner production in firms is interrelated to productivity innovation, innovation, and sustainability because cleaner production is the initial avenue for further environmental and resource considerations to deliver eco-efficient products and services. Thereby, SMEs derive benefits from the economic (direct cost effects and long term viability of firm), environmental (reduce resource consumption and positively impact environment), and social sustainability (increase in quality of life) dimension. A case study by Larson (2000) illustrates how a single firm can re-design its innovation process through interacting with external actors with effects on the product, process, and organizational level.

Based on a case study on green product innovation in SMEs Noci and Verganti (1999: 14) show that process and product innovations interact in that initial incremental changes at the manufacturing level to increase eco-efficiency, in the long-term should lead to a renewed perspective on the entire product life cycle (cradle-to-cradle principle). How the analysis of the eco-efficiency of the whole production system, can lead to innovations in the product itself (e.g. replacing materials) is shown in a case study by Suh et al. (2005: 223) who explain that by identifying a central cost driver a series of alternative processes for product characteristics can be developed. Process innovations, such as cleaner production, can also lead to improvements at the product level (e.g. Bos-Brouwers, 2010; Michelsen and Fet, 2010) as the awareness for sustainability characteristics of a product is strengthened. This may even lead to affect actors along an SME’s supply chain.

Process innovations also interact with organizational innovations (e.g. Christensen and Niels, 1996; Gurbuz et al., 2004; Hitchens et al., 2003) as they may complement each other and thereby improve the environmental performance of firms. For instance, pursuing process innovations through cleaner production is facilitated by those organizational innovations that are tools and management systems because they help the organization to understand and measure its waste, discharges, and emissions. Through implementing cleaner production SMEs not only focus on improvements at the level of material and energy flows but it also affects the firm’s management systems (e.g. Fresner, 1998: 178–179). EMS can be linked to process innovations (e.g. Biondi et al., 2002) to enhance environmental performance, respond to supply chain pressures, or improve communication (e.g. Lefebvre et al., 2001; Pesonen, 2001).

How an initial product innovation links to organizational innovation is shown in a case study by Parrish and Foxon (2005: 56) where they show how new marketing and purchasing mechanisms alongside intense partnering with local communities (here native tribes) were necessary to successfully diffuse renewable energy. Despite potentially low implementation rates and unsuitability of concept, EMS may prove a critical first step to product-oriented eco-innovation based on life-cycle assessments (e.g. Lefebvre et al., 2001). Further, Noci and Verganti (1999: 4) suggest a link between EMS and radical product innovation to promote the commitment of the firm to sustainability, for example, in terms of financing. Similarly, certification processes can serve to promote organizational learning, initiate further process innovations, and support communication efforts (e.g. Pesonen, 2001).

Overall, it becomes clear that SOI requires a more integrative approach, that is, it translates as an interactive process between the product, process, and organizational level (see Table 7 for examples).

6. Discussion

Based on the previously presented literature review, we developed an integrated framework that aggregates our results (Fig. 4) on innovation practices in terms of strategic sustainability behaviors and types of SOIs.

6.1. An integrated framework on SOIs of SMEs

First, we argue that the heterogeneous SOI practices of SMEs can be explained by an extended taxonomy of five different strategic sustainability behaviors as is summarized in Table 8.

---

**Table 6**

<table>
<thead>
<tr>
<th>Type of innovation (primary focus)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single type</td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td>6</td>
</tr>
<tr>
<td>Process</td>
<td>12</td>
</tr>
<tr>
<td>Organizational</td>
<td>7</td>
</tr>
<tr>
<td>Multiple types</td>
<td></td>
</tr>
<tr>
<td>Process and organizational</td>
<td>9</td>
</tr>
<tr>
<td>Product and organizational</td>
<td>9</td>
</tr>
<tr>
<td>Product and process</td>
<td>4</td>
</tr>
<tr>
<td>Product, process, and organizational</td>
<td>36</td>
</tr>
<tr>
<td>Not specified*</td>
<td>1</td>
</tr>
<tr>
<td>Total no. articles</td>
<td>84</td>
</tr>
</tbody>
</table>

*Articles which did not meet at least one of the innovation type categories.*
### Table 7
Exemplary interactions between innovation types.

<table>
<thead>
<tr>
<th>Influence of …</th>
<th>On …</th>
<th>Process innovation</th>
<th>Organizational innovation</th>
<th>Product innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process innovation</td>
<td>Successful process innovations (e.g. energy-efficiency) can motivate to engage in further process improvements</td>
<td>Initial process improvements (e.g. eco-efficiency practices) may reveal benefits of a systematic environmental management system</td>
<td>Cleaner production can lead to eco-efficient products/services (van Berkel, 2007) Regional sourcing leads to co-developing products with regional suppliers Environmental management system can be a (partial) basis for life-cycle assessments and improvements and thus product innovation Set-up of an environmental team facilitates incorporation of employees in product development Successful introduction of an (pilot) eco-product may lead to an entire eco-line or even rethinking of conventional business</td>
<td></td>
</tr>
<tr>
<td>Organizational innovation</td>
<td>Environmental management system can provide evaluation data as preparation for process innovations</td>
<td>Set-up of an environmental team may lead to further organizational modifications (e.g. employee training and development)</td>
<td>Introducing sustainable products may require a more systematic management approach to the value chain both regarding production and supply chain (e.g. environmental policy with procurement guidelines; supplier selection, evaluation)</td>
<td></td>
</tr>
<tr>
<td>Product innovation</td>
<td>Offering more sustainable products often requires significant process changes (e.g. certified organic products require inputs from organic agriculture)</td>
<td>Introducing sustainable products may require more radical process changes (e.g. certificated organic products require inputs from organic agriculture)</td>
<td>Introducing sustainable products may require a more systematic management approach to the value chain both regarding production and supply chain (e.g. environmental policy with procurement guidelines; supplier selection, evaluation)</td>
<td></td>
</tr>
</tbody>
</table>

---

### Fig. 4
An integrated framework for SOI practices of SMEs.
### Extended taxonomy for strategic sustainability behaviors in SMEs.

<table>
<thead>
<tr>
<th>Strategic behavior</th>
<th>Profit function</th>
<th>Goals</th>
<th>Innovation types</th>
<th>Interaction with external actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistant</td>
<td>Ignorance of environmental/social factors</td>
<td>Compliance</td>
<td>./</td>
<td>./ Very low</td>
</tr>
<tr>
<td>Reactive</td>
<td>Environmental/social factors cause costs</td>
<td>Compliance and limited action beyond</td>
<td>Process improvements, Incremental process and organizational innovations</td>
<td>Low</td>
</tr>
<tr>
<td>Anticipatory</td>
<td>Consideration of environmental/social factors</td>
<td>Ahead of compliance and tangible cost reductions</td>
<td>./</td>
<td>./ Low</td>
</tr>
<tr>
<td>Innovation-based</td>
<td>Consideration of environmental/social factors</td>
<td>Differentiation</td>
<td>Incremental process, organizational, and incremental (limited radical) product innovations</td>
<td>Medium</td>
</tr>
<tr>
<td>Sustainability-rooted</td>
<td>Integration of economic, environmental, and social aspects define core business</td>
<td>Market transformation</td>
<td>Radical product, process, and organizational innovations (business model innovation)</td>
<td>High</td>
</tr>
</tbody>
</table>

1 based on strategy literature analyzed in sample (see Section 5.1.1).

Resistant SMEs ignore sustainability or environmental-related pressures (cf. Tilley, 1999) and expectations whereas reactive SMEs respond to external stimuli, for example, governmental regulation or external stakeholder pressures (Noci and Verganti, 1999). They are limited to complying with regulations as the consideration of environmental or social issues is seen as an additional cost. Their interaction with external actors will be limited and overall for SMEs with (resistant and) reactive strategic sustainability behavior incremental innovations at the process level are to be expected based on limited eco-efficiency measures or minor changes in products and organizational routines.

Anticipatory SMEs time their innovation strategies to anticipate future innovation opportunities (Noci and Verganti, 1999). They consider environmental and social issues to reduce costs and attempt to stay ahead of regulations. They are further characterized by a low interaction with external actors and incremental process and organizational innovations can be expected. For anticipatory type SMEs a comprehensive remodeling of core business processes and structures in line with sustainability principles remains a challenge as these SMEs fail to develop the SOI capabilities in the long term. To introduce radically new processes, organizational forms, and products often requires entirely new business models (Boons and Lüdeke-Freund, 2012; Hansen et al., 2009; Paramathan et al., 2004; Schaltegger et al., 2012).

Innovation-based SMEs proactively seek innovative solutions to environmental and social challenges (cf. Aragón-Correa et al., 2008; Noci and Verganti, 1999) to realize competitive advantages. The consideration of environmental and social issues can lead to market success in the form of differentiation. Incremental process, organizational, and incremental (limited radical) product innovations can be expected. Their interaction with external actors is considerable.

A step further is taken by sustainability-rooted SMEs where the business model builds on the triad of the environmental, social, and economic variable to contribute to the sustainable development of markets and society by spreading SOIs in niche and mass markets (cf. Schaltegger, 2002; Tilley, 1999). Furthermore, these SMEs begin to change their innovation process for SOIs through biomimicry and interaction with external actors. This strategic sustainability behavior is more likely to lead to radical product, process, and organizational innovations and their interaction with external actors will be extensive. It may be argued that SMEs with innovation-based strategies and sustainability-rooted SMEs will find and develop more radical innovation paths for sustainability, also because they are willing to make long-term investments based on their strategies. Sustainability-rooted SMEs may even successfully unlock dominant technologies and institutional structures to effect change and transformation on an industry level (e.g. Parrish and Foxon, 2009).

With respect to strategy formation we propose that both deliberate and emergent strategies exist (Mintzberg and Waters, 1985). Regarding deliberate strategies, the SME can consciously articulate a sustainability strategy which is then implemented and subsequently reflected in related innovation outcomes (i.e. process, organizational, and product innovations). As we are analyzing SOIs of SMEs, it has to be considered that they can be strongly owner-manager driven and are furthermore characterized by few formalized structures. Hence, deliberate strategies are usually not explicitly articulated – they are ‘entrepreneurial strategies’ (ibid). Still, except for mission-driven (sustainable) entrepreneurs, clear intentions for sustainability and thus deliberate strategies often do not exist. When no clear intention regarding sustainability exists, the actual innovation outcomes (i.e. processes, organizational forms, products) reflect the underlying sustainability strategy and can thus be considered strategic (sustainability) behavior. It is for this reason that we speak of strategic behavior in this paper (cf. Fig. 4). Of course, business practice often represents an interplay between deliberate and emergent strategies.

Furthermore, in our analysis we observed that in many cases the innovation effort at one level (product, process, or organizational) leads also to changes on another level. For example, eco-design at the product level requires local sourcing and production which can overall result in securing supply chains. Hence, we argue that SOIs do not occur in isolation but are rather characterized through a high level of simultaneity at the product, process, and organizational level (cf. Fig. 4). It is thus essential that SMEs are put into a position to recognize these innovation potentials at all three levels as they start to (re-)build their entire business model on the triad of environmental, social, and economic variables.

### 6.2. Capacity building for SOIs as an interactive process

Second, we argue that innovation will occur at varying degrees also due to different levels of innovative capacity in SMEs (skills, competencies, capabilities). To strengthen the innovative capacity for SOIs, SMEs can remodel their innovation process to interact more frequently with external actors, that is, engage in collaboration practices beyond the firm level. This we showed for the more proactive strategic sustainability behaviors. Collaboration is recognized as a key element for the transition toward sustainability (e.g. Lozano, 2007; Rooke, 2012) and describes a high-level of interaction between multiple actors that benefit from differences in...
perspective, knowledge, resources, and problem solving approaches (cf. Hartono and Holsapple, 2004; Lozano, 2007). It facilitates firms to identify sustainability issues (e.g. van Kleef and Roome, 2007), access new or complementary resources, enhance their problem solving capacity (e.g. Jenkins, 2009; Lozano, 2007; Roome, 2001), search for and seek legitimacy for innovations, or secure and identify future markets (e.g. van Kleef and Roome, 2007).

Linking this argument back to our analysis of SOI practices of SMEs, we propose that different modes of interaction can affect the strategic sustainability behavior and subsequently the SOI practices of SMEs. Given their cardinal disposition to respond to external stimuli, a continuous activation through external factors, for example regulation, or actors, for instance in public private partnerships (e.g. Hansen and Klewitz, 2012b), is feasible to further motivate the deployment of the strategic behavior of reactive SMEs to eventually move beyond cost reductions through SOIs. As anticipatory SMEs are generally willing to engage in SOIs continuous capacity building can facilitate long term change and an overall increase in innovative activity for sustainability. To take innovation-based SMEs up the ladder of proactivity toward more radical SOIs, changes in their business model and increased interaction with external factors are feasible means to replicate their strategic behavior beyond differentiation with SOIs. Sustainability-rooted SMEs are certainly not “the perfect” type and continuous capacity building and engagement with external actors may prove meaningful to affect change not only at the organizational but also at industry level, for instance, through co-innovation. For such proactive strategic sustainability behaviors, interaction becomes an avenue for learning and innovation at the process, organizational, product, and even systems or institutional level (Bertels, 2012). This may lead to more radical SOIs because, novel ideas, new information, and resources are exchanged in knowledge flows that are more distant to the firm’s own environment (e.g. Boschma, 2005; Granovetter, 1983). Research on learning-action networks (e.g. Clarke and Roome, 1999; Roome, 2001), for example, shows that through collaboration links between multiple actors are developed that go beyond and complement organizational learning and innovation. Hence, interaction for SOIs is an enabling mechanism which leads to learning and innovative capacity building in SMEs that ultimately translates into innovation at the product, process, and organizational level.

6.3. From eco- to sustainability-oriented innovation

Third, we argue that even though our sample was strong on eco-innovations followed by a more integrative approach to sustainability, this should not be misleading in the sense that SMEs do not innovate in the area of social sustainability. We would argue that this is not the case, as there is an extensive literature on more CSR-related (indirectly related to social innovation) practices in SMEs (e.g. Jenkins, 2004, 2009; Jamali et al., 2009; LeProust and Heene, 2006; Murillo and Lozano, 2009; Perrini, 2006; Tilley, 2006). Here, studies find practices in the area of community engagement or employee development (e.g. EC, 2007a). This has also been partially shown in our sample, in that, SMEs pay considerable attention to employee development, developing a corporate mission to engage in society, or taking community needs into account. However, these practices are often declared as good business sense rather than specific innovation behavior. Furthermore, the introduction of methods which primarily aim to improve the environmental performance of firms can also affect social sustainability, in terms of increasing the quality of life (van Berkel, 2007). For example, the production system behind organic products also leads to removal of health threats in the entire value chain as well as, with regard to farmers, to increased independence from capital-intensive inputs (e.g. pesticides) and potential income improvements through green price premiums. Thus, rather than SMEs not innovating extensively in the area of social sustainability it may be more a matter of them using a different language. This is a common phenomenon when talking about sustainability in SMEs, which often do not use the terms established by research or used by larger firms, such as corporate social sustainability or corporate sustainability (cf. EC, 2007b). SMEs simply often speak a different language on SOI.

6.4. Future research

One central aim of a systematic literature review is to propose issues for future research, which we will do in the present section. As SOIs are complex in nature and are themselves a form of organizational and social learning (Roome, 2012), more research into learning processes for SOIs (e.g. Siebenhüner and Arnold, 2007) and capacity building is essential. In this line, research could focus on the different capabilities at the firm level and competencies at the individual management level. Furthermore, in our sample we discussed a range of methods and tools for SOIs, e.g. life-cycle-analysis or EMS. We suggest that more research is necessary on how to streamline these often resource intensive and complex methods into more simplified versions to make them applicable for SMEs (cf. González et al., 2002; Scholl and Nisisu, 1998). For instance, it could be studied how the qualitative method of “strategic LCA” (Andersson et al., 1998) applies to SMEs and could thus spur eco-design.

Overall, it is recommended to move away from the focus on SMEs as reactive entities with disadvantageous characteristics such as resource scarcity which is taken so often, and instead focus on their unique advantages in support of SOIs (e.g. Aragón-Correa et al., 2008). Maybe the key alley for future research is related to their potential to innovate radical. It has to be noted that traditionally SMEs concentrate on environmental process innovations (Gärdström and Norrthon, 1994), and process innovations are often considered as first steps toward more radical innovations. However, the last decade of research has not revealed much evidence that this causality actually exists. The literature sample indicates that a wide range of traditional SMEs are still mostly focused on harvesting low hanging fruits by engaging primarily in incremental innovation (e.g. Bos-Brouwers, 2010; Klewitz et al., 2012).

To focus on more radical innovations, the concept of sustainable entrepreneurship (Hall et al., 2010; Hockerts and Wüstenhagen, 2010; Schaltegger, 2002) particularly with a focus on entrepreneurial firms and new ventures is promising (e.g. Kearns et al., 2010; Plieth et al., 2012; Rodgers, 2010). Sustainable entrepreneurs create ‘hybrid organisations’ which are both ‘market-oriented and mission-centered’ (Boyd et al., 2009: 1; see also Hoffman et al., 2010). Existing practitioner communities such as the “B Corp” (http://www.bcorporation.net) aiming to redefine business in a more sustainable manner (e.g. Ben & Jerrys) provide interesting case study material.

While this seems to emphasize the creation of new ventures, also conventional SMEs can radically change by remodeling their business models. Business model innovation can enable conventional firms to radically change processes, products, and organizational forms in order to more successfully integrate sustainability into core business (e.g. Boons and Lüdeke-Freund, 2012; Schaltegger et al., 2012). In many cases, radical innovations can only be achieved with business model innovation, such as in the case of product service systems (Hansen et al., 2009). For instance, Interface Inc. introduced a carpet leasing offering linked to significant environmental benefits, which radically changed the value proposition, customer interface, financial logic, and infrastructure (Stubbs and Cocklin, 2008). In SMEs, such radical innovations often...
occurs in cases of threats of organizational survival or success to the next generation in family businesses, both phenomena which should be further studied.

In our sample, we further find that literature on SOIs of SMEs could greatly benefit from a stronger theoretical debate. For instance, absorptive capacity should provide some insight (e.g., Cohen and Levinthal, 1989; Lane et al., 2006) on the process of strengthening the innovative capacity for SOIs of SMEs. Hansen and Klewitz (2012b), for instance, show how public-private partnerships support SMEs in building up absorptive capacity, ultimately enabling evolution of their strategic environmental behavior. As the discussion on SOIs of SMEs often revolves around learning and knowledge as specific resources for innovation (cf. Aragón-Correa et al., 2008), the resource based view (e.g., Barney, 2001), the natural resource based view (e.g., Hart, 1995), and the knowledge based view of the firm (e.g., Grant, 1996) might be adequate theoretical lenses. In the context of learning, theories related to organizational learning (e.g., Snell and Chak, 1998) would also enrich the debate on change processes at firm level, for instance, how methods such as cleaner production or eco-design lead to which types of learning (e.g., single or double loop learning) at the organizational level (see in our sample Siebenhüner and Arnold, 2007). A theoretical lens of institutional theory could provide additional insight into the broad debate on drivers and barriers for SOIs and how organizational behavior is guided by the formation of institutions as is shown by Hoffman (1999) in the area of corporate environmentalism.

Similarly, research in the area of sustainable entrepreneurship, provides insight into the interplay between SMEs with other economic actors for industrial transformation toward sustainability (Hockerts and Wüstenhagen, 2010). Large companies, for instance, can adopt the new and more radical sustainability strategies of the SMEs through acquisition to thereby engage more rapidly in disruptive change (Moore and Manning, 2009). Also, SMEs can network with each other and compensate for resource shortages through scaling effects and ‘multiplying’ (Hockerts and Wüstenhagen, 2010). SMEs in the business-to-business context are involved in broader supply chains and therein can exert influence over or can be influenced by larger firms further downstream operating as buyers (or marketers). Literature on sustainable supply chain management (e.g., Carter and Rogers, 2008; Gold et al., 2010; Seuring and Müller, 2008) and particularly “supply chain management for sustainable products” (Seuring and Müller, 2008) is important in this endeavor.

Last but not least, future research could try a more differentiated look at SMEs, for example, into micro, small, and medium businesses. Also, there should be a stronger differentiation of SMEs operating in business-to-business vs. business-to-consumer markets. These firms operate at different value chain positions, are under different pressures, and have more or less varying degrees of freedom in innovation, particularly with regard to products. This focus on business-to-business is particularly important for the more radical strategic behavior as represented by the literature on sustainable entrepreneurship, where articles are mostly limited to case studies from business-to-consumer markets (e.g., food and beverages, clothing).

7. Conclusion

In this paper, we conducted a systematic review of SOI practices of SMEs in order to develop an integrated framework covering a taxonomy of strategic sustainability behaviors linked to different innovation outcomes. By analyzing interdisciplinary literature from diverse fields as broad as environmental and sustainability management, innovation management, and SME research, the framework allows integrating the previously scattered knowledge and we can explain contingencies through an extended taxonomy of strategic sustainability behaviors.

However, the present paper is limited in various ways. First, with our focus on academic journal papers in English, we are aware of excluding papers in other languages as well as other types of publications. With this we also exclude the broad literature on eco-innovation in SMEs extensively dealt with in publications by international organizations which in future research would provide valuable insights on for instance policy schemes, environmental programs or initiatives, and best-practice examples (e.g. by the OECD, European Commission, United Nations Industrial Development Organization, or the United Nations Environment Programme). Second, due to the keyword-based identification of publications, it is possible that publications matching the research focus have not been found, because they do not contain required keywords in the title or abstract of the paper.

Overall, our analysis is a qualitative interpretation of SOI practices of SMEs providing an aggregated overview of the research agenda development from 1987 until 2010 and thus allowing us to systematically identifying future research avenues.

Acknowledgments

We are greatly indebted to the three anonymous reviewers from the Journal of Cleaner Production and the valuable comments made by Donald Huisingh and Frank Boons which guided us to substantially improve the paper in its progress of finalization. Many thanks are directed to two anonymous reviewers who evaluated the paper and the helpful feedback we received on this paper from presenting it at the XXII International Society for Professional Innovation Management (ISPIM) conference in 2010 (Hamburg, Germany). Moreover, we would like to acknowledge the insightful feedback given by Stefan Schaltegger in preparation of this article.

References


B Corp, Certified B Corporation. What are B Corps?, http://www.bcorporation.net (accessed 12.03.13.).


References (accessed 12.03.13.)

Please cite this article in press as: Klewitz, J., Hansen, E.G., Sustainability-oriented innovation of SMEs: a systematic review, Journal of Cleaner Production xxx (2013) 1–19


Further reading


Please cite this article in press as: Klewitz, J., Hansen, E.G., Sustainability-oriented innovation of SMEs: a systematic review, Journal of Cleaner Production (2013), http://dx.doi.org/10.1016/j.jclepro.2013.07.017