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SUSTAINABILITY KNOWLEDGE MANAGEMENT IN SMALL AND MEDIUM-SIZED ENTERPRISES:

INVESTIGATING THE EFFECTS OF SUSTAINABILITY MANAGEMENT TOOLS

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Matthew Phillip Johnson

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Johnson, M. P. (2012): Awareness, Application and Facilitating Conditions of Sustainability Management Tools for SMEs: Results of an Empirical Analysis in Germany. Corporate Responsibility Research Conference 2012, Bordeaux, France.

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Johnson, M. P. & Schaltegger, S. (2015): Nachhaltigkeitsmanagementsoftware: Software und webbasierte Ansätze zur Integration unternehmerischer Nachhaltigkeit in kleinen und mittleren Unternehmen. Lüneburg/Herne: Centre for Sustainability Management (CSM) & NWB Verlag.

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Matthew Phillip Johnson

Table of Contents

A. Framework paper for PhD thesis

Sustainability Knowledge Management in Small and Medium-Sized Enterprises: Investigating the Effects of Sustainability Management Tools (including an overview of the PhD-relevant papers).

Framework Paper for PhD Thesis:

Sustainability Knowledge Management in Small and Medium-Sized Enterprises:

Investigating the Effects of Sustainability Management Tools

Matthew Johnson
Centre for Sustainability Management (CSM), Leuphana Universität Lüneburg
Scharnhorststraße 1, D-21335 Lüneburg
johnson@uni.leuphana.de

Abstract

This framework paper examines the connections between sustainability knowledge management (SKM) and sustainability management tools in small and medium-sized enterprises (SMEs). While previous literature has established that knowledge is essential for the application of sustainability management tools, the effects of such tools on knowledge management are under-researched in the sustainability context. Drawing on multiple academic papers and utilizing various research methods, including a systematic literature review, several quantitative surveys and a multiple case study approach, the PhD thesis systematically examines how such tools can facilitate the identification, acquisition, conversion, application and retention of sustainability knowledge, and potentially lead to the improvement of SKM effectiveness in SMEs. Furthermore, it examines how support functions for sustainability management tools and SKM correspond with each other.

The findings reveal that sustainability management tools facilitate the SKM processes (identification, acquisition, conversion, application and retention), and align with the support factors to advance SKM in SMEs. Particularly, such tools permit the institutionalization of sustainability knowledge into the daily routines and practices in SMEs, which can also be considered as collectors and carriers of knowledge. Additionally, tools create a support structure for SKM, embedding and preserving sustainability knowledge in documents, policies, procedures and norms. The framework paper concludes with complementing areas of future research and offers practical implications for SME management.

Keywords: sustainability knowledge management (SKM); sustainability management tools; small and medium-sized enterprises (SMEs); environmental management system (EMS); corporate citizenship (CC)

1. Motivation and Background

It has been emphasized in the literature that sustainable development can only be achieved if all companies embrace it as well (Bansal 2005; Schaltegger & Burritt 2005). In the context of business sustainability, the importance of small and medium-sized enterprises (SMEs) to engage in sustainable development has increasingly become a research focus for several reasons. First, the collective effects that SMEs have on economies, societies and the environment should not be overlooked (Morsing & Perrini 2009; Revell et al. 2010). While SMEs create many positive economic and social effects (e.g. creating stability in economies around the globe; contributing to the social welfare of surrounding communities; Moore & Manring 2009), it has been estimated that SMEs contribute up to 70% of global industrial pollution (Hillary 2004; Revell et al. 2010). The collective challenge is finding ways for SMEs to improve their environmental and social performance by reducing the negative or harmful impacts, increasing value-add for its products and services, and contributing to a sustainability-oriented economy (Schaltegger & Burritt 2005).

Second, environmental and social concerns are becoming central economic aspects for all companies, including SMEs (Schaltegger & Wagner 2006; Halila 2007; Revell et al. 2010). At the heart of business sustainability, described as the integration of environmental, social and economic concerns in the core business of companies, the solution is establishing linkages between environmental and social performance and economic success (Schaltegger & Wagner 2006; Starik & Kanashiro 2013). Many SMEs are already confronted with sustainability challenges that pose both threats and opportunities for their business, which include i.a. reducing energy consumption and related harmful emissions, increasing material productivity, ensuring health and safety at the workplace, and improving sustainability conditions along the supply chain (Halila 2007; Revell et al. 2010; Johnson & Schaltegger 2015).

Various SME-friendly approaches to deal with sustainability-related issues have been proposed in the literature, including the application of sustainability management tools. Such tools range from environmental management systems (EMS) and corporate citizenship (CC) to audits, benchmarking, reports, incentive systems, and stakeholder dialogue (Johnson 2013; Johnson & Schaltegger 2015). Even SME-specific tools have been proposed in the academic literature, such as SERS, the sustainability evaluation and reporting scheme (Perrini & Tencati 2006). Many of these tools are associated with general terms (e.g. sustainability report); however, variations in format (e.g. printed or web-based versions) and application (e.g. stand-alone or integrated reports) may exist in practice (Johnson & Schaltegger 2015; Johnson et al., forthcoming).

Despite the availability of such tools, many authors provide reasons why SMEs have not yet implemented sustainability management tools compared to large enterprises (see Johnson & Schaltegger 2015 for an overview). These reasons include the lack of awareness of environmental and social impacts (Gerstenfeld & Roberts 2000; Hillary 2004; Revell & Blackburn 2007), the lack of human and financial resources (Ammenberg & Hjelm 2003; Burke & Gaughran 2007; Collins et al. 2007), the sophistication of formal management approaches for the flexible, informal business cultures of SMEs (Perrini & Tencati 2006; Revell & Blackburn 2007), and the lack of knowledge and expertise required to properly manage and execute the tasks embedded in these tools (Bradford & Fraser 2008; Lee 2009). Most of these barriers can be overcome

if certain facilitating conditions are met to assist SMEs in the application of tools, including user-friendliness, cost-effectiveness, flexibility and group-assisted implementation of tools (Johnson & Schaltegger 2015).

This PhD dissertation has investigated multiple perspectives of sustainability management tools in SMEs using a variety of frameworks and methodologies. A systematic review of two decades of literature on sustainability management tools in SMEs (from 2001 to 2011) has captured various tools for application in SMEs, from EMS to sustainability reports, providing reasons why such tools should be applied (e.g. reduction of complexities and performance improvement), exposing reasons why most SMEs do not apply such tools, and revealing success factors that improve the likelihood of tool application in SMEs (Johnson & Schaltegger 2015). The results of the systematic literature review led to an exploratory investigation on the knowledge and application rates of sustainability management tools in SMEs. Although the results of the empirical analysis reveal low knowledge and application rates of 36 sustainability management tools in SMEs, a positive relationship exists between knowledge and application (Johnson 2013). This study provided the groundwork to conduct more in-depth research on the linkages between knowledge and application of such tools in SMEs.

The overall focus of this PhD thesis concentrates on examining the interaction between knowledge and application of sustainability management tools in SMEs. It has already been established that SMEs require knowledge about tools before they can be applied (Johnson 2013; Hörisch et al. 2014). In fact, it is inconceivable that management tools would be applied without any prior knowledge of them (Hashem & Tann 2007; Johnson 2013). Furthermore, knowledge can be seen as an extremely important factor for the application of sustainability management tools in both large corporations and SMEs (Hörisch et al. 2014). From an inverted perspective, sustainability management tools themselves consist of codified and context-specific knowledge, which act as collectors and carriers of knowledge (Boiral 2002; Huang & Shih 2009; Johnson, forthcoming). Codified, or articulated knowledge, can be found in the documents, processes and procedures that are encased in prescribed execution of many tools, such as an EMS (Boiral 2002; Johnson, forthcoming). Context-specific knowledge can be addressed through sustainability management tools that lead to distinctive values and norms on sustainability matters, such as gaining expertise to improve the environmental impact of products through a lifecycle assessment (Huang & Shih 2009; Johnson, forthcoming).

Thus, knowledge and tools for sustainability management are interconnected. Tools require knowledge for the application, and context-specific knowledge can be codified through tools. It has been previously established that applied sustainability management tools can improve the overall sustainability performance of an enterprise (e.g. Melnyk et al. 2003; Iraldo et al. 2009; Henri & Journeault 2010; Daddi et al. 2011; Hörisch 2013). However, the extent that such tools can improve an organization's management of sustainability knowledge is currently under-researched.

Utilizing the knowledge based view and absorptive capacity as theoretical frameworks (Cohen & Levinthal 1990; Grant 1996; Eisenhardt & Santos 2002), this framework paper explores how the application of sustainability management tools can facilitate the sustainability knowledge management of SMEs. Through a

meta-analysis of the PhD-relevant papers in combination with a literature review on existing knowledge management practices in SMEs, this paper develops a proposed model on advancing the effectiveness of sustainability knowledge management through the application of such tools.

This framework paper is structured as follows: the second section provides a literature review on knowledge management, bearing in mind the peculiarities of SMEs and framing it in the context of business sustainability. The review culminates with a conceptual framework on the sustainability knowledge management processes and support factors in SMEs, which exposes several research gaps and leads to the main research question, including four sub-questions of this PhD thesis. Section 3 gives an overview of the relevant PhD papers and methodologies that can address the research questions. Following, section 4 discusses the key findings according to the four sub-questions. Section 5 presents a condensed summary of the key findings, relating this back to the overall conceptual framework, which thus leads to a discussion of the contributions to scientific research, practical implications for SME management and concluding remarks of the thesis.

2. Theoretical Framing and Research Gaps

2.1. Sustainability Knowledge Management

Before framing sustainability knowledge management in the SME-context, it is essential to define knowledge and knowledge management in general and in the sustainability context. Knowledge is more than just a collection of data (i.e. facts and figures) and information (i.e. processed data used in specific contexts), but it rather implies know-how (e.g. advanced skills) and the ability to apply information to complex, real-world problems, which is widely expressed through experience, values and norms (Quinn et al. 1996; Davenport & Prusak 1998; Alavi & Leidner 2001; Tsoukas & Vladimirou 2001; Baskerville & Dulipovici 2006). Several seminal articles (Polanyi 1975; Nonaka 1991; Nonaka & Takeuchi 1995) differentiate between two types of knowledge, tacit and explicit, in enterprises. Tacit knowledge usually resides within individuals, which is difficult to express in words and transfer to others, but it can also be found as engrained company culture (Nonaka & Takeuchi 1995; Meso & Smith 2001). Explicit, or codified, knowledge can be easily communicated, readily stored and transferred through documents, databases, processes and norms (Polanyi 1975; Zack 1999). While both types of knowledge are crucial for an enterprise (Nonaka & Takeuchi 1995; Alavi & Leidner 2001), this PhD thesis covers a more general approach to knowledge management in which particular types of knowledge are not the focus, but rather the overall sustainability knowledge in SMEs.

Prominent authors of the knowledge based view (KBV) argue that knowledge is the most important strategic resource in an organization, as it can coordinate and streamline other resources in an effective manner (Kogut & Zander 1992; Grant 1996). While knowledge rests in and is created by individuals – the "knowers" as Baskerville and Dulipovici (2006, p. 4) state – an enterprise is able to acquire, convert, and apply knowledge from individuals as part of an organization's knowledge management (Grant 1996; Lane et al. 2006). In this sense, a firm can be seen as "…an institution for integrating knowledge" (Grant 1996, p. 109). Thus, an enterprise's knowledge can be defined as a set of collective understandings embedded in a firm's

documents, organizational routines, practices, and norms, which enable an enterprise to effectively utilize its resources (Davenport & Prusak 1998, p. 5; Tsoukas & Vladimirou 2001, p. 981).

In the context of business sustainability, knowledge is required not just for economic matters, but it is also vital for ecological and social aspects as well (Egbunike et al. 2006; Miller et al. 2011). In this sense, knowledge on economic issues is not sufficient for sustainability, but it has to be expanded to capture a further expertise and understanding on environmental and social issues as well, and encompass the multiple facets of sustainability management (Boiral 2002; Schaltegger et al. 2013). Therefore, an enterprise's sustainability knowledge can be defined as a collective set of interdisciplinary understandings of economic, environmental and social aspects that is embedded in an enterprise's routines, practices, documents and norms (adapted from Davenport & Prusak 1998; Tsoukas & Vladimirou 2001).

An important aspect for an enterprise's knowledge is that expertise knowledge does not just reside in one individual in the firm, but it is managed in such a way to involve as many people as necessary. The literature offers the concept of knowledge management (KM) to create, develop and expand the overall knowledge stocks within an enterprise through clearly communicated and properly executed processes (Nonaka 1991; Alavi & Leidner 2001; Gold et al. 2001). KM becomes especially important when considering that the loss of key personnel to competition or retirement could create a major knowledge setback (Gold et al. 2001).

Despite the vast benefits of KM to organize an enterprise's knowledge, KM is not easily established in SMEs, especially considering the required resources and personnel to invest in such a system (Wong 2005; Chan & Chao 2008). When establishing a KM faces restrictions, such as lack of financial and human resources, several authors offer solutions for establishing KM in SMEs through the theoretical construct of absorptive capacity (Caloghirou et al. 2004; Roy & Thèrin 2008; Hansen & Klewitz 2012; Johnson, forthcoming). Absorptive capacity combines the already existing knowledge base of a firm with its ability to expand this base through the acquisition, conversion and application of new knowledge (Cohen & Levinthal 1990; Zahra & George 2002; Lane et al. 2006). When the existing knowledge base of an SME is restricted (e.g. by the lack of human and financial resources), the absorptive capacity construct can offer alternative pathways to acquire knowledge from external sources (Roy & Thérin 2008; Hansen & Klewitz 2012). Thus, SMEs oftentimes rely on external partners through various cooperation forms, including public-private partnerships (Hansen & Klewitz 2012), university-enterprise collaboration (Johnson, forthcoming), and business networks (Collins et al. 2007; Halila 2007).

However, absorptive capacity does not fully cover the range of possibilities of KM, as it is conceivable to integrate additional elements and support factors to derive value from knowledge (Gold et al. 2001; Lin 2007). Additional processes include the identification of required knowledge and allow for the measurement of effectiveness of KM through improving innovativeness and overall company performance (Lin 2007; Schreyögg & Duchek 2010). In sum, KM can encompass both the absorptive capacity processes and additional elements to establish a complete model of KM. Therefore, KM can be described as the processes and support factors to identify, acquire, convert and apply relevant knowledge, leading to the increased effectiveness of KM in an enterprise (Lin 2007; Schreyögg & Duchek 2010).

An advantage of KM is that it is usually context-specific, such as establishing a framework to capture, develop and exploit relevant knowledge on sustainability issues in firms (Egbunike et al. 2012). This framework paper argues that sustainability knowledge would benefit from an established KM, as it can structure and further develop such vast economic, environmental and social knowledge stocks within an enterprise (Boiral 2002; Huang & Shih 2009; Gavronski et al. 2012). With very few exceptions (Boiral 2002; Huang & Shih 2009; Nejati et al. 2010; Egbunike et al. 2012; Gavronski et al. 2012), very little literature exists on the interface between business sustainability and KM. Most of this literature looks at the effects of KM on environmental management or stakeholder management, but an inverted view on the influence of sustainability management tools on KM is missing.

Therefore, this paper has developed a conceptual framework for sustainability knowledge management based on previous notions established by Lin (2007) and Schreyögg and Duchek (2010). Sustainability knowledge management (SKM) can thus be defined as the processes and support factors to facilitate the identification, acquisition, conversion and application of sustainability-related knowledge, which can be combined to measure its overall effectiveness (Lin 2007; Schreyögg & Duchek 2010). Adapted from Lin (2007), Figure 1 illustrates the course of progression as an enterprise can potentially move from the initiation stage of SKM, where it recognizes the relevance of SKM and prepares to incorporate it, into the development stage and finally into the mature stage of SKM, where sustainability knowledge is not only contained within an enterprise, but also networked with external partners.

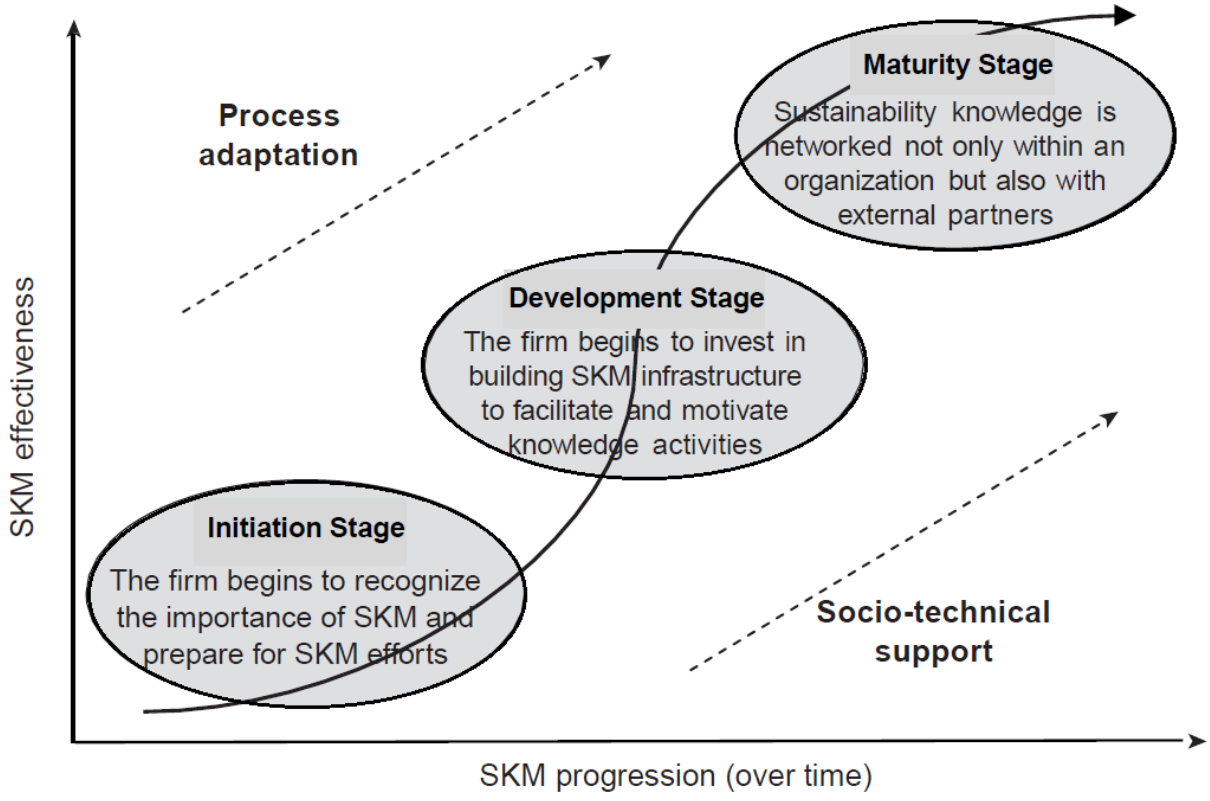

Figure 1: Sustainability Knowledge Management Stages (adapted from Lin 2007, p. 648)

As an enterprise progresses through these stages, the effectiveness of SKM should increase as well (Lin 2007). SKM effectiveness can be described as the realization of successful outcomes from absorbed sustainability knowledge, including an increase of sustainability innovativeness through new technical and organizational innovations and the improvement of sustainability performance in an enterprise (Lin 2007; Schreyögg & Duchek 2010; Hansen & Klewitz 2012; Johnson, forthcoming). The SKM processes should be constantly adapted and improved, and they can be supported by firm-related conditions, also known as socio-technical support factors (Lin 2007). The current research on processes, effectiveness and support factors for SKM in SMEs will be described in greater depth in the next sub-section.

2.2. Processes and Support Factors of Sustainability Knowledge Management in SMEs

The KM literature stresses the importance for a firm to manage both its internal and external knowledge sources (Gold et al. 2001; Zahra & George 2002; Lin 2007). When internal knowledge sources are lacking, which is often the case in SMEs, external knowledge sources become very crucial (Roy & Thérin 2008; Hansen & Klewitz 2012). Oftentimes, SMEs have limited resources and personnel to dedicate to investing and developing their knowledge base internally (e.g. through R&D investments; Roy & Thérin 2008). Therefore, SMEs can turn to external sources of knowledge to increase it, even in the sustainability context (Roy & Thérin 2008; Hansen & Klewitz 2012; Johnson, forthcoming).

When observing the absorptive capacity of firms from a KM perspective, knowledge can be observed as a series of processes and flows (Eisenhardt & Santos 2002; Zahra & George 2002; Lin 2007; Schreyögg & Duchek 2010). Several mainstream KM processes have been highlighted in the literature. Gold et al. (2001) establish that KM consists of multiple interconnected processes, including knowledge acquisition, conversion and application. Several authors find similar processes of knowledge management in its overlap with absorptive capacity, including acquisition, transformation and application, while omitting the protection process (Zahra & George 2002; Schreyögg & Duchek 2010).

Schreyögg and Duchek (2010) extend the KM framework not just to capture these three central processes, i.a. knowledge acquisition, conversion and application, but also include the identification of knowledge from external sources as an initial process, and the measurement of effectiveness of KM as a final outcome. This extension of the KM model is in line with Lin's (2007) proposal to include KM effectiveness to these processes, and expands it to include socio-technical support factors to the model. The SKM processes, its effectiveness and support functions will now be described individually.

As an initial step of the SKM processes, a firm recognizes the importance of organizational sustainability knowledge and begins to identify valuable knowledge for its sustainability management (Lin 2007). A successful KM strategy usually begins with the identification of what knowledge is required, what knowledge is missing in the firm and where to find it (Kamara et al. 2002; Apulu & Latham 2009). Thus, this initial process of SKM includes the identification of relevant knowledge for sustainability. When the required knowledge is not found within the firm, it is important to recognize which external sources can help to fill

these knowledge gaps (Roy & Thérin 2008). Particularly in SMEs, external sources can help to increase the knowledge base for sustainability management (Roy & Thérin 2008; Johnson forthcoming).

Following the identification of relevant sustainability knowledge, the second step of SKM is to assimilate this knowledge and make it useful within the firm (Gold et al. 2001; Zahra & George 2002; Lane et al. 2006; Lin 2007). In order to ensure a proper allocation and application of sustainability knowledge, a company should incorporate several processes to improve the absorptive capacity of the firm (Gold et al. 2001; Zahra & George 2002; Lane et al. 2006; Schreyögg & Duchek 2010). These processes (referred to in this paper as the "absorptive capacity processes"; Gold et al. 2001, p. 190) include the acquisition, conversion and application of sustainability knowledge. The absorptive capacity processes deal with developing current knowledge, acquiring missing knowledge, converting it and applying it to decision-making (Gold et al. 2001; Zahra & George 2002).

Acquisition implies the accumulation of external and internal knowledge, i.e. through individuals and groups that possess such knowledge (Alavi & Leidner 2001; Gold et al. 2001; Boiral 2002; Lin 2007). For example, company technicians possess knowledge on many aspects of energy and environmental impacts of machinery that is oftentimes impossible to recognize without them (Boiral 2002). For SMEs, an alternative to the further development of internal knowledge is acquiring it from external sources (Wong & Aspinwall 2004; Roy & Thérin 2008). The acquisition of external sustainability knowledge does not have to be costly for SMEs, as it can be acquired through various collaborative partnerships, including university-enterprise cooperation, collaborations with customers and suppliers, and through participation in various business and sustainability-oriented networks (Halila 2007; Hansen & Klewitz 2012; Johnson forthcoming).

Following acquisition, the next process of SKM is knowledge conversion, which is oriented towards organizing, structuring and preparing knowledge for its application (Gold et al. 2001; Lin 2007). This process involves the combination of existing and acquired knowledge, the creation of linkages between various digital knowledge depots, such as documents and images, and the distribution of these items to the involved personnel throughout an enterprise (Alavi & Leidner 2001). Zack (1999) describes such conversion as knowledge codification, a process that arranges and prepares semantic knowledge, or knowledge found in documents and processes, so that it can be understood and reused by an individual or an organization. The conversion process also entails the development of a structure and common language to access and interpret knowledge. According to Gold (2001, p. 191), "without common representation standards, no consistency or common dialogue of knowledge would exist." SMEs often struggle with this process as conversion implies the formalization of procedures and use of additional resources, which SMEs either do not possess or do not perceive the advantages of this process (Wong & Aspinwall 2004; Brammer et al. 2012). Therefore, this process should be kept simplistic and reflect the available resources of a particular SME (Chan & Chao 2008).

The knowledge application process addresses the actual use of knowledge, incorporating it into the firm's decisions, actions and procedures (Bhatt 2001; Gold et al. 2001; Wong & Aspinwall 2004). This process also includes the transfer and sharing of knowledge throughout a firm, which can lead to context-specific

problem solving (Lin 2007; Apulu & Latham 2009). Wong and Aspinwall (2004) state that SMEs may be at an advantage in this area because small firms can exploit their flatter hierarchies and shorter communication paths to create a shared understanding and application of particular knowledge. During this process, the owner-manager plays a vital role in sharing and encouraging others to get involved in KM application (Wong 2005).

The proper integration and execution of these processes – identification, acquisition, conversion and application – can potentially lead an enterprise to improve the effectiveness of SKM (Lin 2007; Schreyögg & Duchek 2010). In general, firms must exploit knowledge internally to derive value from it (Zahra & George 2002; Wong & Aspinwall 2004). The effectiveness of SKM can be measured by the improvement of organizational innovativeness as well as the improvement in overall company performance (Lin 2007; Schreyögg & Duchek 2010). Thus, SKM can be advanced when relevant knowledge is effectively identified, acquired, converted and applied, which leads to higher innovativeness and achieves improved sustainability performance (Lin 2007). This is an area that is under-researched for SKM in SMEs. Until now, few authors (Roy & Thérin 2008; Hansen & Klewitz 2012) have made a connection to absorptive capacity and eco-innovativeness in SMEs.

Finally, several socio-technical support factors can increase the successful development of these processes, which can also lead to improved effectiveness of SKM (Lin 2007). Gold et al. (2001) find three basic preconditions to ensure proper flow of processes and greater effectiveness of knowledge management, including technology, structure and culture. Lin (2007) restructures these preconditions into the term "social-technical support", which can be divided into social and technical support factors. Social support factors include top management support, employee involvement and the creation of an open culture for sharing knowledge within the enterprise (Lin 2007; Chan & Chao 2008). Technical support factors include IT systems, databases and communication technology (e.g. e-mail and intranet). Several authors have especially studied that social support factors are important for KM in SMEs (Wong 2005; Tan & Hung 2006; Chan & Chao 2008). These SME-particular factors include positive attitude by owner-manager, support from management, organizational culture promoting learning and interaction, employee involvement, training and education of staff, and a simplified IT structure. Figure 2 includes all these processes and support functions to leading the increased effectiveness of SKM in SMEs, which combines the proposed model from Lin (2007) with that of Schreyögg and Duchek (2010). The framework illustrates how these processes and support functions can improve SKM effectiveness in SMEs.

As portrayed with the numbers 1 to 4, this model can be divided into four distinct parts, or areas of investigation, which will be explored individually in this framework paper. The next section will address the research gaps and present research questions according to these areas of investigation. The subsequent discussion of key findings will reveal the particular aspects of the model that should be adapted.

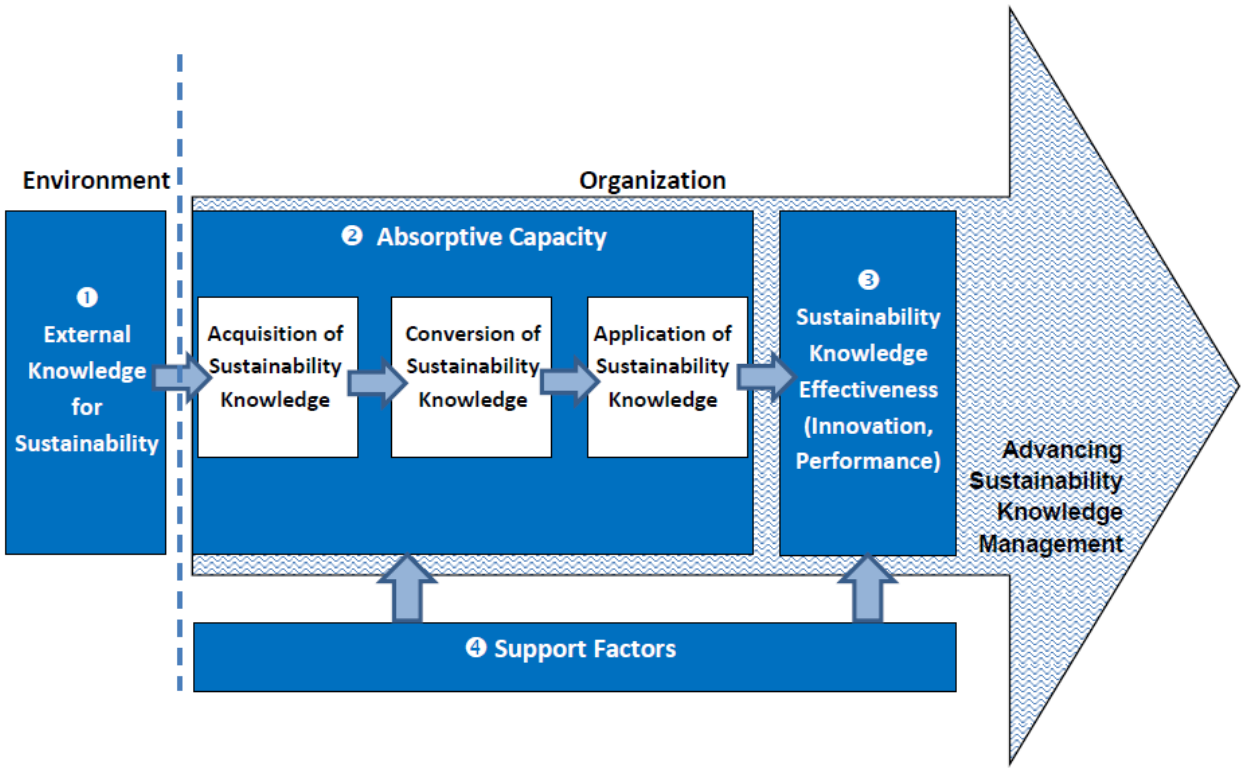

Figure 2: Sustainability Knowledge Management Model: Processes, Effectiveness and Factors (combination of conceptualizations from Lin 2007; Schreyögg & Duchek 2010)

2.3 Research Gaps and Guiding Questions

A review of the literature on sustainability knowledge management (SKM) processes in SMEs has exposed several research gaps, which this framework paper will address. First, the literature on the implementation of SKM processes in SMEs has been growing over the past 15 years (e.g. McAdam & Reid 2001; Wong & Aspinwall 2004; Wong 2005; Chan & Chao 2008; Zhang et al. 2006); however, these processes, support factors and overall effectiveness have not been combined in the SME context. Second, the KM literature pertaining to sustainability knowledge has mostly focused on the absorptive capacity processes to improve sustainability innovations in SMEs (Roy & Thèrin 2008; Hansen & Klewitz 2012); however, research has not yet investigated how such knowledge can lead to improvements of sustainability performance. Third, an exploration of the effects of sustainability management tools on these processes, support factors and overall effectiveness are missing.

Therefore, this framework paper contributes to the literature by addressing these research gaps and by providing a more complete representation of the SKM processes, corresponding support factors, and its potential effectiveness for SMEs in the sustainability context. In addition, the paper provides initial insights how sustainability management tools can facilitate more advanced stages of SKM, especially when the support factors are aligned for both tools and the knowledge management processes. Thus, the overarching research question for this paper is:

> *How can sustainability management tools facilitate the knowledge management processes and correspond with the support factors to advance sustainability knowledge management in SMEs?*

The sub-questions provided below will follow the areas of investigation highlighted in Figure 2 (numbers 1 to 4) in the previous section, especially how sustainability management tools strengthen the various processes and effectiveness of SKM, and to what extent that support factors for the SKM processes and sustainability management tools correspond with each other.

First, in order to identify what sustainability knowledge is necessary for an enterprise and where to locate it, SME managers should integrate the identification process as an initial stage of SKM. Previous literature mentions that SMEs typically have limited time and resources for the discovery of new knowledge, yet a simplified and focused identification procedure could be of assistance (Roy & Thèrin 2008; Apulu & Latham 2009). To streamline the identification process in SMEs, the recognition of several relevant and reliable knowledge sources, such as a public-private partnership (Hansen & Klewitz 2012) or a sustainability-focused network (Collins et al. 2007; Halila 2007), is essential. While previous literature highlights which external knowledge sources can foster the identification of sustainability knowledge for SMEs, very little is known about how sustainability management tools assist in knowledge identification. Thus, the first research question (RQ1) is:

RQ 1: How can sustainability management tools improve the identification of sustainability knowledge and corresponding sources in SMEs?

Second, even if relevant knowledge and available sources for sustainability knowledge have been identified, no guarantee can be offered that this knowledge will be properly acquired, converted and applied, especially in SMEs. As previously mentioned, SMEs face limitations in the implementation the central SKM processes, possessing fewer resources for knowledge acquisition, conversion and application (Desouza & Awazu 2006; Apulu & Latham 2009). Nevertheless, these processes are very important if SMEs intend on expanding their absorptive capacity towards developing their sustainability knowledge (Lane et al. 2006; Roy & Thérin 2008; Schreyögg & Duchek 2010; Hansen & Klewitz 2012). Previous researchers (Wong 2005; Desouza & Awazu 2006; Chan & Chao 2008) state that information technologies are essential for KM; however, these technologies are usually not adopted by SMEs. Therefore, SMEs should consider the use of simplistic forms of technology (e.g. document management, email, internet and intranet) for SKM (Chan & Chao 2008). However, little is known how sustainability management tools can enhance these absorptive capacity processes. Therefore, the second research question is:

RQ 2: How can sustainability management tools strengthen the absorptive capacity processes (i.e. acquisition, conversion and application) of SKM in SMEs?

Third, if the absorptive capacity processes are well-managed and further developed, this could potentially lead to the increase of SKM effectiveness in SMEs (Lin 2007; Chan & Chao 2008; Schreyögg & Duchek 2010). Such effectiveness of SKM can be measured on how it contributes to innovativeness as well as improved sustainability performance in an enterprise (Lin 2007; Schreyögg & Duchek 2010). While previous literature has revealed how absorptive capacity can potentially lead to an increase of sustainable technological and organizational innovations in SMEs (Halila 2007; Hansen & Klewitz 2012), a direct link between

SKM and sustainability performance in SMEs has not yet been established in the literature. Current and future research on business sustainability and KM would greatly benefit from new understandings on how SKM could enhance sustainability performance. This PhD thesis provides first insights with regard to sustainability management tools support to increase the effectiveness of SKM in SMEs. Thus, the third research question is:

RQ 3: How can sustainability management tools contribute to an increased effectiveness of sustainability knowledge management in SMEs?

Finally, the effectiveness of SKM can be improved not only through the abovementioned processes, but also through incorporating the socio-technical support factors (Gold et al. 2001; Lin 2007). More specifically, the support factors for SKM in SMEs include the positive attitude by the owner-manager, top management support, an open culture promoting learning, employee involvement, training and education of staff, and a simplified IT structure (Wong 2005; Chan & Chao 2008). Furthermore, previous literature has established certain facilitating conditions of sustainability management tools to ensure their application in SMEs (Johnson & Schaltegger 2015). Nonetheless, an inquiry into the alignment of these support factors between SKM and sustainability management tools is missing entirely in the literature. If the most important support factors between SKM and tools would correspond with each other, an argument could be established that SKM and tools could be integrated into one comprehensive framework, despite the financial and human resource constraints in SMEs. Therefore, the final research question is:

RQ 4: What critical success factors correspond between sustainability management tools and the sustainability knowledge management processes?

3. PhD-relevant Papers and Methodologies

3.1. Connecting Sustainability Knowledge and Management Tools in PhD-relevant Papers

Five academic papers of this PhD thesis contribute to answering the four research questions posed in the previous section. This framework paper makes a connection between the SKM model and sustainability management tools in SMEs. Previous literature has examined the effects of knowledge management on environmental management in general (Boiral 2002; Huang & Shih 2009; Gavronski et al. 2012), but not the other way around. Furthermore, sustainability management tools (i.e. audits, incentive systems, dialogue, etc.) have not yet been brought in direct connection with SKM.

This PhD thesis has already stressed the importance of knowledge for the application of sustainability management tools in SMEs (Johnson 2013; Hörisch et al. 2014). From an inverted perspective, an explanation on how sustainability management tools can facilitate the advancement of SKM processes and overall effectiveness in SMEs will now be addressed. This PhD thesis offers an original contribution into this specific area by investigating the effect that such tools have on the processes, effectiveness and support factors of the SKM model.

The combination of PhD-relevant papers makes such an investigation possible. The contribution of this PhD thesis can be found in five academic papers. Table 1 presents an overview of these papers and how they provide insights to the research questions.

Paper No.	Paper Title & *Journal*	Authors & Year of Publication	Research Question
1	Two Decades of Sustainability Management Tools for SMEs: How far Have We Come? *Journal of Small Business Management*	Johnson, M. & Schaltegger, S. (accepted 2013, early view 2015)	RQ 1 & 4
2	Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools. *Corporate Social Responsibility and Environmental Management*	Johnson, M. (accepted 2013, early view 2013)	RQ 2 & 3
3	Implementation of Sustainability Management *and Company Size:* A Knowledge-Based View. *Business Strategy and the Environment*	Hörisch, J.; Johnson, M. & Schaltegger, S. (accepted 2014, early view 2014)	RQ 2
4	Knowledge Acquisition Practices in Sustainability-oriented SMEs: Exploring the Effects of Internal Support and External Cooperation. *International Small Business Journal*	Johnson, M. (in review, submitted 11/2014)	RQ 1 – 4
5	Software and Web-Based Tools for Sustainability Management in Micro-, Small- and Medium-Sized Enterprises. *Special Issue: EnviroInfo 2014 - Selected Contributions*	Johnson, M.; Halberstadt, J.; Schaltegger, S. & Viere, T. (in review, submitted 01/2015)	RQ 2 & 4

Table 1: Overview of PhD-relevant papers and application to research questions

The individual papers contribute to answering the four research questions. In addition, the combined results of the individual research questions will provide answers to the main research question, "*How can sustainability management tools facilitate the knowledge management processes and correspond with the support factors to advance sustainability knowledge management in SMEs?"*

3.2. Methodologies

The analysis draws data from multiple research methods, including a systematic literature review, two quantitative surveys and a multiple case study. Based on these various datasets, the individual papers were written. For Paper 1, a systematic literature review according to Tranfield et al. (2003) and Moustaghfir (2008) examined 112 peer-reviewed articles on sustainability management tools in SMEs that were published between the years 1991 and 2011. In addition to conducting a meta-analysis of the academic literature, the included articles were analyzed according to four areas of investigation, including (a) proposed tools for SMEs, (b) reasons for implementation in SMEs, (c) barriers for implementation in SMEs, and (d) success factors improving the likelihood of implementation in SMEs. The data was extracted using an Excel spreadsheet, which was thus synthesized and applied in Paper 1.

For Papers 2 and 3, a web-based survey was conducted from February to June 2012 with German SMEs, according to the EU definition of SME (European Commission 2005). The survey produced 177 usable

questionnaires from the original 1,000 email invitations sent. The response rate of 17.7% is comparable to other quantitative surveys with similar research on sustainability management in SMEs, providing a solid base of investigation for SMEs studied as a single group (Gadenne et al. 2009; Revell et al. 2010). Paper 2 used IBM SPSS (Versions 19 and 20) to conduct correlation and linear regression analyses. Paper 3 benefited from combined datasets, including the SME survey data and that from the Corporate Sustainability Barometer 2012 (Schaltegger et al. 2012b) that compared knowledge and application in large corporations and SMEs, utilizing IBM AMOS 21.0.0 to perform structural equation modelling.

In paper 4, a multiple case study approach was chosen to explore how knowledge acquisition practices are carried out in sustainability-oriented SMEs. Ten companies were selected according to size, i.e. they must fall into the EU definition of SME (European Commission 2005) and prior implementation of an EMS. The form of data collection consisted mainly of interviews in 2014, which were conducted with the environmental management officer in each company. The interviews were then fully transcribed and coded using the MAXQDA® Data Analysis Software. In addition, environmental statements, sustainability reports and other company documents were analyzed in order to ensure triangulation (Yin 2003).

In paper 5, a web-based survey was conducted in 2014 with German SMEs according to the EU-definition of SME (European Commission 2005). The survey was centered on determining which technological, organizational and environmental factors (TOE-Framework; Tornatzky & Fleischer 1975) influence the adoption of sustainability management software (a form of web-based sustainability management tools) in SMEs. The survey produced 145 usable questionnaires from the original 1,152 invitations sent, resulting in a response rate of 12.6%. While the response rate is comparable to similar surveys on sustainability management in SMEs (Revell et al. 2010), it also meets the criteria of analyzing a sample as a single group (Bartlett et al. 2001). The paper used IBM SPSS (Version 21) to conduct a multinomial logistic regression analysis.

4. Discussion of Key Findings

In order to avoid a broad generalization of sustainability management tools, this framework paper includes five specific tools that are applied in SMEs. The aim is to reveal both general and specific aspects of tools and how they facilitate the various SKM processes, its effectiveness and the support factors. Not all sustainability management tools were created equal, and thus they should not be treated as such. First of all, the notion "tool" is just an umbrella term to describe either an instrument, a concept or a system that helps to achieve an objective or group of objectives (Schaltegger et al. 2002; 2007). Second, such tools often address different aspects of sustainability management, including ecological challenges (e.g. EMS) and social challenges (e.g. CC). Table 2 shows the five selected tools, based on two selection criteria: (a) the times cited in the literature [Paper 1], and (b) the rates of knowledge and application in SMEs as well as the ratio of application to knowledge [Paper 2].

No.	Sustainability Management Tool	Citations	Known (%)	Applied (%)	Ratio Application to Knowledge (%)
1	Environmental Management System	47	44.77	27.91	62.34
2	Corporate Citizenship	20	50.58	43.02	85.05
3	Audit	6	47.67	21.51	45.12
4	Incentive System	5	44.19	30.81	69.72
5	Dialogue	4	8.14	5.23	64.25

Table 2: Selected Sustainability Management Tools for PhD Thesis

Bearing in mind the average rates of knowledge (28.15%) and application (16.26%) in SMEs [Paper 2], most selected sustainability management tools have above average knowledge and application rates. The one exception is dialogue (also known as stakeholder dialogue), where the knowledge and application rates are below the SME average. However, the ratio of application to knowledge is relatively high (64.25%). This ratio shows the relative percentage a tool is applied by the degree of knowledge. It is calculated by dividing the rate of application by the rate of knowledge [Paper 2]. In addition, Gold et al (2001) state that incentive systems and dialogue are key tools to build up an enterprises' knowledge management.

These tools represent various instruments (audit and dialogue), systems (EMS and incentive system) and concepts (CC) of sustainability management, and thus provide ample examples how tools can facilitate various processes of the SKM model. Of course, more tools could have been included in this paper, but this might actually confuse rather than inform how tools facilitate the processes and improve overall effectiveness of SKM. The following four sections highlight how sustainability management tools both generally and specifically support the SKM model.

4.1. Identification of Sustainability Knowledge in SMEs

Identifying knowledge on relevant sustainability issues for a particular SME's business is no simple task (Boiral 2002; Perez-Sanchez et al. 2003; Roy & Thérin 2008). Not only do firms need to have a specialized knowledge on the individual fields of sustainability, including economic, environmental and social aspects, but they also must find ways to integrate this knowledge in integrative and transdisciplinary ways (Miller et al. 2011; Schaltegger et al. 2013). While there is no one-size-fits-all approach to recognizing the exact knowledge needs for a particular company, sustainability management tools can assist managers during the identification process. Two papers of this PhD thesis [Papers 1; 2; 4] provide greater details how such tools can improve the identification of sustainability knowledge and corresponding knowledge sources in SMEs.

First, sustainability management tools can break down the complexities of sustainability knowledge to a manageable level in SMEs [Paper 1]. Sustainable development defined by the Brundtland commission (UN-WCED 1987) is too broad of a concept for SME's to directly manage. How can SMEs properly address the

needs of the present without compromising future generation needs? Rather, concepts such as the triple-bottom-line (Elkington 1998) and integrative sustainability management (Dyllick & Hockerts 2002; Schaltegger & Burritt 2005) sort out the far-fetching notion of sustainable development into manageable pieces for SME managers [Paper 1]. Many sustainability management tools follow the triple-bottom line or integrative sustainability management approaches to measure, manage and communicate sustainability-related activities in SMEs [Paper 1]. The most frequently applied tools in SMEs resemble those now established in conventional business practice, such as quality management systems and risk analysis [Paper 2].

Second, sustainability management tools can lead SME managers to the identification of new sustainability knowledge not previously recognized [Paper 4]. Various tools make it possible for SMEs to identify relevant knowledge for particular sustainability aims. For example, a dialogue with internal and external stakeholders can reveal sustainability knowledge that a company previously did not identify as being important, and potentially lead managers to pinpoint what knowledge is required (Seidel et al. 2008; Arnold 2010). Another tool, CC, also provides an exchange with various stakeholder groups; however, the aim of this tool is not to identify new sustainability knowledge, but primarily to give back to the community through company-led initiatives. Any new knowledge obtained through such programs is done so in an indirect, unstructured way; therefore, CC would not be considered a knowledge-identification tool (Jenkins 2006).

Third, sustainability management tools require specific knowledge to properly perform the predefined actions to execute them [Paper 1]. In particular, specialized tools, such as a sustainability audit and EMS, often require additional training and experience in order to effectively carry them out (Perez-Sanchez et al. 2003; Lee & Klassen 2008). The contents of a sustainability audit can assist experienced SME managers to identify areas of knowledge deficits in a timely manner (Graafland et al. 2003). In addition, a properly executed EMS, for instance, can assist an SME to pinpoint areas of knowledge deficits, so that the company can either develop this knowledge internally or seek it out from external sources (Hillary 2004; Seiffert 2008).

Fourth, the identification of relevant knowledge for sustainability can also be enhanced through the previous adoption of sustainability management tools [Paper 4]. For example, the prior application of an EMS can be extremely helpful in properly identifying knowledge for additional sustainability needs and tools [Paper 4]. The acquired capabilities and dedicated resources to EMS can facilitate a greater understanding of knowledge needs (Darnall & Edwards 2006). In particular, an EMS can help to reduce the time and additionally required resources for recognizing knowledge for particular aspects, such as environmental audits, benchmarking and reporting (Seiffert 2008; Zorpas 2010; [Paper 4]).

The identification stage of the SKM model is not just limited to finding relevant sustainability knowledge, but also includes the recognition of corresponding knowledge sources [Paper 4]. Sustainability management tools can facilitate in the identification of knowledge sources as well. For example, an EMS according to ISO 14001 standard or the Eco-Management and Audit Scheme (EMAS) provide sources of knowledge to facilitate their implementation (Perez-Sanchez et al. 2003; Hillary 2004; Zorpas 2010). Recognizing these knowledge sources is often not so straightforward with tools, such as stakeholder dialogue, as a SME is allowed to choose which stakeholders to approach and which topics to address. Nevertheless, dialogues with

customers and suppliers can provide extremely important sources of knowledge, as they usually have company-specific knowledge on improving sustainability performance [Paper 4].

One aspect of knowledge identification rarely addressed in the KM literature is the differentiation between internal and external knowledge sources. The SKM model leans more to the external side of the absorptive capacity processes that focus strongly on the identification of external knowledge sources (Zahra & George 2002; Schreyögg & Duchek 2010). However, several sustainability management tools reveal that a great source of knowledge can also be found within the firm, just waiting to be untapped (Boiral 2002; [Paper 4]). For example, an EMS can help to expose these internal knowledge sources inside the company through yearly performance checks, environmental teams and employee involvement schemes [Paper 4]. In addition, incentive systems can be established for employees to contribute to identification of knowledge; however, this might render a very costly process if not coupled with tangible, measurable outcomes (Goetz 2010).

Thus, the addition of the identification of internal knowledge to the SKM model widens the options for SMEs through the use of sustainability management tools. This leads to the first adaptation of the SKM model, which originally views identification as event occurring outside of the enterprise (Schreyögg & Duchek 2010). Now, this process combines the identification of internal and external knowledge as part of an inter-organizational process, which is now incorporated within the enterprise. As a consequence, this process can also be supported by the socio-technical factors, which will be addressed in the final section. The following sub-section investigates how sustainability management tools strengthen the absorptive capacity processes.

4.2. Absorptive Capacity Processes for SMEs

Following the identification of internal and external sustainability knowledge and corresponding knowledge sources, the SKM model continues into the absorptive capacity processes, including the acquisition, conversion and application of sustainability knowledge. These processes focus on assimilating, converting and using the identified knowledge, and can be adjusted to potentially lead to their increased effectiveness over time (Lin 2007; Schreyögg & Duchek 2010). This sub-section will shed light on how sustainability management tools can strengthen these processes in SMEs, using several PhD papers [Papers 2; 3; 4; 5].

The acquisition of sustainability knowledge can now be handled from both internal and external knowledge perspectives. From an internal knowledge perspective, knowledge acquisition can be observed through the accumulation of existing knowledge within the firm, which most oftentimes rests within the individuals possessing such tacit knowledge (Boiral 2002). In order to externalize such tacit knowledge and make it explicit for other staff, Boiral (2002) suggests a process of consultation which includes meeting employees directly who have such knowledge. Sustainability management tools can assist in this consultation process by instructing sustainability managers to systematically plan and meet such knowledge experts on a regular basis [Papers 2; 3; 4]. For example, an EMS according to EMAS compels SME managers not only to get employees involved, but to engage with the knowledge-bearers and get them involved with the continuous

improvement process [Papers 3; 4]. Coupled with additional sustainability management tools, such as dialogues, internal audits and incentive systems, an EMS can activate many persons to get involved with this process within an enterprise [Papers 2; 4].

From an external knowledge perspective, several sustainability management tools can assist managers in the acquisition of external knowledge [Papers 2; 4]. Stakeholder dialogues facilitate not only the identification of knowledge sources, but they can assist in the acquisition of knowledge through structured communication with key stakeholders [Paper 4]. Sustainability audits established between customers and suppliers also deliver information and knowledge on particular sustainability aspects prevalent to the enterprise on a routine basis [Paper 4]. The implementation of an EMS is unique for external acquisition of knowledge, as it provides direct links to acquire knowledge, which can range from free-of-charge sources (e.g. handbooks for implementing an EMS in SMEs) [Paper 2] over the use of SME-friendly software and web-based tools [Paper 5] to the less frequent use of costly consultants and external auditors [Papers 4; 5]. CC is found not to assist in the acquisition of either internal or external knowledge [Paper 2].

As the second process of absorptive capacity, knowledge conversion is oriented towards organizing the prepared knowledge for its application in the firm (Gold et al. 2001; Lin 2007). From the literature review, this process tends to be a problematic area for SMEs, as it implies the establishment of a formalized structure requiring expert personnel and financial investments, which SMEs either do not possess or are not willing to invest in (Wong & Aspinwall 2004; Wong 2005). To help resolve the investment problem, Chan and Chao (2008) recommend that this process should be simplified and focused to address the most important aspects of sustainability knowledge in SMEs. Depending on a SME's particular knowledge requirements, sustainability management tools can also facilitate this process, as revealed mostly in three papers of this thesis [Papers 2; 3; 4].

Sustainability management tools can enable the codification of knowledge into newly established documents, processes and procedures to various extents (Boiral 2002; [Papers 2; 3]). From the list of five specific tools examined in this framework paper, three separate categories are established. The first category, "no codification", means that tools do not explicitly call for the transfer to knowledge into documents and/or processes, and it may even be considered a waste of time to do so. One specific tool fits into this category, namely CC, as no requirements are found to create documentation or processes to capture knowledge. The second category, "codification possible", refers to those tools that do not directly require new documents or procedures to be established, but even a SME could benefit from the formalization of these items. Two tools, incentive systems and stakeholder dialogue, can be classified as "codification possible", as they are can be treated flexibly with firms deciding the level of documentation and process-orientation to execute them [Paper 2]. The third category, "codification required", include those tools tied to strict formal requirements and sometimes external certification standards that demand the conversion of knowledge into documents, processes and procedures to properly implement them. Two specific tools fit into the "codification required" category, including audits and EMS [Papers 2; 4], which offer the opportunity of having knowledge created for current and future application through continuous improvement cycles in yearly intervals [Papers 2; 4].

The final absorptive capacity process is knowledge application, which addresses the actual use and incorporation of converted knowledge into an enterprise's decision-making, actions and routines (Alavi & Leidner 2001; Bhatt 2001; Gold et al. 2001). This process also includes the transfer and sharing of knowledge throughout an enterprise (Lin 2007; Apulu & Latham 2009). It has been found that SMEs can take advantage of certain capabilities during this process, as smaller enterprises often imply shorter communication routes and better understanding of overall company goals (Wong & Aspinwall 2004; Chan & Chao 2008).

Sustainability management tools can facilitate the application of knowledge through the execution of these tools [Papers 2; 3; 4]. This is observed especially in an EMS, which follows a prescribed continual improvement process to plan, do, check and act on established environmental performance goals (Boiral 2002; [Paper 4]). Furthermore, sustainability management tools can transfer knowledge from person to person and between businesses functions (Schaltegger et al. 2012a; [Paper 2]). Once these tools are applied, they can create more informed decision-making on sustainability aspects [Paper 4]. While the other specific tools, including audits and incentive systems, do not have such a straightforward continual improvement process in place, these tools can also lead to better decision-making by providing proper management controls for their sustainability activities (Perez-Sanchez et al. 2003; Tencati et al. 2004; [Paper 2]). Dialogue and CC do not implicitly have these management controls that lead to direct application of sustainability knowledge (Gold et al. 2001; [Paper 4]). Thus, they do not have an impact sustainability knowledge application in a firm.

One stage not included in the original SKM model (combined from Lin 2007; Schreyögg & Duchek 2010) is the retention of knowledge. Sustainability management tools can assist in the retention through saved and updated documents. For instance, EMS and audits both permit SMEs to retain previous experience in forms of reports and other documentation, which can always be picked up by future environmental teams. If most of the activities conducted with such tools are properly documented, it should prevent the loss of knowledge when a key person leaves the enterprise [Paper 4]. It is not enough to acquire, convert and apply knowledge, but also to be able to retain and retrieve it for later application (Lane et al. 2006; [Paper 4]). Retention of sustainability knowledge implies building up an organizational memory, which entails maintenance and updating of converted knowledge found in documents and processes and adjusting this knowledge from lessons learned during the application process (Alavi & Leidner 2001). The tools dialogue and incentive systems indirectly contribute to knowledge retention by providing the means of communication and incentives for employees to retain such knowledge (Gold et al. 2001; [Paper 4]). It is difficult to assess how CC makes any contribution to the retention of knowledge.

This leads to the second adaptation of the SKM model to include knowledge retention in the absorptive capacity processes, which will also be highlighted in the concluding section. The next sub-section will address how sustainability management tools support the increased effectiveness of SKM in SMEs.

4.3. Effectiveness of Sustainability Knowledge Management in SMEs

If the previous processes (identification, acquisition, conversion, application and retention) have been properly implemented in a SME, the effectiveness of SKM can be improved as it advances from the development to mature stage (Lin 2007). In general, enterprises should exploit the gained knowledge to derive value from it (Zahra & George 2002; Wong & Aspinwall 2004). More specifically, SKM effectiveness can be improved by the increase of sustainability innovativeness and/or the improvement of overall sustainability performance (Lin 2007; Schreyögg & Duchek 2010). Several papers of the PhD thesis [Papers 2; 4] reveal how sustainability management tools contribute to an increased effectiveness of SKM in SMEs.

First, sustainability management tools allow firms to integrate novel environmental and social practices, which are innovations in themselves when compared to the previous practices and procedures in place [Paper 2]. Also known as organizational innovations, such tools not only imply novel approaches to deal with sustainability topics in SMEs, but they also permit the institutionalization of ecological, social and sustainability knowledge into the daily routines and activities of SMEs [Paper 2]. For example, Halila (2007) investigates the extent that an EMS is an organizational environmental innovation, as it creates new management practices, processes and systems, which replace previous management practices. In addition, dialogues can lead to new innovations and competitive advantages by utilizing the jointly created knowledge pooling between firms and other stakeholders, which can thus lead to the innovation and new products and services as a result of these dialogues (Schaltegger et al. 2002; [Paper 4]).

Second, sustainability management tools can measure and provide direction to improve environmental and social performance [Paper 2]. Several tools can create a link between knowledge obtained and action that can lead to such improvements and provide such measurement and guidance, including sustainability audits, EMS and incentive systems. Sustainability audits can be used for checking performance compared to specific standards and established targets generated inside the firm. If the sustainability targets (e.g. energy savings and safety at the workplace) are met, audits give a clear indication that performance has been improved in the firm (Schaltegger et al. 2002; Perez-Sanchez et al. 2003; Lee & Klassen 2008). Similarly, an EMS can assist the measuring and improving of environmental performance in SMEs [Paper 4]. However, several authors warn that the focus should remain on improving performance and not on implementing a certain tool (Ammenberg & Hjelm 2003; Holton et al. 2010). Nevertheless, the SKM model would benefit from the use of tools as control measures and guidance support. An incentive system can provide employee targets that might encourage the proper application of knowledge (Goetz 2010), which should contribute to the overall effectiveness of SKM. Again, CC was not found to have an impact on SKM effectiveness.

Third, applied management tools offer economic advantages as well. Various sustainability management tools can increase economic benefits through i.a. lowered costs, improved internal processes, increased employee productivity, improved reputation, retention and attraction of customers, especially those requiring specific standards, such as ISO 14001, along the supply chain [Paper 2]. The survey results in 2012 and 2014 reveal that SMEs see the relative advantages of applied tools [Papers 2; 5]. Relevant advantage is

described as the managers' perception of economic benefits from the application of sustainability management tools when compared to the previous practices in place (Halila 2007; Hashem & Tann 2008).

Finally, sustainability management tools provide a foundation of sustainability knowledge that SMEs can build upon [Paper 4]. The overall SKM model can be enhanced when knowledge is converted and embedded in commonly shared documents, procedures and policies in SMEs, which are offered through the application of certain sustainability management tools, including an EMS, audits, dialogue and incentive systems. Furthermore, a harmonious combination of tools reduces knowledge overlaps and shortens the communication routes between knowledge carriers inside and outside the company [Paper 4]. Through a combination of the knowledge gained by sustainability management tools, SKM would be less likely to take a major step backward when a qualified key person leaves the company [Paper 4]. However, this does not ensure that the SKM remains effective forever. Sustainability knowledge runs the risk of becoming outdated, as sustainability is a constantly changing and a moving target of organizational development (Schaltegger & Burritt 2005). Nevertheless, the knowledge that is required for sustainability management tools can and should be constantly updated and improved, which is seen through the continual improvement process of an EMS and the renewed audit process on a yearly basis [Papers 2; 4].

This subsection confirms that sustainability management tools can help to contribute to the overall effectiveness of the SKM model in multiple ways, not just increasing innovativeness and being able to measure sustainability performance, but offering economic advantages as well. The next sub-section will explain how sustainability management tools correspond with the support factors of SKM in SMEs.

4.4. Corresponding Support Factors between Sustainability Knowledge Management and Tools

In addition to the abovementioned processes being adjusted to improve the effectiveness of SKM, support factors also play a vital role in the effectiveness of organizational execution of SKM (Gold et al. 2001; Lin 2007). The support factors that act as important determinants for the effectiveness of SKM in SMEs include top management support, positive attitude of owner-manager, organizational culture, employee involvement, education and training of staff, and a simplified IT structure (Wong 2005; Chan & Chao 2008). Without these support factors in place, the SKM will most likely not be effectively executed in SMEs (Chan & Chao 2008). This sub-section investigates which of these support factors overlap with the necessary criteria for sustainability management tools in SMEs, which several PhD-relevant papers [Papers 1; 2; 4; 5] cover.

First, the positive attitude by owner-managers is an essential requirement for both SKM and sustainability management tools [Papers 4; 5]. A positive attitude can act as a lever in the decision-making process to adopt such tools in the first place [Paper 4]. This is particularly important in SMEs, which already have limited resources to allocate to additional projects. The acceptance of SKM and sustainability management tools typically stems from the willingness of the owner-manager to integrate sustainability in SMEs (Wong 2005; Revell et al. 2010; Cassells & Lewis 2011; Hsu & Cheng 2012). Compared to other individual factors, including prior knowledge and willingness to be innovative, attitude is a major determinant in deciding to adopt sustainability management tools and software, which has been empirically tested [Papers 2; 5].

Second, top management support is also an important factor for the adoption of both SKM and sustainability management tools [Papers 4; 5]. From the SKM perspective, top management support strengthens internal capabilities, such as a culture for learning as well as education and training [Paper 4]. While it is not important for top managers to engage in all the SKM processes or implement every sustainability management tool themselves, it is crucial that they clearly communicate, provide assistance and give direction to their employees on the implementation of such sustainability management tools [Papers 1; 4]. The results of an empirical study reveal that top management is a major determinant for the adoption of sustainability management software and tools when compared to other organizational factors, such as availability of financial resources and expertise [Papers 2; 5].

Third, organizational culture is both important for SKM and tools, and yet it is simultaneously one of the greatest challenges for SMEs to overcome (Gold et al. 2001; Wong 2005). Creating a culture for the proper implementation of SKM and tools implies establishing the correct mechanisms that allow employees to learn and share on sustainability topics [Papers 2; 4]. However, most SMEs lacks the time and resources to allow their employees to deal with additional tasks (Wong 2005; [Paper 4]). Furthermore, SME managers are oftentimes responsible for multiple business functions, wearing many hats within the firm (Burke & Gaughran 2007; Borga et al. 2009; Lee 2009). For example, an environmental officer can be simultaneously responsible for an EMS and others functions, such as controlling or technical support [Paper 4]. If it is not feasible to create a new position (e.g. sustainability manager) in SMEs, creating a culture of learning can still be accomplished by involving multiple employees in the enterprise.

Fourth, employee involvement can be encouraged through the establishment of a shared vision throughout a company. Shared vision describes the ability for enterprises to clearly communicate visions and goals, and employees understand why they are contributing to these goals (Aragón-Correa et al. 2008; Caloghirou et al. 2004). With regard to SKM, this would imply that employees know why obtaining and sharing knowledge for sustainability management is important, and then actively contribute to the overall SKM program [Paper 4]. This also benefits the application of sustainability management tools. For example, a requirement of a certified EMS according to EMAS is the active involvement of employees. Some advanced SMEs reveal that meeting this requirement can bring overall benefits for their enterprise, getting many personnel involved in implementing and carrying out the EMS [Paper 4].

Fifth, providing education and training of staff acts as a catalyst for both SKM and sustainability management tools [Papers 4 & 5]. The greater the level of education and training on sustainability in an enterprise, the more a firm can acquire and exploit knowledge for its own uses [Paper 4]. When little or no education and training is offered, it is difficult to get many persons involved within the company. However, when SMEs do realize the benefits of such training, they often use formal and regular training schemes, both internally and externally, to educate and promote employees [Paper 4].

Finally, a simplified IT structured for SKM is crucial for SMEs with limited resources and informal management structures (Wong 2005; Chan & Chao 2008). The IT structure should be user-friendly, which provides straightforward guidelines and communication routes to share knowledge throughout a firm. This is

also a very important factor for many sustainability management tools [Paper 1]. For example, the simplified and streamlined approach to an EMS can be afforded to SMEs through handbooks, such as EMAS EASY (Burke & Gaughran 2006; Zorpas 2010). In addition, software programs offer user-friendly features, such as service as a software that allows multiple users to work simultaneously on sustainability projects, which oftentimes requires little or no training to input and retrieve knowledge into the system [Paper 5].

Several additional factors can increase the likelihood of the application of sustainability management tools in SMEs, including cost-effectiveness, flexibility and network-orientation [Paper 1]. These additional criteria of tools can be applied to the establishment of SKM in SMEs as well. SKM should be cost-effective, meaning that it should not only fit into the cost and time constraints of SMEs, but also provide an ample return on investment. While tools should be flexible, taking into the consideration of the informal business characteristics of SMEs [Paper 1], flexibility does not play an important role in sustainability knowledge acquisition and application processes (Wong 2004; [Paper 4]). Nevertheless, flexibility does play a role in knowledge conversion and retention, as SMEs are most likely not to adopt formal processes to convert and store their knowledge (Chan & Chao 2008). Network-orientation, described as sharing experiences with others to adopt tools (e.g. group-based application of an EMS; Halila 2007; Zobel 2007), can be a major benefit for SKM in SMEs, as it connects external sources to easily identify and acquire knowledge for sustainability purposes (Hansen & Klewitz 2012; [Paper 4]). Since these additional conditions also apply to SKM, this provides an advancement of the previous literature on such SKM factors for SMEs (e.g. Boiral 2002; Wong 2005).

5. Scientific Contributions and Practical Implications

5.1. Summary of the Key Findings

The findings in the last section reveal that sustainability management tools do indeed facilitate the SKM processes, and they align with the support factors to advance SKM in SMEs. Furthermore, the literature on sustainability management tools proposed several additional support factors that can be applied to SKM. To sum up, sustainability management tools can facilitate the SKM in numerous ways.

First, the complexities of sustainability knowledge are made more manageable for SMEs through sustainability management tools, providing clearer pathways towards the required knowledge to execute such tools [Paper 1]. In particular, several sustainability management tools (e.g. audits and EMS) help to identify what internal knowledge on sustainability exists, how to obtain it and how to further develop this knowledge in SMEs [Paper 1]. Without being able to recognize such knowledge deficits through tools, SMEs would mostly likely be wandering in the dark to obtain the relevant sustainability knowledge. It is important to mention that tools are much more than just a social support or technical factor, such as an IT-based program, but rather they act as collectors and carriers of knowledge themselves [Papers 4; 5].

Second, sustainability management tools act as organizational innovations that permit the institutionalization of ecological, social and integrated sustainability knowledge into the daily routines and practices of

SMEs, which can be previously converted and be readily applied [Papers 2; 4]. For example, various tools (e.g. EMS and audits) assist in the codification and application of sustainability knowledge through new documentation, procedures and routines [Papers 2; 4]. These tools contain both formal and flexible requirements to convert knowledge into various forms. Once converted, such tools can also be helpful in the application of knowledge in enabling and incentivizing the enterprise's decision-making, actions and routines on sustainability-related issues. The previous adoption of certain tools (e.g. EMS and audit) can also support the current and future development of SKM in all of its processes, including identification, conversion, application and retention of knowledge. As a result, sustainability knowledge can be advanced and not necessarily lost when a qualified person leaves the firm.

From the preliminary findings on specific tools in the previous section, first insights are given how these tools can facilitate the various processes and effectiveness of SKM. Table 3 below illustrates the extent tools support these SKM processes and overall effectiveness. For example, an EMS can directly support all SKM processes and improve its effectiveness. Conversely, CC neither facilitates these processes nor improves effectiveness. The other tools either directly support these processes (✓), indirectly support them through the combination with other tools (O), or do not support them at all (X). For example, an incentive system directly supports the identification, acquisition and application processes, and indirectly supports the conversion, retention and effectiveness of SKM through the combination of an EMS or audit, which provides a reward system for employees improving environmental performance. Nevertheless, a word of caution should be given concerning an EMS, as it deals primarily with the ecological challenges of business sustainability (Schaltegger et al. 2002); thus, additional tools (e.g. a social management system along with sustainability audits) could complement an EMS for the integrated social and economic knowledge aspects.

No.	Sustainability Management Tool	Identification	Acquisition	Conversion	Application	Retention	Effectiveness
1	Environmental Management System	✓	✓	✓	✓	✓	✓
2	Corporate Citizenship	✘	✘	✘	✘	✘	✘
3	Audit	✓	✓	✓	O	✓	✓
4	Incentive System	✓	✓	O	✓	O	✓
5	Dialogue	✓	✓	O	✘	O	✓

(✓– directly supports the process; O – indirectly supports the process; ✘ – does not support it)

Table 3: Assessment of Specific Sustainability Management Tools for the SKM Processes

Finally, many support factors overlap between sustainability management tools and SKM, including positive attitude by the owner-manager, top management support, organizational culture, employee involvement, education and training of staff, and a simplified IT structure [Papers 1; 2; 4; 5]. Additional criteria were found in the PhD-thesis [Papers 1; 5], including the user-friendliness, cost-effectiveness, flexibility

and network-orientation. The cohesion of these support factors create a common baseline for SKM and tools to be integrated. More research is required to find out how exactly these factors lead to improved effectiveness of SKM in SMEs. The following section highlights how this PhD thesis contributes to the overall academic science in this area, and how future research can complement these developments.

5.2. Contribution to Research

With very few exceptions (Boiral 2002; Huang & Shih 2009; Nejati et al. 2010; Egbunike et al. 2012; Gavronski et al. 2012), the combination of knowledge management and sustainability management tools in the SME-context has not been covered in great depth in the literature. Furthermore, previous papers have mostly examined the effects of knowledge management on particular sustainability management aspects (e.g. environmental and stakeholder management) and not the other way around. From an inverted perspective, this paper provides first insights on how sustainability management tools facilitate SKM in SMEs.

Furthermore, previous research on knowledge management for sustainability aspects in SMEs has mostly concentrated on the absorptive capacity processes (Roy & Thèrin 2008; Hansen & Klewitz 2012). This PhD thesis links these processes to the effectiveness and support factors offered in conventional KM literature (Lin 2007; Schreyögg & Duchek 2010), which has not yet been considered in the sustainability-context thus far. It shows how a comprehensive KM approach can be advanced through sustainability management tools.

While this paper focuses mostly on how such tools support SKM, it is important to recognize that both tools and knowledge are interlinked in many ways. On one hand, it has already been established in previous papers that sustainability management tools require knowledge [Papers 2; 3]. On the other hand, this framework paper reveals which aspects and processes of SKM could potentially benefit from the application of tools. While it could be debated if tools are even necessary for SKM, this paper argues that tools provide focused and concrete knowledge embedded in the encoded functions. Sustainability management tools allow SKM efforts to be institutionalized through newly established routines, documents and norms in SMEs.

In addition, this PhD thesis expands the SKM model, which originally combines two frameworks of SKM processes, effectiveness and support factors (Lin 2007; Schreyögg & Duchek 2010), and provides several modifications to this combined perspective. First, the identification process is not just limited to external knowledge sources, which the absorptive capacity literature suggests (Schreyögg & Duchek 2010), but it also includes recognizing internal knowledge through tools. Second, the identification of knowledge has shifted from an external phenomena to an internal knowledge process. Thus, the entire process moves into the organization, where the support factors apply to it. Third, the aspect of knowledge retention is included in the absorptive capacity processes, which shows a circular pattern versus a straight line. In addition, retained knowledge can be immediately re-applied or also further developed and converted for future application, which is illustrated by arrows pointing in both direction between application and retention. This circulation of processes reveals that knowledge can be further developed, combined with new knowledge and improved to increase the overall effectiveness of the SKM model. Figure 3 below captures these adaptations to the SKM model.

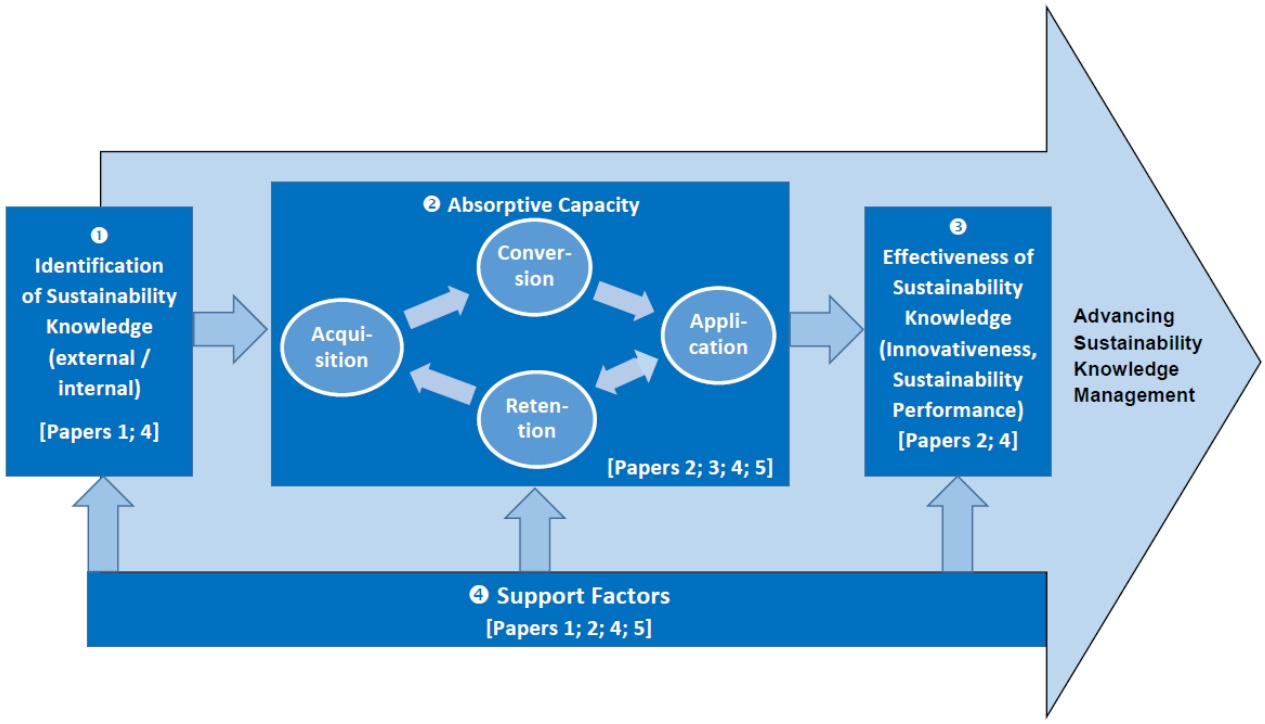

Figure 3: Adaptation of the SKM Model (combined from Lin 2007; Schreyögg & Duchek 2010)

While these adaptations shown in Figure 3 provide a conceptual base for the research to expand in the field of sustainability knowledge management, these contributions can be complemented by various future research projects. First, the adapted SKM model should be tested empirically to observe how processes and sustainability tools integrate with each other, and how they lead to an improved effectiveness of SKM. Such research should bear in mind the extent that the support factors are met to strengthen the overall effectiveness.

Second, the SKM model could be expanded to include various types of knowledge, such as tacit and explicit knowledge. While this framework paper covered a more general approach to knowledge management, further research could potentially overlap this SKM model with the framework established by Nonaka and Takeuchi (1995), based on the stages of socialization (from tacit to tacit), externalization (from tacit to explicit), combination (from explicit to explicit) and internationalization (from tacit to explicit). Boiral's framework (2002) provides a good starting point for such combinations in the environmental management context, and such a combination of frameworks could further investigate how tools might stimulate the creation of tacit and explicit knowledge.

Third, additional perspectives of knowledge management exist, such as organizational behavior and organizational structure (Baskerville & Dulipovici 2006). Organizational behavior could integrate the concepts of organizational creativity, learning and organizational memory to examine how enterprises depart from conventional forms of KM, and create and maintain knowledge by "thinking outside of the box" (Baskerville & Dulipovici 2006, p. 92). Organizational structure could offer a broader research perspective that begins with strategy and goal-setting, establishing the correct capabilities and competencies to obtain and develop knowledge throughout an enterprise (Starbuck 1997; Dyer & Nobeoka 2000).

Finally, further research could see how effectively these SKM processes can improve sustainability performance. Previous research on measuring sustainability performance (Melnyk et al. 2003; Henri & Journeault 2010) could be combined with the conceptualization of this paper to establish linkages between the SKM processes (i.e. identification, acquisition, conversion, application, and retention), support factors and sustainability performance. The results of this framework paper offer several important implications for SME management, which are covered in the next section.

5.3. Practical Implications and Conclusions

This framework paper has uncovered several crucial insights that are important to SME management. First, this paper provides a clearly structured model for SMEs to identify, acquire, convert, apply and retain sustainability-related knowledge. In addition, this framework can assess the effectiveness of SKM according to greater innovativeness and improved sustainability performance. In doing so, this model allows the knowledge processes to be critically assessed. Just having some knowledge on sustainability is not enough. It is crucial that sustainability knowledge is relevant to the particular business' endeavors and properly communicated, which could lead to improvements of social and environmental performance.

Second, the SKM model can be supported by sustainability management tools throughout these processes. In addition, it gives these tools a new meaning and a renewed purpose for SME's sustainability efforts. It might not be enough that a tool creates a social benefit (e.g. CC), but that it contributes to the increase of effectiveness of SKM in an enterprise (e.g. dialogue). In that sense, managers can now evaluate tools before implementation on a further level. Based on this evaluation, a SME would not apply CC for its SKM purposes. Rather, it would consider an EMS that can support all the processes of SKM. However, an EMS only addresses the environmental knowledge of a firm. Therefore, additional tools (e.g. audits and a social management system) could fill the gap of sustainability knowledge.

Finally, the framework paper highlights the most crucial support factors to implement SKM and integrate it with sustainability management tools. Even though SMEs have limited financial and human resources to dedicate to sustainability efforts, it is important to create the right culture, structure and technological support to ensure that SKM will be properly implemented and effectively operated. If these support functions are in place, the SKM provides a great opportunity to reap the benefits by increasing innovativeness and overall sustainability performance.

In conclusion, this PhD thesis offers a foundation for both future research to develop and practical implementation to apply the SKM model. This framework paper highlights how sustainability management tools can facilitate various SKM processes and contribute to increasing the effectiveness of SKM in SMEs. Nevertheless, SMEs must ensure that the support functions are properly addressed to ensure the effectiveness of this framework. If the proper support factors are in place, an integrated SKM with select sustainability management tools has a great potential to enhance innovativeness and improve sustainability performance in SMEs.

References

Alavi, M. & Leidner, D. (2001): Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues, MIS Quarterly, Vol. 25, No. 1, 107–136.

Ammenberg, J. & Hjelm, O. (2003): Tracing business and environmental effects of environmental management systems? A study of networking small and medium-sized enterprises using a joint environmental management system, Business Strategy and the Environment, Vol. 12, No. 3, 163–174.

Apulu, I. & Latham, A. (2009): Knowledge Management: Facilitator For SME's Competitiveness In Nigeria, UK Academy for Information Systems Conference Proceedings, 1–27.

Aragón-Correa, J. A.; Hurtado-Torres, N.; Sharma, S. & García-Morales, V. J. (2008): Environmental strategy and performance in small firms: A resource-based perspective, Journal of environmental management, Vol. 86, No. 1, 88–103.

Arnold, M. (2010): Stakeholder Dialogues for Sustaining Cultural Change, International Studies of Management and Organization, Vol. 40, No. 3, 61–77.

Bansal, P. (2005): Evolving sustainably: a longitudinal study of corporate sustainable development, Strategic Management Journal, Vol. 26, No. 3, 197–218.

Bartlett, J. E.; Kotrlik, J. W.; Higgins & Chadwick, C. (2001): Organizational Research: Determining Appropriate Sample Size in Survey Research, Information Technology, Learning, and Performance Journal, Vol. 19, No. 1, 43–50.

Baskerville, R. & Dulipovici, A. (2006): The theoretical foundations of knowledge management, Knowledge Management Research & Practice, Vol. 4, No. 2, 83–105.

Bhatt, G. D. (2001): Knowledge management in organizations: Examining the interaction between technologies, techniques, and people, Journal of Knowledge Management, Vol. 5, No. 1, 68–75.

Boiral, O. (2002): Tacit Knowledge and Environmental Management, Long Range Planning, Vol. 35, No. 3, 291–317.

Bradford, J. & Fraser, E. D. G. (2008): Local authorities, climate change and small and medium enterprises: Identifying effective policy instruments to reduce energy use and carbon emissions, Corporate Social Responsibility and Environmental Management, Vol. 15, No. 3, 156–172.

Burke, S. & Gaughran, W. F. (2007): Developing a framework for sustainability management in engineering SMEs, Robotics and Computer-Integrated Manufacturing, Vol. 23, No. 6, 696–703.

Caloghirou, Y.; Kastelli, I. & Tsakanikas, A. (2004): Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance?, Technovation, Vol. 24, No. 1, 29–39.

Cassells, S. & Lewis, K. (2011): SMEs and environmental responsibility: do actions reflect attitudes?, Corporate Social Responsibility and Environmental Management, Vol. 18, No. 3, 186–199.

Chan, I. & Chao, C.-K. (2008): Knowledge Management in Small and Medium-Sized Enterprises, Communications of the ACM, Vol. 51, No. 4, 83–88.

Cohen, W. M. & Levinthal, D. A. (1990): Absorptive Capacity: A New Perspective on Learning and Innovation, Administrative Science Quarterly, Vol. 35, 128–152.

Collins, E.; Lawrence, S.; Pavlovich, K. & Ryan, C. (2007): Business networks and the uptake of sustainability practices: The case of New Zealand, Journal of Cleaner Production, Vol. 15, 8-9, 729–740.

Daddi, T.; Magistrelli, M.; Frey, M. & Iraldo, F. (2011): Do environmental management systems improve environmental performance? Empirical evidence from Italian companies, Environment, Development and Sustainability, Vol. 13, No. 5, 845–862.

Darnall, N. & Edwards, D. (2006): Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure, Strategic Management Journal, Vol. 27, No. 4, 301–320.

Davenport, T. H. & Prusak, L. (1998): Working Knowledge: How Organizations Manage What They Know. Boston: Harvard Business Press.

Desouza, K. C. & Awazu, Y. (2006): Knowledge management at SMEs: Five peculiarities, Journal of Knowledge Management, Vol. 10, No. 1, 32–43.

Dyer, J. H. & Nobeoka, K. (2000): Creating and managing a high-performance knowledge-sharing network: The Toyota case, Strategic Management Journal, Vol. 21, 345–367.

Dyllick, T. & Hockerts, K. (2002): Beyond the business case for corporate sustainability, Business Strategy and the Environment, Vol. 11, No. 2, 130–141.

Egbunike, F. C.; Echekoba, F. N. & Udeh, F. N. (2012): A Novel 'Stakeholder Sustainability Knowledge Management' (SSKM) Model: Developing Linkages of Stakeholder Management, Knowledge Management and Triple Bottom Line Performance, Review of Public Administration & Management, Vol. 1, No. 2, 227–247.

Eisenhardt, K. M., & Santos, F. M. (2002): Knowledge-based view: A new theory of strategy. Handbook of strategy and management, Vol. 1, 139-164.

Elkington, J. (1998): Partnerships from cannibals with forks: The triple bottom line of 21st-century business, Environmental Quality Management, Vol. 8, Nr. 1, 37–51.

European Commission (2005):The new SME definition: User guide and model declaration, 1–51. Brussels: European Commision.

Fresner, J. & Engelhardt, G. (2004): Experiences with integrated management systems for two small companies in Austria, Journal of Cleaner Production, Vol. 12, Nr. 6, 623-631.

Gadenne, D. L.; Kennedy, J. & McKeiver, C. (2009): An Empirical Study of Environmental Awareness and Practices in SMEs, Journal of Business Ethics, Vol. 84, No. 1, 45–63.

Gavronski, I.; Klassen, R. D.; Vachon, S. & Nascimento, L. (2012): A learning and knowledge approach to sustainable operations, International Journal of Production Economics, Vol. 140, No. 1, 183–192.

Gerstenfeld, A. & H. Roberts (2000): Size Matters: Barriers and Prospects for Environmental Management in Small and Medium-Sized Enterprises, in Small and Medium-Sized Enterprises and the Environment. Ed. R. Hillary. Sheffield, England: Greenleaf Publishing, 106-118.

Gold, A. H.; Mahlhotra, A. & Segars, A. H. (2001): Knowledge Management: An Organizational Capabilities Perspective, Journal of Management Information Systems, Vol. 18, No. 1, 185–214.

Graafland, J.; van de Ven, Bert & Stoffele, N. (2003): Strategies and Instruments for Organising CSR by Small and Large Businesses in the Netherlands, Journal of Business Ethics, Vol. 47, No. 1, 45–60.

Grant, R. M. (1996): Toward a Knowledge-Based Theory of the Firm, Strategic Management Journal, Vol. 17, 109–122.

Halila, F. (2007): Networks as a means of supporting the adoption of organizational innovations in SMEs: the case of Environmental Management Systems (EMSs) based on ISO 14001, Corporate Social Responsibility and Environmental Management, Vol. 14, No. 3, 167–181.

Hansen, E. G. & Klewitz, J. (2012): The Role of an SME's Green Strategy in Public-Private Eco-innovation Initiatives: The Case of Ecoprofit, Journal of Small Business & Entrepreneurship, Vol. 25, No. 4, 451–477.

Hashem, G. & Tann, J. (2007): The Adoption of ISO 9000 Standards within the Egyptian Context: A Diffusion of Innovation Approach, Total Quality Management & Business Excellence, Vol. 18, No. 6, 631–652.

Henri, J.-F. & Journeault, M. (2010): Eco-control: The influence of management control systems on environmental and economic performance, Accounting, Organizations and Society, Vol. 35, No. 1, 63-80.

Hillary, R. (2004): Environmental management systems and the smaller enterprise, Journal of Cleaner Production, Vol. 12, No. 6, 561–569.

Hoivik, H. & Melé, D. (2009): Can an SME Become a Global Corporate Citizen? Evidence from a Case Study, Journal of Business Ethics, Vol. 88, No. 3, 551–563.

Holt, D. & Goetz, K. S. (2010): Encouraging sustainable business practices using incentives: A practitioner's view, Management Research Review, Vol. 33, No. 11, 1042–1053.

Hörisch, J. (2013). Combating climate change through organisational innovation: an empirical analysis of internal emission trading schemes. Corporate Governance, 13(5), 569-582.

Hörisch, J.; Johnson, M. P. & Schaltegger, S. (2014): Implementation of Sustainability Management and Company Size: A Knowledge-Based View, Business Strategy and the Environment (Early View).

Hsu, J.-L. & Cheng, M.-C. (2012): What Prompts Small and Medium Enterprises to Engage in Corporate Social Responsibility? A Study from Taiwan, Corporate Social Responsibility and Environmental Management, Vol. 19, No. 5, 288–305.

Huang, P.-S. & Shih, L.-H. (2009): Effective environmental management through environmental knowledge management, International Journal of Environment Science and Technology, Vol. 6, No. 1, 35–50.

Iraldo, F., Testa, F., & Frey, M. (2009): Is an environmental management system able to influence environmental and competitive performance? The case of the eco-management and audit scheme (EMAS) in the European Union, Journal of Cleaner Production, Vol. 17, No. 16, 1444-1452.

Jenkins, H. (2006): Small Business Champions for Corporate Social Responsibility, Journal of Business Ethics, Vol. 67, No. 3, 241–256.

Johnson, M. P. (2013): Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools, Corporate Social Responsibility and Environmental Management (Early View).

Johnson, M. P. (forthcoming): Knowledge Acquisition Practices in Sustainability-oriented SMEs: Explor- the Effects of Internal Support Factors and External Cooperation, International Small Business Journal (in review).

Johnson, M. P.; Halberstadt, J; Schaltegger, S & Viere, T. (forthcoming): Software and Web-Based Tools for Sustainability Management in Micro-, Small- and Medium-Sized Enterprises. Special Issue: EnviroInfo 2014 - 28th International Conference on Informatics for Environmental Protection - Selected Contributions.

Johnson, M. P. & Schaltegger, S. (2015): Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come? Journal of Small Business Management (Early View).

Kamara, J.M., Augenbroe, G. & Carrillo, P.M. (2002): Knowledge managemnt in the architecure, engineering and construction industry. Construction Innovations, Vol. 2, No. 1, 53-67.

Kogut, B. & Zander, U. (1992): Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology, Organization Science, Vol. 3, No. 3, 383–397.

Lane, P. J.; Koka, B. R. & Pathak, S. (2006): The Reification of Absorptive Capacity: A Critical Review and Rejuvenation of the Construct, Academy of Management Review, Vol. 31, No. 4, 833–863.

Lee, S.-Y. & Klassen, R. D. (2008): Drivers and Enablers That Foster Environmental Management Capabilities in Small- and Medium-Sized Suppliers in Supply Chains, Production and Operations Management, Vol. 17, No. 6, 573–586.

Lin, H.-F. (2007): A stage model of knowledge management: An empirical investigation of process and effectiveness, Journal of Information Science, Vol. 33, No. 6, 643–659.

McAdam, R. & Reid, R. (2001): SME and large organisation perceptions of knowledge management: comparisons and contrasts, Journal of Knowledge Management, Vol. 5, No. 3, 231–241.

Melnyk, S. (2003): Assessing the impact of environmental management systems on corporate and environmental performance, Journal of Operations Management, Vol. 21, No. 3, 329–351.

Meso, P. & Smith, R. (2000): A resource-based view of organizational knowledge management systems, Journal of Knowledge Management, Vol. 4, No. 3, 224–234.

Miller, T. R.; Muñoz-Erickson, T. & Redman, C. L. (2011): Transforming knowledge for sustainability: Towards adaptive academic institutions, International Journal of Sustainability in Higher Education, Vol. 12, No. 2, 177–192.

Moore, S. B. & Manring, S. L. (2009): Strategy development in small and medium sized enterprises for sustainability and increased value creation, Journal of Cleaner Production, Vol. 17, No. 2, 276–282.

Morsing, M. & Perrini, F. (2009): CSR in SMEs: Do SMEs matter for the CSR agenda?, Business Ethics: A European Review, Vol. 18, No. 1, 1–6.

Moustaghfir, K. (2008): The dynamics of knowledge assets and their link with firm performance, Measuring Business Excellence, Vol. 12, No. 2, 10–24.

Nejati, M.; Shahbudin, A. & Amran, A. (2010): Putting sustainability at the core of knowledge management performance evaluation system, Journal of Organizational Knolwedge Management, 1–13.

Nonaka, I. (1991): The knowledge-creating company. Harvard Business Review, Vol. 69, 96-104.

Nonaka, I. & Takeuchi, H. (1995): The Knowledge-Creating Company. New York: Oxford University Press.

Perez-Sanchez, D.; Barton, J. R. & Bower, D. (2003): Implementing environmental management in SMEs, Corporate Social Responsibility and Environmental Management, Vol. 10, No. 2, 67–77.

Perrini, F. & Tencati, A. (2006): Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems, Business Strategy and the Environment, Vol. 15, No. 5, 296–308.

Polanyi, M. (1975): Personal knowledge, in Polanyi, M. and Prosch H. (Eds),Chicago, IL: University of Chicago Press, 22–45.

Quinn, J. B.; Anderson, P. & Finkelstein, S. (1996): Managing Professional Intellect: Making the Most of the Best, Harvard Business Review, Vol. 74, No. 2, 71–80.

Revell, A. & Blackburn, R. (2007): The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors, Business Strategy and the Environment, Vol. 16, No. 6, 404–420.

Revell, A.; Stokes, D. & Chen, H. (2010): Small businesses and the environment: turning over a new leaf?, Business Strategy and the Environment, Vol. 19, No. 5, 273-288.

Roy, M.-J. & Thérin, F. (2008): Knowledge acquisition and environmental commitment in SMEs, Corporate Social Responsibility and Environmental Management, Vol. 15, No. 5, 249–259.

Schaltegger, S.; Beckmann, M. & Hansen, E. G. (2013): Transdisciplinarity in Corporate Sustainability: Mapping the Field, Business Strategy and the Environment, Vol. 22, No. 4, 219–229.

Schaltegger, S. & Burritt, R. (2005): Corporate Sustainability, in: Folmer, H. & Tietenberg, T. (Eds.): The International Yearbook of Environmental and Resource Economics 2005/2006. A Survey of Current Issues, Cheltenham: Edward Elgar, 185-222.

Schaltegger, S.; Harms, D.; Windolph, S. E. & Hörisch, J. (2012a): Involving Corporate Functions: Who Contributes to Sustainable Development?, Sustainability, Special Issue: Proceedings of the 3rd International Sustainability Conference.

Schaltegger, S., Herzig, C., Kleiber, O. & Müller J. (2002): Sustainability Management in Business Enterprises. Concepts and Instruments for Sustainable Organisation Development/ Berlin/Lüneburg: BMU/CSM.

Schaltegger, S..; Herzig, C.; Kleiber, O.; Klinke, T. & Müller J. (2007): Nachhaltigkeitsmanagement in Unternehmen. Managementansätze zur unternehmerischen Nachhaltigkeit. Berlin/Lüneburg: BMU/CSM.

Schaltegger, S.; Hörisch, J.; Windolph, S.E; Harms, D. (2012b): Corporate Sustainability Barometer 2012. Centre for Sustainability Management. Lüneburg.

Schaltegger, S. & Wagner, M. (2006): Integrative Management of Sustainability Performance, Measurement and Reporting, International Journal of Accounting, Auditing and Performance Evaluation, Vol. 3, No. 1, 1–19.

Schreyögg, G. & Duchek, S. (2010): Absorptive Capacity: Schlüsselpraktiken für die Innovationsfähigkeit von Unternehmen, Wirtschaftswissenschaftliches Studium, Vol. 39, 474–479.

Seidel, M.; Seidel, R.; Des Tedford; Cross, R.; Wait, L. & Hämmerle, E. (2009): Overcoming barriers to implementing environmentally benign manufacturing practices: Strategic tools for SMEs, Environmental Quality Management, Vol. 18, No. 3, 37–55.

Seiffert, Mari Elizabete Bernardini (2008): Environmental impact evaluation using a cooperative model for implementing EMS (ISO 14001) in small and medium-sized enterprises, Journal of Cleaner Production, Vol. 16, No. 14, 1447–1461.

Starbuck, W.H. (1997): Learning by knowledge-intensive firms. In Knowledge in Organizations, Prusak, L. (Ed). Boston: Butterworth-Heinemann, 147-175.

Starik, M. & Kanashiro, P. (2013): Toward a Theory of Sustainability Management: Uncovering and Integrating the Nearly Obvious, Organization & Environment, Vol. 26, No. 1, 7–30.

Tencati, A.; Perrini, F. & Pogutz, S. (2004): New Tools to Foster Corporate Socially Responsible Behavior, Journal of Business Ethics, Vol. 53, 173–190.

Tornatzky, L.G. & Fleischer, M. (1975): The Processes of Technological Innovation. Lexington, MA: Lexington Books.

Tranfield, D.; Denyer, D. & Smart, P. (2003): Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review, British Journal of Management, Vol. 14, No. 3, 207–222.

Tseng, M.-L. (2010): An assessment of cause and effect decision-making model for firm environmental knowledge management capacities in uncertainty, Environmental Monitoring and Assessment, Vol. 161, No. 1, 549–564.

Tsoukas, H. & Vladimirou, E.: What is Organizational Knowledge?, Journal of Management Studies, Vol. 38, No. 7, 973–993.

Veleva, V. R. (2009): Managing corporate citizenship: a new tool for companies, Corporate Social Responsibility and Environmental Management, Vol. 17, 40-51.

Wong, K. (2005): Critical success factors for implementing knowledge management in small and medium enterprises, Industrial Management & Data Systems, Vol. 105, No. 3, 261–279.

Wong, K. & Aspinwall, E. (2004): Characterizing knowledge management in the small business environment, Journal of Knowledge Management, Vol. 8, No. 3, 44–61.

Wong, K. & Aspinwall, E. (2005): An empirical study of the important factors for knowledge-management adoption in the SME sector, Journal of Knowledge Management, Vol. 9, No. 3, 64–82.

Yin, R. K. (2003): Case study research. Design and methods. Thousand Oaks: Sage Publications, 3rd ed.

Zack, M. H. (1999): Managing Codified Knowledge, Sloan Management Review, Vol. 40, No. 4, 45–58.

Zahra, S. A. & George, G. (2002): Absorptive Capacity: A Review, Reconceptualization, and Extension, Academy of Management Review, Vol. 27, No. 2, 185–203.

Zhang, M. (2006): Conceptualizing the Learning Process in SMEs: Improving Innovation through External Orientation, International Small Business Journal, Vol. 24, No. 3, 299–323.

Zobel, T. (2007): The 'pros' and 'cons' of joint EMS and group certification: a Swedish case study, Corporate Social Responsibility and Environmental Management, Vol. 14, No. 3, 152–166.

Zorpas, A. (2010): Environmental management systems as sustainable tools in the way of life for SMEs and VSMEs, Bioresource Technology, Vol. 101, 1544-1557.

B. Annex I – Authors' contributions to the articles and publication status

Article #	Short title	Specific contributions of all authors	Author status	Weighting factor	Publication status	Conference contributions
[1]	Two Decades of Tools in SMEs	MJ: conception of research approach; literature review; data collection, analysis and interpretation; writing StSch: conception of research approach; data interpretation, writing	Co-author with equal contribution	1.0	Early view version published online in Journal of Small Business Management (peer reviewed; IF: 1.361; VHB JQ2.1: B)	
[2]	Sustainability Management in SMEs	MJ: conception of research approach, literature review; data analysis and interpretation; writing	Single author	1.0	Early view version published online in Corporate Social Responsibility and Environmental Management (peer reviewed; IF 2.054; VHB JQ2.1: D)	AOM ONE Division 2013; CRRC 2012
[3]	Sustainability Management and Company Size	JaHo: conception of research approach; data collection, analysis and interpretation; writing MJ: data collection and interpretation; literature review; writing StSch: conception of research approach; data interpretation, writing	Co-author with equal contribution	1.0	Early view version published online in Business Strategy and the Environment (peer reviewed; IF: 3.236; VHB JQ2.1: B)	
[4]	Knowledge Acquisition in SMEs	MJ: conception of research approach, literature review; data analysis and interpretation; writing	Single author	1.0	In review: International Small Business Journal (peer reviewed; VHB JQ2.1: C)	
[5]	Software and Web-Based Tools in SMEs	MJ: conception of research approach, literature review; data analysis and interpretation; writing	Co-author with equal contribution	1.0	In review: Special Issue: EnviroInfo 2014 - Selected Contributions (book chapter, peer reviewed)	ENVIRO-INFO 2014

		JtHa: conception of research approach, literature review; writing StSch: conception of research approach; data interpretation, writing TV: conception of research; data inter-pretation; writing				
			Sum:	5.0		

Explanations

Specific contributions of all authors

JaHo: Jacob Hörisch

JtHa: Jantje Halberstadt

MJ: Matthew Johnson

StSch: Stefan Schaltegger

TV: Tobias Viere

Author status

according to §12b of the guideline:

Single author [Allein-Autorenschaft] = Own contribution amounts to 100%.

Co-author with predominant contribution [Überwiegender Anteil] = Own contribution is greater than the individual share of all other co-authors and is at least 35%.

Co-author with equal contribution [Gleicher Anteil] = (1) own contribution is as high as the share of other co-authors, (2) no other co-author has a contribution higher than the own contribution, and (3) the own contribution is at least 25%.

Co-author with important contribution [Wichtiger Anteil] = own contribution is at least 25%, but is insufficient to qualify as single authorship, predominant or equal contribution.

Co-author with small contribution [Geringer Anteil] = own contribution is less than 20%.

Weighting factor

according to §14 of the guideline:

Single author [Allein-Autorenschaft]	1.0
Co-author with predominant contribution [Überwiegender Anteil]	1.0
Co-author with equal contribution [Gleicher Anteil]	1.0
Co-author with important contribution [Wichtiger Anteil]	0.5
Co-author with small contribution [Geringer Anteil]	0

Publication status

IF = Thomson Reuters Impact Factor/Journal Citation Report 2012, http://wokinfo.com/products_tools/analytical/jcr/ (31.01.2015)

VHB JQ2.1 = VHB-JOURQUAL 2.1 2011, http://vhbonline.org/service/jourqual/vhbjourqual-21-2011/jq21/ (31.01.2015)

Conference contributions (acronym, society, date, venue, website)

AOM 2013	73rd Annual Meeting of the Academy of Management, Organization and the Natural Environment (ONE) Division, August 9 – 13, 2013, Walt Disney World Resort, Lake Buena Vista, USA.
CRRC 2012	Corporate Responsibility Research Conference 2012, 'Beyond the Limits – Below Potential', September 12 -14, 2012, BEM Bordeaux Management School, Bordeaux, France.
ENVIROINFO 2014	28th International Conference on Informatics for Environmental Protection (ENVIROINFO), 'ICT for Energy Efficiency', September 10-12, 2014, Carl von Ossietzky University, Oldenburg, Germany.

All papers were presented by me.

Declaration (according to §16 of the guideline)

I affirm that all information given in this appendix is true and accurate in each instance and overall.

Matthew P. Johnson

C. Annex II - Papers included in this cumulative PhD thesis

I. Paper 1

Johnson, M. P. & Schaltegger, S. (2015): Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come?, Journal of Small Business Management (early view).

Journal of Small Business Management 2015 ••(••), pp. ••–••

doi: 10.1111/jsbm.12154

*Two Decades of Sustainability Management Tools for SMEs: How Far Have We Come?**

by Matthew P. Johnson and Stefan Schaltegger

Many scholars have emphasized the importance of sustainability management in small and medium-sized enterprises (SMEs). Although various publications discuss different approaches and potential barriers of implementation, a review of the existing research on sustainability management tools for SMEs is nonetheless missing. Based on a systematic review of the academic literature, this paper discusses reasons why SMEs should implement sustainability management tools. A further analysis reveals that most such tools are perceived to have little to no implementation in SMEs. The main implementation barriers and facilitating criteria are discussed. In addition, implications for future research, SME management, and public policy are drawn.

Introduction

Visions and strategies of corporate sustainability are important, but if environmental and social sustainability are to become truly effective in everyday business practice, they have to be operationalized. One main aspect of the operationalization of corporate sustainability is the implementation of management instruments, concepts, and systems, also known as sustainability management tools. This encompasses a broad range of environmental, social, and integrative tools, such as environmental and social audits, eco-efficiency analyses, life-cycle assessments (LCAs), environmental and social management systems, and sustainability reports.

Research has certainly come a long way since Thompson and Smith (1991) conducted an analysis of the limited academic literature on corporate social responsibility (CSR) in small businesses. Over the past two decades, sustainability management tools, including tools for CSR and environmental management, and their proposed implementation in small and medium-sized enterprises (SMEs) have been increasingly addressed in the academic literature (Ammenberg and Hjelm 2003; Graafland, van de Ven, and Stoffele 2003; Hillary 2004; Lawrence et al. 2006; Perrini and Tencati 2006; Perrini, Russo, and Tencati 2007; Seiffert 2008; Zorpas 2010).

Several authors have examined a range of these tools in SMEs in different regions. For

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Matthew P. Johnson is a Ph.D. candidate at the Centre for Sustainability Management, Leuphana University Lüneburg.

Stefan Schaltegger is a full professor and head of the Centre for Sustainability Management, Leuphana University Lüneburg.

Address correspondence to: Matthew P. Johnson, Centre for Sustainability Management, Leuphana University Lüneburg, Scharnhorststr. 1, 21335 Lüneburg, Germany. E-mail: johnson@uni.leuphana.de.

example, Starkey (2000) examined a list of environmental management tools for European SMEs. Other authors have conducted country-specific investigations. Graafland, van de Ven, and Stoffele (2003) analyzed a series of CSR strategies and compatible tools between small and large Dutch firms. Tencati, Perrini, and Pogutz (2004) studied similar CSR tools in Italian SMEs. Furthermore, several SME-specific approaches to sustainability management have been developed. Based on previous findings, Perrini and Tencati (2006) developed an SME-specific tool, *sustainability evaluation and reporting system* (SERS), which covers a systematic approach to gradually implement sustainability management practices. Burke and Gaughran (2007) provided a conceptual model to incrementally integrate an environmental management system (EMS) along with sustainability reporting in SMEs.

Although research is gaining momentum in this academic field, a review of the existing literature on the proposed implementation of sustainability management tools in SMEs is nonetheless missing. Questions pertaining to the design and applicability of such tools in SMEs remain under-researched. Therefore, this paper conducts a systematic review of the extant academic literature to investigate which sustainability management tools have been designed for SMEs and what is known about the applicability of sustainability management tools proposed for SMEs. The synthesized results on specific tool designs, on barriers for implementation, and on facilitating criteria required to improve the applicability and dissemination of tools provide additional insights that complement the previous literature and offer suggestions for future research in this field.

The paper is structured as follows. The second section provides a background on corporate sustainability and the importance of management tools. The third section explains the methodological approach of the systematic literature review and reveals the initial findings of the analysis. The three subsequent sections cover the four thematic areas of analysis from the selected literature, including the tools proposed for implementation and the reasons for implementation (fourth section), the barriers for implementation (fifth section), and the main facilitating criteria for the application of tools in SMEs (sixth section). The final two sections provide a discussion and outlook for future research and SME management, followed by the conclusions.

Corporate Sustainability and Management Tools

A business approach to address sustainable development, also known as corporate sustainability, has gained substantial interest in management literature over the past 25 years. Since the Brundtland Commission definition of sustainable development, "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations World Commission on Environment and Development 1987, p. 8), the term corporate sustainability has emerged and been defined many times (for an overview of definitions, see Gladwin, Kennelly, and Krause 1995; van Marrewijk 2003). Dyllick and Hockerts (2002) propose that corporate sustainability entails the integration of economic, ecological, and social aspects in an organization's short and long-term planning. Schaltegger and Burritt (2005, p. 192) define corporate sustainability as "the contextual integration of economic, environmental and social aspects . . . and integrating environmental and social management in conventional economically oriented business management."

In addition, a number of related concepts have been discussed in the extant literature, such as CSR (see e.g., Carroll 1999), corporate social performance (CSP; Wartick and Cochran 1985; Wood 1991), corporate social responsiveness (Frederick 1994), business ethics (Göbbels 2002), corporate citizenship (Matten and Crane 2005; Rondinelli and Berry 2000), corporate governance (Yoshikawa and Rasheed 2009), corporate philanthropy (Seelos and Mair 2005), social entrepreneurship (Leviner, Crutchfield, and Wells 2007; Seelos and Mair 2005), sustainable entrepreneurship (e.g., Schaltegger and Wagner 2011), environmental management and stakeholder management (for a review of these concepts, see van Marrewijk 2003).

These related notions mostly describe important facets and approaches for large corporations to address particular aspects of sustainable development; however, such terms can be applied to SMEs as well. In the context of business sustainability, the importance of SMEs to engage in sustainable activities has often been emphasized (Hahn and Scheermesser 2006; Williamson, Lynch-Wood, and Ramsay 2006). On one hand, SME engagement in

sustainability aspects derives from the concerns about their collective economic, environmental, and social impacts. Although SMEs positively contribute to economies and societies in various ways (e.g., providing millions of jobs and securing a high level of economic stability in many countries; Morsing and Perrini 2009), they also generate negative impacts from conducting business. It has been estimated that SMEs contribute up to 70 percent of global pollution collectively (Hillary 2000; Revell, Stokes, and Chen 2010). On the other hand, environmental and social concerns are also becoming central economic aspects for many SMEs (Halila 2007; Revell, Stokes, and Chen 2010). Pressing environmental and social matters, such as rising prices for energy and raw materials, cost savings through effective management of resources and waste reduction, and ensuring health and safety at the workplace, and pose significant challenges as well as great opportunities for businesses of all sizes.

Sustainability management entails the internal development of environmental and social measures, and the external contribution to sustainability in society and the economy (Bansal 2005; Schaltegger and Burritt 2005; Shrivastava and Hart 1995). Thus, sustainability management requires managers to measure and supervise this internal development, as well as to engage in a dialogue with external stakeholders on sustainable development issues (Kuhndt 2004).

A wide range of tools has been proposed in the literature for various functional areas (e.g., accounting tools, marketing tools, process management tools, etc.), as well as cross-functional support systems affecting the overall goals of an enterprise (Schaltegger et al. 2002). Although most of these tools were developed with large companies in mind, streamlined versions of tools removing processes of an existing tool (Weitz and Sharma 1998), or reversely, incorporating only several elements of a tool (Ahire and Golhar 1996), have been proposed for small businesses.

Sustainability management tools enable business managers to operationalize sustainability-oriented strategies and to coordinate the activities throughout an enterprise. Gladwin, Kennelly, and Krause (1995) point out that companies pursuing corporate sustainability will need practical decision-support tools to facilitate the design and selection of sustainable products, processes, and programs. In addition, such management tools can also be useful in the process of organizational change and learning.

Sustainability management tools aim to support managers and entrepreneurs in various functions to find ways to reduce negative environmental and social impacts, exploit and manage positive impacts, and simultaneously stay competitive and economically successful. As various authors have emphasized (Epstein 2008; Gladwin, Kennelly, and Krause 1995; Kuhndt 2004; Robert 2000; Robert et al. 2002), well-organized sustainability management requires instruments and tools to measure, manage, and communicate sustainability issues effectively. Kuhndt (2004) has grouped these tools into three categories, including tools for analysis and evaluation (e.g., LCA), tools for action (e.g., EMS according to the ISO 14001 standard), and tools for communication (e.g., sustainability reporting). Although most tools are identified with overarching terms (e.g., sustainability report), variations in design (e.g., web-based or printed versions) and application (e.g., stand-alone reports or integrated annual reports) may exist in practice.

Various institutions and initiatives have created platforms, programs, and partnerships intended to raise awareness and support companies in the implementation of sustainability management tools in SMEs. In the United States, the Foundation Center (2011) has created the *Tools and Resources for Assessing Social Impact* (TRASI) online platform that provides organizations with a list of over 150 tools available for social accounting and social impact. In Austria, the EcoProfit public–private partnership initiative (Fresner 1998; Martinuzzi, Huchler, and Obermayr 2000) was created to support the implementation of environmental management in companies, which it has extended to 10 countries in more than 2,000 enterprises worldwide. Further awareness raising campaigns targeting SMEs include the Natural Step, developed in Sweden (Bradbury and Clair 1999; Holmberg 1998; Robert 2000), Envirowise in the United Kingdom (Coskeran and Phillips 2005; Gibson 2001), and the Green Network in Denmark (Lehmann 2006).

Nevertheless, a comprehensive overview of the academic literature on sustainability management tools for SMEs, including CSR management tools and environmental management tools, has not been conducted so far. In addition, fundamental questions pertaining to the widespread applicability of such tools in SMEs

remain under-researched. For this reason, the following sections examine the existing academic literature on the design, implementation and applicability of sustainability management tools in SMEs.

Methodology

The literature review was guided by the following research question: *What sustainability management tools, including tools for corporate social responsibility and tools for environmental management, have been designed for and are applicable to SMEs?* The subsequent analysis of the academic literature covered the following four thematic areas of investigation:

- Which specific sustainability management tools have been proposed and observed in SMEs?
- What reasons are provided why SMEs should implement sustainability management tools?
- What main reasons may explain why most SMEs are not implementing such management tools?
- What key criteria are emphasized in the literature that such management tools must fulfill in order to improve their applicability in SMEs?

Before these thematic areas of investigation are examined, this section will give details on how the literature review was conducted and provide the initial quantitative findings.

To answer these questions, the academic literature on sustainability management tools in SMEs was systematically reviewed and synthesized. According to Tranfield, Denyer, and Smart (2003), a systematic literature review consists of five methodological steps, including: (1) identification of keywords and creation of search strings based on the identified keywords; (2) selection of studies through relevant research databases; (3) analysis of identified papers based on inclusion and exclusion criteria; (4) data extraction into a reference management database (in this case, Excel); and (5) data synthesis and reporting. In the first step, keywords were identified and constructed into search strings. Based on our main research question, the following search strings were established (Table 1).

All search strings included an additional cluster of words to denote a tool, including the term "tool" itself as well as "instrument," "concept," and "system." For example, the first search string was written as "sustainability management" AND "small and medium-sized enterprise"—including the abbreviation "SME"—AND ("tool" OR "instrument" OR "concept" or "system"). Each search string was entered exactly the same way into the following six databases: EBSCO Business Source Premier, Emerald, JSTOR, Science Direct, Springer Link, and Wiley Online. In addition to these databases, a cross-check was conducted in Google Scholar in an attempt to find other influential academic publications outside of these databases. By doing so, additional journal articles and book chapters in edited volumes were identified.

In order to narrow down the vast amount of literature available, several inclusion and exclusion criteria were established, which is based on similar systematic review process refined by Moustaghfir (2008). For example, conference papers, working papers, technical reports, and practical handbooks were omitted from the search to focus on peer-reviewed academic papers. A complete list of inclusion/exclusion criteria is provided in Table 2.

When possible, the search strings were entered into the six databases using advanced search options and filters, such as searching strictly for peer-reviewed journal articles and book chapters. In order to find articles and papers in a wide range of journals, all the filters by subject (e.g., "business management" or "environmental sciences") were included. The initial search of papers using the specific search strings resulted in 5,891 articles and papers. Browsing through titles and abstracts with the inclusion and exclusion criteria as a guide, a preliminary set of publications was identified. Most of the papers could be eliminated for further review because they did not relate to business management at all. This resulted in 216 publications addressing environmental and social issues as well as management tools in SMEs. The authors and titles of these retained papers were imported into an Excel spreadsheet, and the full papers were downloaded and reviewed by both authors. Thereafter, a full-text search was conducted within this preliminary set to exclude those papers that mention some of the keywords, but do not cover any of the four thematic areas of investigation. This resulted in a final count of 112 publications (Table 3).

Table 1
Search String Combinations for the Literature Search

Search String	Constant Terms in Every Search String
"Sustainability management" AND "small and medium-sized enterprise (SME)" AND. . .	. . ."tool" OR "instrument" OR "concept" OR "system"
"Sustainability management" AND "small business" AND. . .	
"Sustainability management" AND "family business" AND. . .	
"Corporate social responsibility" AND "small and medium-sized enterprise (SME)" AND. . .	
"Corporate social responsibility" AND "small business" AND. . .	
"Corporate social responsibility" AND "family business" AND. . .	
"Corporate citizenship" AND "small and medium-sized enterprise (SME)" AND. . .	
"Corporate citizenship" AND "small business" AND. . .	
"Corporate citizenship" AND "family business" AND. . .	
"Business ethics" AND "small and medium-sized enterprise (SME)" AND. . .	
"Business ethics" AND "small business" AND. . .	
"Business ethics" AND "family business" AND. . .	
"Environmental management" AND "small and medium-sized enterprise (SME)" AND. . .	
"Environmental management" AND "small business" AND. . .	
"Environmental management" AND "family business" AND. . .	
"Social management" AND "small and medium-sized enterprise (SME)" AND. . .	
"Social management" AND "small business" AND. . .	
"Social management" AND "family business" AND. . .	

SME, small and medium-sized enterprise.

Thereafter, these papers were examined methodically to derive the findings. All articles and papers included in the review were analyzed on two levels. First, a basic meta-analysis was conducted, indicating quantifiable statistics of each paper, including the publication year, publication type, journal type, research method applied, geographical location of the conducted survey/case study analysis (if any), and industry/sector of sample (if any). Second, a thematic analysis was carried out for every paper within the framework of the four areas of investigation, including: (1) the tools proposed for implementation; (2) the reasons for implementation in SMEs; (3) the barriers for implementation in SMEs; and (4) the facilitating criteria of tools for implementation in SMEs. The next two sections will highlight the main quantitative findings, as well as present the results on the four thematic areas of investigation.

Initial Quantitative Findings

The initial quantitative findings provide an overview of the quantifiable statistics on the 112 publications reviewed, including the publication year, publication journal, research methods applied, and the geographical focus of SME research. For starters, the analysis of year published reveals a growing trend in publications over the past two decades (Figure 1).

Table 4 provides an overview of the academic journals that published on sustainability management tools for SMEs.

Surprisingly, a vast majority of identified publications (79 studies) can be found in sustainability management and ethics journals, whereas the topic is less discussed in both

Table 2
Inclusion and Exclusion Criteria for Literature Search

Criteria	Reason for Inclusion/Exclusion
Inclusion criteria	
Published articles/papers from 1991 to 2011	The scholarly works regarding SMEs and CSR/environmental management, starting with Thompson and Smith's (1991) article
Articles/papers in the English language	Most academic business journals are published in English.
Articles/papers address environmental and/or CSR issues	To ensure the term "sustainability" was applied to ecological and social issues versus only on economic or family-related issues
Articles/papers study management tools	To ensure the focus was on management tools dealing with sustainability management
Articles/papers focus on SMEs	To narrow the investigation on sustainability management tools proposed and designed for SMEs
Scholarly published articles/papers	To provide more rigorous arguments and to critically assess the applicability of tools in SMEs
Exclusion criteria	
Articles/papers do not address any of the four thematic areas, including application of tools, reasons for application, barriers to application, and tool criteria for SMEs	The purpose of this is to review the literature on applicability of tools in SMEs and reference has to be made to at least one of the four thematic areas of investigation
Conference papers, working papers, technical reports, and practical handbooks	To ensure quality and consistency in the comparative analysis, all articles/papers should be peer reviewed

CSR, corporate social responsibility; SME, small and medium-sized enterprise.

general management journals (15 studies) and SME journals (7 studies). This raises the question: Are sustainability and ethics researchers more concerned than small business and general management researchers on the subject of sustainability management tools in SMEs? Although this inquiry was not covered in the areas of investigation for this literature review, it is worth considering that future research could benefit from stronger collaboration between small business and sustainability researchers in this field.

Furthermore, the strong emphasis on academic literature in sustainability management and ethics journals suggests a more theoretical or conceptual focus of research on sustainability management tools for SMEs as opposed to a quantitative research approach. However, an initial analysis of the research methods applied in the reviewed studies only partially confirms the expected strong theoretical perspective.

The spectrum of research methods applied on this subject area ranges from conceptual or theoretical studies to empirical studies (quantitative and qualitative methods). When sorting the studies according to the research methods applied, a distribution can be observed of 35 publications purely conceptual or theoretical in kind, and 77 being empirically supported (34 quantitative and 43 qualitative). Therefore, a good distribution of research methods can be found. The next three sections present the results of the four thematic areas of investigation, starting with the tools designed and proposed for SME implementation.

Table 3
Search Results, Fully Reviewed Papers, and Included Papers[a]

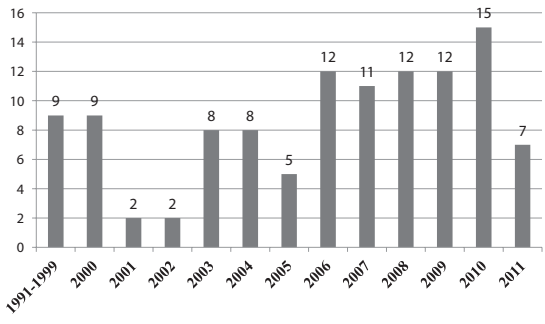
Search strings	Search Hits from Journal Databases	Preliminary Set of Papers for Full Review	Included Papers
"Sustainability management" AND "small and medium-sized enterprise (SME)" AND T/I/C/S	40	15	8
"Sustainability management" AND "small business" AND T/I/C/S	66	10	4
"Sustainability management" AND "family business" AND T/I/C/S	8	2	2
"Corporate social responsibility" AND "small and medium-sized enterprise (SME)" AND T/I/C/S	307	35	27
"Corporate social responsibility" AND "small business" AND T/I/C/S	798	25	10
"Corporate social responsibility" AND "family business" AND T/I/C/S	155	7	1
"Corporate citizenship" AND "small and medium-sized enterprise (SME)" AND T/I/C/S	86	2	1
"Corporate citizenship" AND "small business" AND T/I/C/S	323	4	1
"Corporate citizenship" AND "family business" AND T/I/C/S	59	4	0
"Business ethics" AND "small and medium-sized enterprise (SME)" AND T/I/C/S	267	11	5
"Business ethics" AND "small business" AND T/I/C/S	1,044	15	1
"Business ethics" AND "family business" AND T/I/C/S	296	5	0
"Environmental management" AND "small and medium-sized enterprise (SME)" AND T/I/C/S	723	45	35
"Environmental management" AND "small business" AND T/I/C/S	1,374	25	15
"Environmental management" AND "family business" AND T/I/C/S	164	5	0
"Social management" AND "small and medium-sized enterprise (SME)" AND. . .	30	5	1
"Social management" AND "small business" AND T/I/C/S	104	1	1
"Social management" AND "family business" AND T/I/C/S	47	0	0
Totals	5,891	216	112

[a]T/I/C/S stands for "tool OR Instrument OR Concept OR System," which was included in each search string.

Overview of Tools and Reasons for SME Implementation

The thematic analysis covers four areas of investigation, including: (1) the tools proposed for implementation; (2) the reasons for implementation of tools in SMEs; (3) the barriers for SME implementation; and (4) the facilitating criteria for SME implementation. This section discusses the first two areas of investigation

Figure 1
Number of Publications by Year (1991–2011)



successively. Quite a few publications propose effective tools and give reasons why they should be implemented in SMEs. Even though Hillary (2004) provides a good categorization of benefits for implementation of an EMS, no overarching framework of reasons for implementation has prevailed in the reviewed literature. Therefore, this section summarizes the most frequently cited reasons. After the overview of the proposed tools and the main reasons for implementation are presented, this paper critically questions the widespread applicability of tools in SMEs.

Sustainability Management Tools Proposed for SMEs

A total of 26 sustainability management tools could be identified in the literature with direct reference to SMEs (Table 5). A strong emphasis is on EMS with 47 studies. The total number of 145 references to tools is higher than the total sum of publications reviewed, as 19 of the 112 publications made references to multiple tools.

As seen in Table 5, the majority of the reviewed studies concentrates on a single tool (93 of 112 publications), such as an EMS (e.g., Ammenberg and Hjelm 2003; Burke and Gaughran 2007; Fresner 2004; Gerrans and Hutchinson 2000; Hillary 2004; Zorpas 2010). As an exception, some studies cover multiple sustainability management tools. However, these studies only focus on a particular perspective of sustainability management, such as environmental management (e.g., Perez-Sanchez, Barton, and Bower 2003; Starkey 2000) or social management (e.g., Graafland, van de Ven, and Stoffele 2003; Tencati, Perrini, and Pogutz 2004). Furthermore, the geographic focus of research is mostly centered on European SMEs (106 of 145 tools mentioned, as seen in Table 5).

One interpretation of the findings could be that sustainability management in SMEs appears to occur on a more general level (adopting systems and standards like EMS according to the ISO 14001 standard) and less on a specific level (applying specific instruments). However, the broad range of tools may also reflect the heterogeneity of SMEs requiring different kinds of sustainability management tools.

Reasons Provided Why Sustainability Management Tools Should be Implemented

Given the limited coverage of sustainability management tools in SME journals (exceptions are, for example, Jämsä et al. 2011), it is not surprising that the sustainability-minded scholars provide a more normative discussion why SMEs should implement these methods. The main reasons suggested in the literature are:

- *Managing legal compliance:* Tools can help SMEs to ensure proper legal compliance on environmental and social concerns, lower insurance costs through proven risk management techniques, and avoid future costs of noncompliance (Biondi, Frey, and Iraldo 2000; Gerstenfeld and Roberts 2000; Hillary 2004; Seiffert 2008).
- *Managing stakeholder relationships:* Tools can help SMEs improve communications with stakeholders and develop better relationships particularly with regulators and local administrative groups (Gadenne, Kennedy, and McKeiver 2009; Hillary 2004; Perrini and Tencati 2006; Russo and Tencati 2009; Sweeney 2007; Tencati, Perrini, and Pogutz 2004).
- *Reduction of complexity:* Tools allow companies to break down the complexities of sustainable development on a firm level and make it possible for them to measure their environmental and social performance (Burke and Gaughran 2007; Fresner and Engelhardt 2004; Perrini and Tencati 2006; Starkey 2000).
- *Evaluation and decision support:* Tools aid managers in their evaluation of environmental and social impacts, and make appropriate business decisions with this obtained information (Kuhndt 2004; Starkey 2000).

Table 4
Journals and Other Sources on Sustainability Management Tools for SMEs

Category	Journal	No.	Sum
SME journals			
	Journal of Small Business Management	5	
	Journal of Small Business and Enterprise Development	1	
	International Small Business Journal	1	
			7
Sustainability management and ethics journals			
	Business Strategy and the Environment	15	
	Journal of Cleaner Production	14	
	Journal of Business Ethics	13	
	Corporate Social Responsibility and Environmental Management	8	
	Business Ethics: A European Review	6	
	Eco-Management and Auditing	3	
	Business and Society	2	
	Corporate Governance: An International Review	2	
	Environmental Research, Engineering and Management	2	
	Other (e.g., *Journal of Environmental Management*)	14	
			79
General management journals			
	Management Decision	2	
	Journal of Quality Management	1	
	R&D Management	1	
	TQM Magazine	1	
	Other (e.g., *European Journal of International* Management)	10	
			15
Technology management journals			
	Robotics and Computer-Integrated Manufacturing	2	
	Bioresource Technology	1	
			3
Other publications			
	Book chapters in edited volumes		8
Overall total			112

SME, small and medium-sized enterprise.

- *Performance improvement:* Tools can help improve companies' sustainability performance through new environmental and social performance indicators, enhanced internal communication, and better overall awareness and understanding of business impacts on the environment and society (Ammenberg and Hjelm 2003; Gerrans and Hutchinson 2000; Lefebvre, Lefebvre, and Talbot 2003; Perrini and Tencati 2006; Zorpas 2010).
- *Operationalization of strategies:* Tools help operationalize sustainability strategies through systematic approaches to implementing environmental, social, and integrated systems into an organization (Fresner and Engelhardt 2004; Friedman and Miles 2002; Kerr 2006; Parisi and Maraghini 2010; Seiffert 2008; Tencati, Perrini, and Pogutz 2004; Zobel 2007; Zorpas 2010).
- *Organizational learning and innovativeness:* Sustainability management tools, such

Table 5
Overview of Sustainability Management Tools Proposed for SMEs[a]

Proposed Sustainability Management Tools	Number of Studies	Geographical Focus				
		Europe	AU & NZ	Asia	NSAM	Africa
1. Audit (environmental, social, or sustainable)	6	5	—	1	—	—
2. "Balance"	1	1	—	—	—	—
3. Benchmarking (environmental, social, or sustainable)	3	2	1	—	—	—
4. "Better Business Plan"	1	1	—	—	—	—
5. CSR Management	20	18	—	—	2	—
6. Dialogue (also Stakeholder Dialogue)	4	3	1	—	—	—
7. Eco-Efficiency Analysis	2	1	—	—	1	—
8. "Eco-Mapping"	2	2	—	—	—	—
9. "Efficient Entrepreneur Calendar"	1	—	—	—	1	—
10. Education (environmental, social or sustainability)	2	1	—	1	—	—
11. Environmental Cost Accounting	3	3	—	—	—	—
12. Environmental Management System (e.g., ISO 14001)	47	29	7	6	3	1
13. "EPM-KOMPAS"	1	1	—	—	—	—
14. Indicator (environmental, social, or sustainability)	2	2	—	—	—	—
15. Life Cycle Assessment	3	1	1	1	—	—
16. Networking (environmental, social, or sustainability)	6	4	2	—	—	—
17. Policy (environmental, social, or sustainability)	2	2	—	—	—	—
18. Public-Private Partnership (e.g., EcoProfit)	7	7	—	—	—	—
19. Quality Management System (e.g., EFQM)	11	7	2	1	1	—
20. Social Management System (e.g., SA 8000)	7	6	—	1	—	—
21. Supply Chain Management (green or sustainability)	3	2	—	1	—	—
22. "Sustainability Assessment for Enterprises"	1	1	—	—	—	—
23. Sustainability Balanced Scorecard	2	1	—	1	—	—
24. "Sustainability Evaluation and Reporting System"	1	1	—	—	—	—
25. Sustainability Reporting	6	4	—	—	2	—
26. "VerdEE"	1	1	—	—	—	—
Overall total	145	106	13	13	11	1

[a]Tools in quotation marks (e.g., "Balance") refer to direct names of SME-specific tools. AU & NZ, Australia and New Zealand; NSAM, North and South America; SME, small and medium-sized enterprise.

as an environmental policy, can aid companies in organizational learning and foster innovation for sustainable products and services (Dibrell, Craig, and Hansen 2011; Hansen, Sextl, and Reichwald 2010).

Further reasons explaining the implementation of tools are related to external support programs. Numerous studies have observed that SMEs are responding well to external incentives, such as *public support programs and demands by larger customers along the supply chain*, for environmental protection and waste elimination, health and safety standards, and so on (Fresner and Engelhardt 2004; Halila 2007; Johannson 1997; Kerr 2006; Lee 2009; Moore and Manring 2009; Morsing and Perrini 2009). Since the beginning of the new millennium, many large focal corporations have mandated that their SME suppliers must adopt an EMS or to conduct social audits as a precondition to doing business (Fresner and Engelhardt 2004).

Furthermore, small business networks are opening their agendas to sustainability issues, which allow their SME members *to share knowledge and resources* that otherwise might not have been directly available to them (Ammenberg and Hjelm 2003; Collins et al. 2007; Halila 2007; Jämsä et al. 2011; Jenkins 2006; Lawrence et al. 2006). More formally, *strategic alliances may allow members to implement and maintain sustainability management tools*, such as a cooperative business approach to implementing an EMS (Seiffert 2008) and a community-based approach to CSR (Niehm, Swinney, and Miller 2008).

Applicability of the Proposed Tools

Various sustainability management tools have been observed in the literature to be applied by SMEs and/or have the potential to be applied by SMEs. Eight tools were found to be specifically designed for SME application (left-hand column in Table 6): *Balance* (Bull 2007); *Better Business Plan* (Friedman and Miles 2002); *Efficient Entrepreneur Calendar* (Cote, Booth, and Louis 2006); *Eco-Mapping* (Koroljova and Voronova 2007); *EPM-KOMPAS* (Günter and Kaulich 2005); *Sustainability Assessment for Enterprises* (SAFE; Kinderyte 2008), *Sustainability Evaluation and Reporting System* (SERS; Perrini and Tencati 2006), and *VerdEE* (Masoni et al. 2004). Most publications, however, propose generally developed tools with regard to SMEs (right-hand column of Table 6). Most of this research investigates the applicability of generally developed tools in small companies. For example, an EMS according to the ISO 14001 standard has received a decent amount of attention in the literature, which is due to the fact that ISO 14001 was supposedly created also with small businesses in mind (Hillary 2004; Zorpas 2010).

Although many publications provide evidence that these generally developed tools could be implemented by a larger population of SMEs, a more thorough examination reveals that the number of tools *that have actually been implemented by many SMEs* is substantially less.

The list of tools becomes rather insignificant when considering the empirical evidence on *low implementation rates by SMEs*. Graafland, van de Ven, and Stoffele (2003) and Tencati, Perrini, and Pogutz (2004) conducted surveys with hundreds of SMEs in the Netherlands and Italy, respectively. Their findings revealed that most SME respondents in these countries did not apply the generally developed tools, which are typically implemented by larger enterprises.

When considering the *circumstances and conditions of implementation* at the time sustainability management tools have actually been implemented by SMEs, the methods of implementation reveal that the application in most cases can be linked to publically and/or externally funded projects. In some cases, researchers acted as promoters, encouraging the studied companies to implement tools. This finding calls to question if SMEs would be willing to apply sustainability management tools in the absence of support programs and other external incentives.

In brief, the existing literature dealing with sustainability management tools for SMEs creates mixed results. Most generally developed tools were created for large companies, whereas it remains uncertain if they are even applicable to SMEs (Graafland, van de Ven, and Stoffele 2003; Jenkins 2006; Lee 2009; Perrini and Tencati 2006; Thompson and Smith 1991). It has been debated which tools are most likely to be implemented by SMEs (Fresner and Engelhardt 2004; Tencati, Perrini, and Pogutz 2004). Some literature even argues that many sustainability management tools are not applicable to SMEs (Ammenberg and Hjelm 2003; Graafland, van de Ven, and Stoffele 2003; Lee 2009; Moore and Spence 2006; Perrini and

Table 6
Scope and Authors of Studies on Sustainability Management Tools in SMEs

SME-Specific Tools	Generally Developed Sustainability Management Tools for SMEs
Balance (Bull 2007) *Better Business Plan* (Friedman and Miles 2002) *Eco-Mapping* (Burke and Gaughran 2006; Koroljova and Voronova 2007; Perez-Sanchez, Barton, and Bower 2003) *Efficient Entrepreneur Calendar* (Cote, Booth, and Louis 2006) *EPM-KOMPAS* (Günter and Kaulich 2005) *Sustainability Assessment for Enterprises* (Kinderyte 2008) *Sustainability Evaluation and Reporting System* (Perrini and Tencati 2006) *VerdEE* (Masoni et al. 2004)	*Audit* (Graafland, van de Ven, and Stoffele 2003; Miles, Munilla, and McClurg 1999; Perez-Sanchez, Barton, and Bower 2003; Starkey 2000; Williamson and Lynch-Wood 2001) *Benchmarking* (Altham 2007; Makrinou, Mandaraka, and Assimakopoulos 2008; Tencati, Perrini, and Pogutz 2004) *CSR Management* (Avram and Kühne 2008; Davies and Crane 2010; Fitzgerald et al. 2010; Gelbmann 2010; Jenkins 2009; Klein and Vorbohle 2010; Nielsen and Thomsen 2009; Perrini 2006; Perrini and Minoja 2008; Roberts, Lawson, and Nicholls 2006; Russo and Tencati 2009; Ryan, O'Malley, and O'Dwyer 2010; Spence and Lozano 2000; Spence, Schmidpeter, and Habisch 2003; Sweeney 2007; Tencati, Perrini, and Pogutz 2004; Thompson and Smith 1991; von Weltzien Høivik and Shankar 2011; Williamson, Lynch-Wood, and Ramsay 2006) *Dialogue* (Arnold 2010; Graafland, van de Ven, and Stoffele 2003; Hammann, Habisch, and Pechlaner 2009; Longo, Mura, and Bonoli 2005; Seidel et al. 2008) *Eco-Efficiency Analysis* (Cote, Booth, and Louis 2006; Starkey 2000) *Education* (Cloquell-Ballester et al. 2008; Tseng et al. 2010) *Environmental Cost Accounting* (Heupel and Wendisch 2003; Karvonen 2000; Wendisch and Heupel 2005) *Environmental Management System* (Ammenberg and Hjelm 2003; Biondi, Frey, and Iraldo 2000; Brammer, Hoejmose, and Marchant 2012; Burke and Gaughran 2006, 2007; Bürgi 2011; Cassells, Lewis, and Findlater 2011; Chavan 2005; Copeland and Le Clue 1999; Fresner 2004; Fresner and Engelhardt 2004; Gadenne, Kennedy, and McKeiver 2009; Gerrans and Hutchinson 2000; Gerstenfeld and Roberts 2000; Graafland, van de Ven, and Stoffele 2003; Gunningham and Sinclair 2002; Hahn and Scheermesser 2006; Halila 2007; Heras and Arana 2010; Hicks and Dietmar 2007; Hillary 2004; Hutchinson and Chaston 1994; Ilomäki and Melanen 2001; Jenkins 2006; Jirillo, Rocchi, and Martucci 2003; Johannson 1997; Kehbila, Ertel, and Brent 2009; Kürzinger 2004; Lee 2009; Lefebvre, Lefebvre, and Talbot 2003; McKeiver and Gadenne 2005; Maijala and Pohjola 2006; Masurel 2007; Miles, Munilla, and McClurg 1999; Neamtu 2011; O'Laoire and Welford 1995; Perez-Sanchez, Barton, and Bower 2003; Petts 1998; Revell and Blackburn 2007; Revell, Stokes, and Chen 2010; Schylander and Martinuzzi 2007; Seiffert 2008; Starkey 2000; Tencati, Perrini, and Pogutz 2004; Tsai and Chou 2009; Williams et al. 2000; Zobel 2007; Zorpas 2010) *Indicator* (Kinderyte 2010; Tencati, Perrini, and Pogutz 2004) *Life Cycle Assessment* (Masoni et al. 2004; Miles, Munilla, and McClurg 1999; Perez-Sanchez, Barton, and Bower 2003; Seidel et al. 2008; Starkey 2000) *Networking* (Collins et al. 2007; Halila 2007; Hammann, Habisch, and Pechlaner 2009; Jämsä et al. 2011; Lawrence et al. 2006; Moore and Manring 2009; Murillo and Lozano 2009) *Policy* (Bradford and Fraser 2008; Dibrell, Craig, and Hansen 2011) *Public–Private Partnership* (Balcázar 2010; Fresner 1998; Martinuzzi, Huchler, and Obermayr 2000; Neamtu 2011; von Malmborg 2003) *Quality Management Systems* (Bürgi 2011; Castka et al. 2004; Danes, Loy, and Stafford 2008; Fresner and Engelhardt 2004; Graafland, van de Ven, and Stoffele 2003; Husband and Mandal 1999; Jenkins 2006; Kerr 2006; Tencati, Perrini, and Pogutz 2004; Tsai and Chou 2009) *Social Management Systems* (Fresner and Engelhardt 2004; Hahn and Scheermesser 2006; Harms-Ringdahl, Jansson, and Malmén 2000; Jenkins 2006; Tencati, Perrini, and Pogutz 2004; Tsai and Chou 2009) *Supply Chain Management* (Ciliberti et al. 2009; Lee and Klassen 2008; Pedersen 2009) *Sustainability Balanced Scorecard* (Hansen, Sextl, and Reichwald 2010; Parisi and Maraghini 2010) *Sustainability Reporting* (Borga et al. 2009; Burke and Gaughran 2007; Fassin 2008; Goetz 2010; Kinderyte 2008; Starkey 2000)

CSR, corporate social responsibility; SME, small and medium-sized enterprise.

Tencati 2006; Tencati, Perrini, and Pogutz 2004). Nevertheless, several authors have found exceptions to the prevailing view (Burke and Gaughran 2007; Gerstenfeld and Roberts 2000; Kerr 2006; Lawrence et al. 2006; Starkey 2000; Zorpas 2010). Most case study firms were willing to adopt a particular tool. However, these cases are usually restricted to the application of a single tool, observed during a short period of time, and often aided by a support program (e.g., a publicly funded research project).

At this point, it is reasonable to state that most sustainability management tools are either found to be not applicable for SMEs or observed to have been implemented in extremely limited cases. This raises the question what reasons do the literature provide why such tools are not being implemented in SMEs, which is the third thematic area of analysis covered in the next section.

Barriers for SME Implementation

The most prominent reasons explaining why sustainability management tools are not implemented in SMEs can be broken down into two categories—internal shortcomings and external deficiencies. First, internal shortcomings of SMEs include the lack of awareness on sustainability issues, the absence of perceived benefits, the lack of knowledge and expertise, and the lack of human and financial resources. The second category deals with external deficiencies, including insufficient external drivers and incentives, the unsuitability of formal management tools in informal SME structures, and the complexity of internationally designed standards and instruments for locally focused SMEs. Furthermore, the heterogeneity in the SME sector may explain certain limitations why generally developed tools are not widely implemented.

Internal SME Shortcomings

The lack of awareness of sustainability issues is the first shortcoming frequently attributed to the reasons of limited implementation of tools by SMEs. Small business owner–managers are often unaware of their company's environmental and social impacts. In turn, they do not apply any strategies or tools to rectify unrealized problems (Revell and Blackburn 2007). Compared with larger corporations, SMEs often see themselves as exempt from sustainability issues due to their perception of having minimal impacts on societies and the environment (Gerstenfeld and Roberts 2000; Lawrence et al. 2006). However, such attitudes are counterproductive to sustainable development when considering the collective environmental and social impacts of all SMEs (Collins et al. 2007; Hillary 2004; Revell, Stokes, and Chen 2010).

A second commonly discussed internal shortcoming is the *absence of perceived benefits* (Brammer, Hoejmose, and Marchant 2012; Friedman and Miles 2002; Neamtu 2011). For example, Brammer, Hoejmose, and Marchant (2012) demonstrate that the smallest companies perceive significantly fewer benefits of engagement with environmental issues compared with medium-sized enterprises. Small businesses often do not realize that many opportunities and programs are available to educate and support them on environmental and social issues (Bradford and Fraser 2008; Burke and Gaughran 2007; Gerrans and Hutchinson 2000; Seidel et al. 2008; Zorpas 2010).

The lack of knowledge and expertise on sustainability issues refers to SME owner–managers having an inexperienced view of their social and environmental impacts. Even if they become more aware of the impacts and possible benefits, they still lack the expertise to properly deal with these issues (Ammenberg and Hjelm 2003; Bradford and Fraser 2008; Gerstenfeld and Roberts 2000; Hillary 2000; Lee 2009; Revell and Blackburn 2007; Seidel et al. 2008). This lack of expertise can lead SMEs to adopt reactive strategies to emerging environmental and social issues although they do not embed these strategies into the core business over the long term (Schaper 2002).

Last but not least, the literature considers the *lack of human and financial resources* to be of high relevance toward the weak implementation of sustainability management tools. SMEs are not only faced with financial and time constraints to implement sustainability management tools, but they lack the human resources as well (Ammenberg and Hjelm 2003; Borga et al. 2009; Collins et al. 2007; Friedman and Miles 2002; Gerstenfeld and Roberts 2000; Graafland, van de Ven, and Stoffele 2003; Hillary 2000, 2004; Lee 2009; Tencati, Perrini, and Pogutz 2004). SME employees are usually responsible or at least involved in more than one business function, wearing many different hats within the firm. Burke and Gaughran

(2007) found that time constraints on employees were a major obstacle for implementation.

External Deficiencies

External deficiencies explain the rare implementation of sustainability management tools with insufficient external drivers and the lack of suitable standards and tools for SMEs.

Insufficient *external drivers and incentives*, both from governmental ministries and from the marketplace, are seen as major hindrances for SMEs to engage in sustainability management practices (Ammenberg and Hjelm 2003; Gerstenfeld and Roberts 2000; Hillary 2004; Lawrence et al. 2006; Revell and Blackburn 2007). Little regulatory pressure and low customer demand to adopt sustainability management lead SME managers to believe that the tools and systems to operationalize sustainability are of little relevance.

Several authors criticize *the unsuitability of formal management tools* as the main implementation problem because of the inappropriate fit between formal tools and standards, and informal, flexible SME structures and culture (Ammenberg and Hjelm 2003; Graafland, van de Ven, and Stoffele 2003; Hillary 2000; Perrini and Tencati 2006). Certain tools can be expensive and time consuming to implement and maintain within SMEs. For example, Ammenberg and Hjelm (2003, p. 173) argue, "for some of the smallest of firms, the standardized EMS approach seemed a bit too administratively burdensome, in spite of using a joint EMS."

The complexity of sustainability management standards and tools is often mentioned as an obstacle for locally situated SMEs. Small enterprises mostly act on a local level, whereas most environmental, social, and sustainability standards and tools were developed to account for national and international issues, usually stemming from the impacts of business in large companies (Perrini and Tencati 2006; Revell and Blackburn 2007).

Heterogeneity of SMEs

In addition to these internal and external barriers, it is cumbersome to propose the universal application of sustainability management tools to such a diverse group of companies as SMEs are not a homogenous group (Hillary 2000; Seidel et al. 2008). Hillary (2000, p. 2) questions, "Why should an enterprise be defined by size at all?" She recommended that studies should narrow down their foci on subcategories of SMEs (e.g., micro, small, or medium-sized enterprises, as categorized in European Commission 2005). With few exceptions (Russo and Tencati 2009; Zorpas 2010), the majority of the literature have not made such a differentiation of sustainability management tools according to these subcategories.

Thus, a mismatch exists between the generality of sustainability management tools proposed in research and the heterogeneity of SMEs in practice, which seems to require a diverse set of more size and sector-specific tools. The intention of the following section is to advance the literature by developing a set of criteria for the improved implementation of a wide range of sustainability management tools in SMEs based on the findings in the literature.

Facilitating Criteria of Tools for SME Implementation

So far, the majority of generally designed sustainability management tools in their current form are not being implemented by most SMEs (Graafland, van de Ven, and Stoffele 2003; Lee 2009; Moore and Spence 2006; Perrini and Tencati 2006; Tencati, Perrini, and Pogutz 2004). However, these tools cannot be easily disregarded from the scope of SMEs as they have been observed to operationalize sustainability strategies very effectively in larger enterprises (Graafland, van de Ven, and Stoffele 2003). Surveying the literature has provided a summary list of key criteria that tools must fulfill in order to improve a more widespread acceptance and application in SMEs:

- Simplicity/User-friendliness of tools
- Practicality/Cost-effectiveness of tools
- Adaptability/Flexibility of tools
- Company-tailored tools
- Locally focused tools
- Group and network-oriented tools

For SMEs, tools must be *simple and user-friendly* in the implementation and maintenance processes (Seidel et al. 2008; Starkey 2000; Zorpas 2010). A "user-friendly" tool should contain straightforward guidelines for application and maintenance (Friedman and Miles 2002; Gerstenfeld and Roberts 2000; Maijala and Pohjola 2006). For example, Burke and Gaughran (2006) and Zorpas (2010) emphasized that a streamlined approach to implementing an EMS in comparison with the

standard process is necessary for SMEs. Through the assistance of the EMAS EASY guidebook, SMEs can implement an EMS incrementally and minimize the required documentation through the support of Eco-Mapping (Burke and Gaughran 2006; Koroljova and Voronova 2007; Zorpas 2010).

Tools must be *practical and cost-effective*. More specifically, the implementation of a given tool must fit within the time, cost, and personnel constraints of SMEs (Friedman and Miles 2002; Seidel et al. 2008). For example, the "Better Business Pack (BBP)" supports SMEs in dealing with the major practical aspects of environmental measurement while providing managers with sense of "value for money" on their investment (Friedman and Miles 2002).

Tools must be *adaptable*, *flexible*, *and take into consideration the informal business characteristics* of SMEs, allowing for some tolerance of informal cultures and management structures (Graafland, van de Ven, and Stoffele 2003; Kerr 2006; Seidel et al. 2008; Zorpas 2010). Furthermore, several authors (Collins et al. 2007; Tencati, Perrini, and Pogutz 2004) emphasized that the larger the SME becomes, the more these tools can be systematically adapted to fit the formal management structure of the company. In addition to their adaptability, tools should be *company tailored* so that they address the circumstances of each individual enterprise (Burke and Gaughran 2007; Fresner and Engelhardt 2004; Hillary 2004; Starkey 2000; Zorpas 2010). It may be noted, however, that this requirement could apply to both small and large enterprises.

Due to the mostly strong influence on the local surroundings, SME-specific tools should particularly *consider the local circumstances*, such as local ecosystems, local communities, and stakeholders (Collins et al. 2007; Gerstenfeld and Roberts 2000; Graafland, van de Ven, and Stoffele 2003; Tencati, Perrini, and Pogutz 2004). Thus, they should encourage and support SMEs to use local sustainable resources, hire and promote employees from the region, and invest in the local community (Perrini 2006; Tencati, Perrini, and Pogutz 2004).

Group and network-oriented tools should encourage greater diffusion in SMEs by offering solutions to alleviate many of the barriers to implementation (Ammenberg and Hjelm 2003; Castka et al. 2004; Collins et al. 2007; Halila 2007; Jämsä et al. 2011; Jenkins 2006; Kürzinger 2004; Lawrence et al. 2006; Murillo and Lozano 2009; Seiffert 2008). For example, EcoProfit has helped numerous SMEs improve their environmental performance through public–private partnerships between local municipalities and companies (Balcázar 2010; Fresner 2004; Martinuzzi, Huchler, and Obermayr 2000; Neamtu 2011).

So far, the literature has mainly focused on incremental developments and slight adaptations of the existing sustainability management tools. However, it is still to be empirically investigated whether meeting these aforementioned criteria leads to further implementation of the proposed tools or whether the simultaneous development of new and improved tools for SMEs is necessary. For example, Graafland, van de Ven, and Stoffele (2003) have questioned whether existing tools can be redesigned in a way to fit SMEs or if completely new methods are required.

Discussion and Outlook

Based on the thematic analysis in four particular areas of investigation, including the overview of proposed tools, the reasons for implementation, the barriers for implementation, and the key facilitating criteria to improve applicability of tools in SMEs, the discussion section aims to synthesize these aspects into one. Thereafter, an outlook is provided with regard to consequences for future research and SME management.

Tracing the development of the literature over the past two decades reveals several interesting findings. First, the range of tools proposed in the academic literature has become greater and more diversified over time. Second, most barriers for SME implementation have been addressed with a multitude of manageable solutions. Third, the facilitating criteria for SME implementation, which are mostly theoretical, have also been supported by empirical evidence.

The range of tools proposed in the academic literature has increased in quantity and variety over time. What started out at the beginning with a strong environmental management perspective (e.g., studies concentrating on the implementation of an EMS), has evolved into a more integrative management perspective. This approach has opened new doors to explore integrative management systems (IMS), covering quality, social, health and safety, and environmental management issues simultaneously

(Burke and Gaughran 2006; Bürgi 2011; Fresner and Engelhardt 2004; Jenkins 2006; Tsai and Chou 2009). In addition, SME-specific tools were mostly introduced in the academic literature in the latter part of the last decade (e.g., SERS, discussed in Perrini and Tencati 2006).

Second, most of the barriers for SME implementation, while still prevalent in the majority of the literature, have been specifically addressed with manageable solutions. Several authors have provided a direct link between barriers for implementation and the facilitating criteria that can amend these shortcomings (Borga et al. 2009; Friedman and Miles 2002; Gerstenfeld and Roberts 2000; Hillary 2004; Kinderyte 2010; Schylander and Martinuzzi 2007; Williams et al. 2000). Some authors recognize that tools alone are not enough, and SMEs must look beyond the facilitating criteria at other important aspects, such as employee training, motivation, and leadership (Burke and Gaughran 2007; Friedman and Miles 2002; Kerr 2006; Masurel 2007). In addition, participation and teamwork by an organization's employees are essential for successful implementation (Arnold 2010).

Third, the proposed facilitating criteria to improve applicability of tools in SMEs, which are mostly theoretical, have also been supported by some empirical evidence. For example, Heras and Arana (2010) confirmed that the criteria *simplicity and practicality* can have a positive effect on implementation rates. In their quantitative survey on a simplified EMS, called Ekoscan, the results show an increased adoption of Ekoscan in SMEs in comparison with ISO 14001. They argue that higher implementation rates are mainly due to less work for documentation and lower cost for implementation. In addition, studies covering the facilitating criteria *group and network-oriented tools* (Halila 2007; Seiffert 2008; Zobel 2007) have demonstrated the economic and long-term objective benefits of joint EMS and group certification. Cooperation between multiple SMEs simplifies the implementation process and reduces the cost of certification.

Despite these positive developments of tools and support programs over the past two decades, the literature remains clear that most tools are not being implemented by SMEs, and the majority of small businesses do not implement sustainability management tools at all. The facilitating criteria developed in the more recent literature are intended to alleviate some barriers to SME implementation, especially dealing with lack of resources, lack of awareness and expertise, and so forth. However, it appears that most SMEs still fail to see the economic benefits of sustainability practices. Therefore, these firms have little to no incentive to implement tools to support practices regarded as mere costs (Brammer, Hoejmose, and Marchant 2012; Friedman and Miles 2002). In the absence of perceived economic benefits coupled with insufficient external drivers and support programs, a gap between awareness and implementation of tools in SMEs will persist (Brammer, Hoejmose, and Marchant 2012; Gadenne, Kennedy, and McKeiver 2009; Hahn and Scheermesser 2006; Jenkins 2006). In the following subsections, the consequences for further research and SME management are discussed.

Consequences for Further Research

Given the substantial implementation deficiencies with sustainability management tools, the question may be asked whether the sustainability management literature has been too idealistic (Dentchev 2009) and not sufficiently instrumental with regard to SMEs. One conclusion could be that future research should consider further theories in addition to those already observed. Another conclusion could be that a different focus on research may be required.

The prevailing theory applied more frequently in the covered literature is stakeholder theory. Stakeholder theory sheds some light on the reasons of implementing sustainability management tools, which usually stem from the relationships with internal and external stakeholders. Tools, such as public–private partnerships, reporting, and dialogue, can be very useful to improve the strength of these relationships, which refers back to stakeholder theory (Gadenne, Kennedy, and McKeiver 2009). Stakeholder theory could be relevant to explain an EMS, as it attempts to involve both internal (employees) and external stakeholder (suppliers, local authorities) in safe environmental practices of a firm (Danes, Loy, and Stafford 2008; Fresner and Engelhardt 2004; Friedman and Miles 2002; Kerr 2006; Seiffert 2008; Zobel 2007; Zorpas 2010).

In addition to stakeholder theory, other theories could provide further insight into SME characteristics. For example, social capital

theory refers to beneficial cooperation between various institutions, networks, and business partners, and between individuals (Perrini 2006; Russo and Tencati 2009; Spence, Schmidpeter, and Habisch 2003). Perrini (2006) suggests that specific tools are needed to maintain and enhance SMEs' social capital.

With few exceptions (e.g., Halila 2007), the diffusion of innovative tools has so far not been empirically researched in depth and could be further investigated with regard to their role of supporting corporate sustainability. In accordance with innovation diffusion theory (Rogers 2003), new insights could be gained from two perspectives. Either tools can be perceived as innovations, or tools can be observed to foster the diffusion of sustainability-related innovations. On one hand, tools themselves, such as an EMS, can be considered an "organizational environmental innovation" as it creates new or modifies existing processes, practices, products, and systems (Halila 2007, p. 170). On the other hand, tools can provide support in accelerating sustainability innovations (Maijala and Pohjola 2006). Furthermore, networks (Collins et al. 2007; Halila 2007) and public–private partnerships, such as EcoProfit (Balcázar 2010; Neamtu 2011), can serve as platforms to facilitate the diffusion of sustainability management tools in SMEs.

From an institutional theory perspective, other possible rationales could be investigated in depth, like whether mimicry or coercive behavior (DiMaggio and Powell 1983) or whether management fashions (Abrahamson 1991) play an important role and what consequences could be drawn for the promotion of sustainability management tools. Transaction cost theory (Graafland, van de Ven, and Stoffele 2003) reveals how opportunity costs and risks may influence SME managers' decision-making on implementation of tools. A sustainable family business theory was also mentioned in two studies (Danes, Loy, and Stafford 2008; Fitzgerald et al. 2010), which could provide greater insight into how adopted systems, such as quality management or an EMS, fit into the interface between family and business from generation to generation.

From a more functional standpoint, future research may have to explore new approaches with regard to sustainability management tools for SMEs. For example, the rationale and motivations of SME managers could be investigated with regard to the implementation of sustainability management tools. In particular, the gap between awareness and application of sustainability management tools by SME managers could be further examined (e.g., "value-action gap" in Revell, Stokes, and Chen 2010). Such an investigation would provide a better insight on what tools may have further potential to close these value-action gaps, and how communication could be improved to increase awareness and enhance perceived economic benefits.

Although the SME-specific barriers have been discussed comprehensively in the literature, the relationships between barriers and actual implementation of tools have not yet been investigated. Future research could explore these barriers in greater depth to observe their influences on the implementation of sustainability management tools in SMEs. Regression models could illustrate the varying levels of influence that barriers have to explain the variance in implementation of tools. For example, an interesting outcome would be to identify if the lack of awareness and knowledge has a greater influence on implementation of tools than other barriers. If this were the case, recommendations could be made for awareness raising and training programs that are designed specifically for SME managers as a precursor to implementation.

Future research could benefit from stronger collaboration between SME and sustainability researchers. Researchers and journals with an SME focus could contribute to this field by investigating whether sustainability management tools create lasting benefits for small businesses. Further empirical research could investigate the role of external partnerships, programs, and platforms to overcome the absence of perceived benefits and enhance the diffusion of tools in SMEs. Such studies could find out whether local programs and partnerships go beyond creating short-term hype and awareness, and if they have the capacity to reach most of the SMEs in the community.

Consequences for SME Management

Sustainability management does not mean that a company adopts a one-size-fits-all approach (Gelbmann 2010; Gerstenfeld and Roberts 2000). Thus, SME owner–managers are challenged to choose and implement a set of tools that help them operationalize corporate sustainability relevant to their particular business and surroundings.

The need to develop SME-specific sustainability management tools that consider the heterogeneity among SMEs has been expressed (Hillary 2000). Such differentiation could, for instance, be made in terms of size between micro, small, or medium-sized enterprises, or in terms of industry sector. In fact, many authors encourage the development of further sector-specific tools and indicators (Bradford and Fraser 2008; Friedman and Miles 2002; Lee 2009; Maijala and Pohjola 2006). For example, Maijala and Pohjola (2006) demonstrate how a web-based EMS tool has helped companies in the transportation sector overcome barriers to implementation. They stress that the diffusion of EMS will be improved through the development of similar sector-specific tools.

SME managers may, however, be overtaxed to evaluate a large range of sustainability management tools proposed in the literature. In this context, the development of a sustainability strategy may be a necessary first step for two reasons. First, sustainability management tools may be more relevant to SMEs which have already established a sustainability strategy (Burke and Gaughran 2007; Fresner and Engelhardt 2004; Graafland, van de Ven, and Stoffele 2003; Parisi and Maraghini 2010; Perrini, Russo, and Tencati 2007; Tencati, Perrini, and Pogutz 2004), and second, such a strategy may provide criteria and guidelines to exactly which sustainability management tools may be adequate for the company. These strategies usually reveal the commitment of the SME's leaders to tackle sustainability issues, which can be incorporated into the core business of the firm. However, Russo and Tencati (2009) as well as Parisi and Maraghini (2010) advise that any sustainability-oriented strategies should reflect the level of informality and flexibility of the firm's size and structure.

Conclusions

Over the past two decades, the academic literature on sustainability management tools for SMEs has proposed a range of different approaches. This systematic literature review unveils that most of these tools are in their current, generalized form not being implemented by the majority of SMEs (Graafland, van de Ven, and Stoffele 2003; Lee 2009; Moore and Spence 2006; Perrini and Tencati 2006; Tencati, Perrini, and Pogutz 2004). Even though some tools have been developed specifically for SMEs and other generally developed tools have been modified to improve application in SMEs, these developments have been few and far between. This review summarizes various barriers explaining these low implementation rates and provides key facilitating criteria, which have been proposed for the improved implementation of tools. Future studies could help determine whether meeting the proposed criteria is sufficient to lead to increased implementation, or if completely new approaches are required. Additionally, this field would certainly benefit if small business researchers joined with sustainability researchers on handling the challenges moving forward. Bringing their extensive knowledge and understanding of the peculiarities and complexities of small businesses, researchers with a strong SME focus could complement the existing literature on sustainability management tools.

References

Abrahamson, E. (1991). "Managerial Fads and Fashions. The Diffusion and Rejection of Innovations," *Academy of Management Review* 16(3), 586–612.

Ahire, S. L., and D. Y. Golhar (1996). "Quality Management in Large vs. Small Firms," *Journal of Small Business Management* 34(2), 1–13.

Altham, W. (2007). "Benchmarking to Trigger Cleaner Production in Small Businesses: Drycleaning Case Study," *Journal of Cleaner Production* 15(9), 798–813.

Ammenberg, J., and O. Hjelm (2003). "Tracing Business and Environmental Effects of Environmental Management Systems: A Study of Networking Small and Medium-sized Enterprises using a Joint Environmental Management System," *Business Strategy and the Environment* 12(3), 163–174.

Arnold, M. (2010). "Stakeholder Dialogues for Sustaining Cultural Change," *International Studies of Management and Organization* 40(3), 61–77.

Avram, D. O., and S. Kühne (2008). "Implementing Responsible Business Behavior from a Strategic Management Perspective: Developing a Framework for Austria SMEs," *Journal of Business Ethics* 82, 463–475.

Balcázar, N. (2010). "Sustainability, Climate Protection and Economy: Three Areas Successfully Combined Through ECOPROFIT," *Reviews in Environmental Science and Biotechnology* 9(1), 29–33.

Bansal, P. (2005). "Evolving Sustainability: A Longitudinal Study of Corporate Sustainable Development," *Strategic Management Journal* 26, 197–218.

Biondi, V., M. Frey, and F. Iraldo (2000). "Environmental Management Systems and SMEs: Motivations, Opportunities and Barriers Related to EMAS and ISO 14001 Implementation," *Greener Management International* 29, 55–69.

Borga, F., A. Citterio, G. Noci, and E. Pizzurno (2009). "Sustainability Report in Small Enterprises: Case Studies in Italian Furniture Companies," *Business Strategy and the Environment* 18(2), 162–176.

Bradbury, H., and J. A. Clair (1999). "Promoting Sustainable Organizations with Sweden's Natural Step," *The Academy of Management Executive* 13(4), 63–74.

Bradford, J., and E. D. G. Fraser (2008). "Local Authorities, Climate Change and Small and Medium Enterprises: Identifying Effective Policy Instruments to Reduce Energy Use and Carbon Emissions," *Corporate Social Responsibility and Environmental Management* 15(3), 156–172.

Brammer, S., S. Hoejmose, and K. Marchant (2012). "Environmental Management in SMEs in the UK: Practices, Pressures and Perceived Benefits," *Business Strategy and the Environment* 21(7), 423–434.

Bull, M. (2007). "Balance: The Development of a Social Enterprise Business Performance Analysis Tool," *Social Enterprise Journal* 3(1), 49–66.

Burke, S., and W. F. Gaughran (2006). "Intelligent Environmental Management for SMEs in Manufacturing," *Robotics and Computer-Integrated Manufacturing* 22, 566–575.

——— (2007). "Developing a Framework for Sustainability Management in Engineering SMEs," *Robotics and Computer-Integrated Manufacturing* 23, 696–703.

Bürgi, J. (2011). "A Comprehensive Model for SMEs: Measuring the Dynamic Interplay of Morality, Environment and Management Systems—Towards Continuous Improvement," in *Ethics in Small and Medium-Sized Enterprise: The International Society of Business, Economics and Ethics Book*. Eds. L. J. Spence and M. Painter-Morland. London: Springer Publishing, 147–171.

Carroll, A. B. (1999). "Corporate Social Responsibility: Evolution of a Definitional Construct," *Business and Society* 38, 268–295.

Cassells, S., K. Lewis, and A. Findlater (2011). "SMEs and ISO 14001 Adoption: A New Zealand Perspective," *Small Enterprise Research* 18(1), 19–32.

Castka, P., M. A. Balzarova, C. J. Bamer, and J. M. Sharp (2004). "How Can SMEs Effectively Implement the CSR Agenda? A UK Case Study Perspective," *Corporate Social Responsibility and Environmental Management* 11, 140–149.

Chavan, M. (2005). "An Appraisal of Environmental Management Systems: A Competitive Advantage for Small Businesses," *Management of Environmental Quality* 16(5), 444–463.

Ciliberti, F., G. de Groot, J. de Haan, and P. Pontrandolfo (2009). "Codes to Coordinate Supply Chains: SMEs' Experiences with SA8000," *Supply Chain Management: An International Journal* 14(2), 117–127.

Cloquell-Ballester, V. A., R. Monterde-Diaz, V. A. Cloquell-Ballester, and A. C. Torres-Sibille (2008). "Environmental Education for Small- and Medium-Sized Enterprises: Methodology and E-Learning in the Valencian Region," *Journal of Environmental Management* 87(3), 507–520.

Collins, E., S. Lawrence, K. Pavlovich, and C. Ryan (2007). "Business Networks and the Uptake of Sustainability Practices: The Case of New Zealand," *Journal of Cleaner Production* 15, 729–740.

Copeland, A., and S. Le Clue (1999). "EMS as a Mainstream Business Tool: Perspectives from Hong Kong," *Journal of Environmental Assessment Policy and Management* 1(2), 159–175.

Coskeran, T., and P. S. Phillips (2005). "Economic Appraisal and Evaluation of UK Waste Minimisation Clubs: Proposals to Inform the Design of Sustainable Clubs," *Resources, Conservation and Recycling* 43(4), 361–374.

Cote, R., A. Booth, and B. Louis (2006). "Eco-Efficiency and SMEs in Nova Scotia, Canada," *Journal of Cleaner Production* 14, 542–550.

Danes, S., J. T. C. Loy, and K. Stafford (2008). "Business Planning Practices of Family-Owned Firms Within a Quality Framework," *Journal of Small Business Management* 46(3), 395–421.

Davies, I. A., and A. Crane (2010). "Corporate Social Responsibility in Small- and Medium-Size Enterprises: Investigating Employee

Engagement in Fair Trade Companies," *Business Ethics: A European Review* 19(2), 126–139.

Dentchev, N. (2009). "To What Extent Is Business & Society Literature Idealistic?," *Business and Society* 48(1), 10–38.

Dibrell, C., J. Craig, and E. Hansen (2011). "Natural Environment, Market Orientation, and Firm Innovativeness: An Organizational Life Cycle Perspective," *Journal of Small Business Management* 49(3), 467–489.

DiMaggio, P., and W. Powell (1983). "The Iron Cage Revisited. Institutional Isomorphism and Collective Efficient in Organisational Fields," *American Sociological Review* 48, 147–160.

Dyllick, T., and K. Hockerts (2002). "Beyond the Business Case for Corporate Sustainability," *Business Strategy and the Environment* 11, 130–141.

Epstein, M. J. (2008). *Making Sustainability Work: Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impacts*. Sheffield: Greenleaf Publishing.

European Commission (2005). "The New SME Definition. User Guide and Model Declaration." http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf. Accessed November 6, 2010.

Fassin, Y. (2008). "SMEs and the Fallacy of Formalising CSR," *Business Ethics: A European Review* 17(4), 364–378.

Fitzgerald, M. A., G. W. Haynes, H. L. Schrank, and S. M. Danes (2010). "Socially Responsible Process of Small Family Business Owners: Exploratory Evidence from the National Family Business Survey," *Journal of Small Business Management* 48(4), 524–551.

Foundation Center (2011). "Tools and Resources for Assessing Social Impact (TRASI)." http://trasi.foundationcenter.org/. Accessed July 10, 2012.

Frederick, W. C. (1994). "From CSR1 to CSR2: The Maturing of Business-and-Society Thought," *Business and Society* 33, 150–164.

Fresner, J. (1998). "Options, Measures, Results: Eco-Profit-Styria-Prepare Two Years After Project End," *Journal of Cleaner Production* 6, 237–245.

——— (2004). "Small and Medium Sized Enterprises and Experiences with Environmental Management," *Journal of Cleaner Production* 12, 545–547.

Fresner, J., and G. Engelhardt (2004). "Experiences with Integrated Management Systems for two Small Companies in Austria," *Journal of Cleaner Production* 12(6), 623–631.

Friedman, A. L., and S. Miles (2002). "SMEs and the Environment: Evaluating Dissemination Routes and Handholding Levels," *Business Strategy and the Environment* 11, 324–341.

Gadenne, D. L., J. Kennedy, and C. McKeiver (2009). "An Empirical Study of Environmental Awareness and Practices in SMEs," *Journal of Business Ethics* 84(1), 45–63.

Gelbmann, U. (2010). "Establishing Strategic CSR in SMEs: An Austrian CSR Quality Seal to Substantiate the Strategic CSR Performance," *Sustainable Development* 18, 90–98.

Gerrans, P., and B. Hutchinson (2000). "Sustainable Development and Small and Medium-Sized Enterprises: A Long Way to Go," in *Small and Medium-Sized Enterprises and the Environment*. Ed. R. Hillary. Sheffield: Greenleaf Publishing, 75–81.

Gerstenfeld, A., and H. Roberts (2000). "Size Matters: Barriers and Prospects for Environmental Management in Small and Medium-Sized Enterprises," in *Small and Medium-Sized Enterprises and the Environment*. Ed. R. Hillary. Sheffield: Greenleaf Publishing, 106–118.

Gibson, M. (2001). "The Work of Envirowise in Driving Forward UK Industrial Waste Reduction," *Resources, Conservation and Recycling* 32(3–4), 191–202.

Gladwin, T., J. Kennelly, and T. Krause (1995). "Shifting Paradigms for Sustainable Development: Implications for Management Theory and Research," *Academy of Management Review* 20(4), 874–907.

Goetz, K. S. (2010). "Encouraging Sustainable Business Practices Using Incentives: A Practitioner's View," *Management Research Review* 33(11), 1042–1053.

Göbbels, M. (2002). "Reframing Corporate Social Responsibility: The Contemporary Conception of a Fuzzy Notion."

Graafland, J., B. van de Ven, and N. Stoffele (2003). "Strategies and Instruments for Organising CSR by Small and Large Businesses in the Netherlands," *Journal of Business Ethics* 47(1), 45–60.

Gunningham, N., and D. Sinclair (2002). "Partnerships, Management Systems and the Search for Innovative Regulation in the

Vehicle Body Shop Industry," *Business Strategy and the Environment* 11(4), 236–253.

Günter, E., and S. Kaulich (2005). "The EPM-KOMPAS: An Instrument to Control the Environmental Performance in Small and Medium-Sized Enterprises (SMEs)," *Business Strategy and the Environment* 14, 361–371.

Hahn, T., and M. Scheermesser (2006). "Approaches to Corporate Sustainability Among German Companies," *Corporate Social Responsibility and Environmental Management* 13(3), 150–165.

Halila, F. (2007). "Networks as a Means of Supporting the Adoption of Organizational Innovations in SMEs: The Case of Environmental Management Systems (EMS) Based on ISO 14001," *Corporate Social Responsibility and Environmental Management* 14(3), 167–181.

Hammann, E.-M., A. Habisch, and H. Pechlaner (2009). "Values That Create Value: Socially Responsible Business Practices in SMEs—Empirical Evidence from German Companies," *Business Ethics: A European Review* 18(1), 37–51.

Hansen, E. G., M. Sextl, and R. Reichwald (2010). "Managing Strategic Alliances Through a Community-Enabled Balanced Scorecard: The Case of Merck Ltd., Thailand," *Business Strategy and the Environment* 19(6), 387–399.

Harms-Ringdahl, L., T. Jansson, and Y. Malmén (2000). "Safety, Health and Environment in Small Process Plants: Results from a European Survey," *Journal of Safety Research* 31(2), 71–80.

Heras, I., and G. Arana (2010). "Alternative Models for Environmental Management in SMEs: The Case of Ekoscan vs. ISO 14001," *Journal of Cleaner Production* 18, 726–735.

Heupel, T., and N. Wendisch (2003). "Green Success: Process-Based Environmental Cost Accounting: Implementation in SMEs in Germany," in *Environmental Management Accounting. Purpose and Progress*. Eds. M. Bennett, P. M. Rikhardsson, and S. Schaltegger. Dordrecht: Kluwer Academic Publishers, 333–364.

Hicks, C., and R. Dietmar (2007). "Improving Cleaner Production Through the Application of Environmental Management Tools in China," *Journal of Cleaner Production* 15, 305–408.

Hillary, R. (2000). *Small and Medium-Sized Enterprises and the Environment*. Sheffield: Greenleaf Publishing.

——— (2004). "Environmental Management Systems and the Smaller Enterprise," *Journal of Cleaner Production* 12, 561–569.

Holmberg, J. (1998). "Backcasting: A Natural Step in Operationalising Sustainable Development," *Greener Management International* 23, 30–51.

Husband, S., and P. Mandal (1999). "A Conceptual Model for Quality Integrated Management in Small and Medium Size Enterprises," *International Journal of Quality and Reliability Management* 16(7), 699–713.

Hutchinson, A., and I. Chaston (1994). "Environmental Management in Devon and Cornwall's Small and Medium Sized Enterprise Sector," *Business Strategy and the Environment* 3(1), 15–22.

Ilomäki, M., and M. Melanen (2001). "Waste Minimisation in Small and Medium-Sized Enterprises: Do Environmental Management Systems Help?," *Journal of Cleaner Production* 9, 209–217.

Jämsä, P., J. Tähtinen, A. Ryan, and M. Pallari (2011). "Sustainable SMEs Network Utilization: The Case of Food Enterprises," *Journal of Small Business and Enterprise Development* 18(1), 141–156.

Jenkins, H. (2006). "Small Business Champions for Corporate Social Responsibility," *Journal of Business Ethics* 67(3), 241–256.

——— (2009). "A Business Opportunity Model of Corporate Social Responsibility for Small- and Medium-Sized Enterprises," *Business Ethics: A European Review* 18(1), 21–36.

Jirillo, R., A. Rocchi, and O. Martucci (2003). "EMAS and Its Local Diffusion in Italy," *Corporate Social Responsibility and Environmental Management* 10, 40–49.

Johannson, L. (1997). "The Challenge of Implementing ISO 14001 for Small- and Medium-Sized Enterprises—Surviving the New Global Jungle," *Environmental Quality Management* 7, 9–19.

Karvonen, M. M. (2000). "Environmental Accounting as a Tool for SMEs in Environmentally Induced Economic Risk Analysis," *Eco-Management and Auditing* 7, 21–28.

Kehbila, A. G., J. Ertel, and A. C. Brent (2009). "Strategic Corporate Environmental Management within the South African Automotive Industry: Motivations, Benefits, Hurdles,"

Corporate Social Responsibility and Environmental Management 16, 310–323.

Kerr, I. R. (2006). "Leadership Strategies for Sustainable SME Operation," *Business Strategy and the Environment* 15(1), 30–39.

Kinderyte, L. (2008). "Analysis and Comparison of Methodologies for Corporate Sustainability Assessment," *Environmental Research, Engineering and Management* 46(4), 66–75.

——— (2010). "Methodology of Sustainability Indicators Determination for Enterprise Assessment," *Environmental Research, Engineering and Management* 52(2), 25–31.

Klein, S., and K. Vorbohle (2010). "Corporate Social Responsibility and Stakeholder Relations: The Perspectives of German Small and Medium-Sized Enterprises," in *Ethics in Small and Medium-Sized Enterprise: The International Society of Business, Economics and Ethics Book*. Eds. L. J. Spence and M. Painter-Morland. London: Springer Publishing, 215–225.

Koroljova, A., and V. Voronova (2007). "Eco-Mapping as a Basis for Environmental Management Systems Integration at Small and Medium Enterprise," *Management of Environmental Quality* 18(5), 542–555.

Kuhndt, M. (2004). "Sustainable Business Development," in *Eco-Efficiency and Beyond*. Eds. J. D. Seiler-Hausmann, C. Liedtke, and E. U. von Weizsäcker. Sheffield: Greenleaf Publishing, 64–72.

Kürzinger, E. (2004). "Capacity Building for Profitable Environmental Management," *Journal of Cleaner Production* 12, 237–248.

Lawrence, S. R., E. Collins, K. Pavlovich, and M. Arunachalam (2006). "Sustainability Practices of SMEs: The Case of New Zealand," *Business Strategy and the Environment* 15(4), 242–257.

Lee, K. H. (2009). "Why and How to Adopt Green Management into Business Organizations? The Case Study of Korean SMEs in the Manufacturing Industry," *Management Decision* 47(7), 1101–1121.

Lee, S.-Y., and R. D. Klassen (2008). "Drivers and Enablers That Foster Environmental Management Capabilities in Small- and Medium-Sized Suppliers in Supply Chains," *Production and Operations Management* 17(6), 573–586.

Lefebvre, E., L. A. Lefebvre, and S. Talbot (2003). "Determinants and Impacts of Environmental Performance in SMEs," *R&D Management* 33(3), 263–283.

Lehmann, M. (2006). "Government-Business Relationships through Partnerships for Sustainable Development: The Green Network in Denmark," *Journal of Environmental Policy & Planning* 8(3), 235–257.

Leviner, N., L. Crutchfield, and D. Wells (2007). "Understanding the Impact of Social Entrepreneurs—Ashoka's Answer to the Challenge of Measuring Effectiveness," Ashoka Online. http://www.ashoka.org/files/ME_Impact06.pdf. Accessed November 18, 2010.

Longo, M., M. Mura, and A. Bonoli (2005). "Corporate Social Responsibility and Corporate Performance: The Case of Italian SMEs," *Corporate Governance: An International Review* 5(4), 28–42.

McKeiver, C., and D. Gadenne (2005). "Environmental Management Systems in Small and Medium Business," *International Small Business Journal* 23, 513–537.

Maijala, A., and T. Pohjola (2006). "Web-Based Environmental Management Systems for SMEs: Enhancing the Diffusion of Environmental Management in the Transportation Sector," in *Sustainability Accounting and Reporting*. Eds. S. Schaltegger, M. Bennett, and R. Burritt. London: Springer Publishing, 655–677.

Makrinou, A., M. Mandaraka, and D. Assimakopoulos (2008). "Environmental Benchmarking for Management of Energy and Water Use: A Study of SMEs in the Mediterranean Region," *Environmental Quality Management* 17(3), 31–44.

Martinuzzi, A., E. Huchler, and B. Obermayr (2000). "Ecoprofit: Promoting Partnerships Between Small and Medium-Sized Enterprises and Local Authorities," *Greener Management International* 30, 83–96.

Masoni, P., B. Sara, E. Scimia, and A. Raggi (2004). "VerdEE: A Tool for Adoption of Life Cycle Assessment in Small and Medium Sized Enterprises in Italy," *Progress in Industrial Ecology: an International Journal* 1(3), 203–228.

Masurel, E. (2007). "Why SMEs Invest in Environmental Measures: Sustainability Evidence from Small and Medium-Sized Printing Firm," *Business Strategy and the Environment* 16(3), 190–201.

Matten, D., and A. Crane (2005). "Corporate Citizenship: Toward an Extended Theoreti-

cal Conception," *Academy of Management Review* 30(1), 166–179.

Miles, M. P., L. S. Munilla, and T. McClurg (1999). "The impact of ISO 14000 Environmental Management Standards on Small and Medium Sized Enterprises," *Journal of Quality Management* 4(1), 111–122.

Moore, G., and L. Spence (2006). "Responsibility and Small Business," *Journal of Business Ethics* 67(3), 219–226.

Moore, S. B., and S. L. Manring (2009). "Strategy Development in Small and Medium Sized Enterprises for Sustainability and Increased Value Creation," *Journal of Cleaner Production* 17(2), 276–282.

Morsing, M., and F. Perrini (2009). "CSR in SMEs: Do SMEs Matter for the CSR Agenda?," *Business Ethics: A European Review* 18(1), 1–6.

Moustaghfir, K. (2008). "The Dynamics of Knowledge Assets and Their Link with Firm Performance," *Measuring Business Excellence* 12(2), 10–24.

Murillo, D., and C. Lozano (2009). "Pushing Forward SME CSR Through a Network: An Account from the Catalan Model," *Business Ethics: A European Review* 18(1), 7–20.

Neamtu, B. (2011). "Public-Private Partnerships for Stimulating the Eco-Efficiency and Environmental Responsibility of SMEs," *Transylvanian Review of Administrative Sciences* 34, 137–154.

Niehm, L. S., J. Swinney, and N. J. Miller (2008). "Community Social Responsibility and Its Consequences for Family Business Performance," *Journal of Small Business Management* 46(3), 331–350.

Nielsen, A. E., and C. Thomsen (2009). "Investigating CSR Communication in SMEs: A Case Study Among Danish Middle Managers," *Business Ethics: A European Review* 18(1), 83–93.

O'Laoire, D., and R. Welford (1995). "The Environmental Management System in Small- and Medium-Sized Enterprises Using ISO 14000," *Eco-Management and Auditing* 2(1), 12–17.

Parisi, C., and M. P. Maraghini (2010). "Operationalising Sustainability: How SMEs Translate Social and Environmental Issues into Practice," in *Business Performance Measurement and Management*. Ed. T. Paolo. Berlin: Springer Publishing, 131–148.

Pedersen, E. R. (2009). "The Many and the Few: Rounding Up the SMEs That Manage CSR in the Supply Chain," *Supply Chain Management: An International Journal* 14(2), 109–116.

Perez-Sanchez, D., J. R. Barton, and D. Bower (2003). "Implementing Environmental Management in SMEs," *Corporate Social Responsibility and Environmental Management* 10, 67–77.

Perrini, F. (2006). "SMEs and CSR Theory: Evidence and Implications from an Italian Perspective," *Journal of Business Ethics* 67(3), 305–316.

Perrini, F., and M. Minoja (2008). "Strategizing Corporate Social Responsibility: Evidence from an Italian Medium-Sized, Family-Owned Company," *Business Ethics: A European Review* 17(1), 47–63.

Perrini, F., and A. Tencati (2006). "Sustainability and Stakeholder Management: The Need for New Corporate Performance Evaluation and Reporting Systems," *Business Strategy and the Environment* 15, 296–308.

Perrini, F., A. Russo, and A. Tencati (2007). "CSR Strategies of SMEs and Large Firms: Evidence from Italy," *Journal of Business Ethics* 74(3), 285–300.

Petts, J. (1998). "Environmental Responsiveness, Individuals and Organizational Learning: SME Experience," *Journal of Environmental Planning and Management* 41(6), 711–730.

Revell, A., and R. Blackburn (2007). "The Business Case for Sustainability? An Examination of Small Firms in the UK's Construction and Restaurant Sectors," *Business Strategy and the Environment* 16(6), 404–420.

Revell, A., D. Stokes, and H. Chen (2010). "Small Businesses and the Environment: Turning Over a New Leaf?," *Business Strategy and the Environment* 19, 273–288.

Robert, K.-H. (2000). "Tools and Concepts for Sustainable Development, How Do They Relate to a General Framework for Sustainable Development, and to Each Other?," *Journal of Cleaner Production* 8, 243–254.

Robert, K.-H., B. Schmidt-Bleek, J. Aloisi de Lardeerel, G. Basile, J. L. Jansen, R. Kuehr, P. Price Thomas, M. Suzuki, P. Hawken, and W. Wackernagel (2002). "Strategic Sustainable Development—Selection, Design and Synergies of Applied Tools," *Journal of Cleaner Production* 10, 197–214.

Roberts, S., R. Lawson, and J. Nicholls (2006). "Generating Regional-Scale Improvements in

SME Corporate Responsibility Performance: Lessons from Responsibility Northwest," *Journal of Business Ethics* 67, 275–286.

Rogers, E. M. (2003). *Diffusion of Innovations*, 5th ed. New York: The Free Press.

Rondinelli, D. A., and M. A. Berry (2000). "Environmental Citizenship in Multinational Corporations: Social Responsibility and Sustainable Development," *European Management Journal* 18(1), 70–84.

Russo, A., and A. Tencati (2009). "Formal vs. Informal CSR Strategies: Evidence from Italian Micro, Small, Medium-Sized, and Large Firms," *Journal of Business Ethics* 85, 339–353.

Ryan, A., L. O'Malley, and M. O'Dwyer (2010). "Responsible Business Practice: Re-Framing CSR for Effective SME Engagement," *European Journal of International Management* 4(3), 290–302.

Schaltegger, S., and R. Burritt (2005). "Corporate Sustainability," in *The International Yearbook of Environmental and Resource Economics 2005/2006: A Survey of Current Issues*. Eds. H. Folmer and T. Tietenberg. Cheltenham: Edward Elgar, 185–222.

Schaltegger, S., and M. Wagner (2011). "Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions," *Business Strategy and the Environment* 20(4), 222–237.

Schaltegger, S., C. Herzig, O. Kleiber, and J. Müller (2002). *Sustainability Management in Business Enterprises. Concepts and Instruments for Sustainable Organisation Development*. Bonn/Lüneburg: German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Centre for Sustainability Management.

Schaper, M. (2002). "The Challenge of Environmental Responsibility and Sustainable Development: Implications for SME and Entrepreneurship Academics," in *Radical Changes in the World. Will SMEs Soar or Crash?* Eds. U. Füglistaller, H. J. Pleitner, T. Volery, and W. Weber. St. Gallen: Recontres de St. Gallen, 525–534.

Schylander, E., and A. Martinuzzi (2007). "ISO 14001—Experiences, Effects and Future Challenges: A National Study in Austria," *Business Strategy and the Environment* 16, 133–147.

Seelos, C., and J. Mair (2005). "Social Entrepreneurship: Creating New Business Models to Serve the Poor," *Business Horizons* 48(3), 241–246.

Seidel, M., R. Seidel, D. Tedford, R. Cross, L. Wait, and E. Hämmerle (2008). "Overcoming Barriers to Implementing Environmentally Benign Manufacturing Practices: Strategic Tools for SMEs," *Environmental Quality Management* 18(3), 37–55.

Seiffert, M. E. B. (2008). "Environmental Impact Evaluation using a Cooperative Model for Implementing EMS (ISO 14001) in Small and Medium-Sized Enterprises," *Journal of Cleaner Production* 16, 1447–1461.

Shrivastava, P., and S. Hart (1995). "Creating Sustainable Corporations," *Business Strategy and the Environment* 4, 154–165.

Spence, L. J., and J. F. Lozano (2000). "Communicating about Ethics with Small Firms. Experiences from the U.K. and Spain," *Journal of Business Ethics* 27(2), 43–53.

Spence, L. J., R. Schmidpeter, and A. Habisch (2003). "Assessing Social Capital: Small and Medium Sized Enterprises in Germany and the U.K.," *Journal of Business Ethics* 47, 17–29.

Starkey, R. (2000). "Environmental Management Tools: Some Options for Small and Medium-Sized Enterprises," in *Small and Medium-Sized Enterprises and the Environment*. Ed. R. Hillary. Sheffield: Greenleaf Publishing, 96–105.

Sweeney, L. (2007). "Corporate Social Responsibility in Ireland: Barriers and Opportunities Experienced by SMEs When Undertaking CSR," *Corporate Governance: An International Review* 7(4), 516–523.

Tencati, A., F. Perrini, and S. Pogutz (2004). "New Tools to Foster Corporate Socially Responsible Behavior," *Journal of Business Ethics* 53, 173–190.

Thompson, J. K., and H. L. Smith (1991). "Social Responsibility and Small Business: Suggestions for Research," *Journal of Small Business Management* 29(1), 30–44.

Tranfield, D., D. Denyer, and P. Smart (2003). "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of a Systematic Review," *British Journal of Management* 14, 207–222.

Tsai, W. H., and W. C. Chou (2009). "Selecting Management Systems for Sustainable Development in SMEs: A Novel Hybrid Model Based on DEMATEL, ANP and ZOGP," *Expert Systems with Application* 48(10), 1514–1528.

Tseng, Y. F., Y. C. J. Wu, W. H. Wu, and C. Y. Chen (2010). "Exploring Corporate Social Responsibility Education: The Small and Medium-Sized Enterprise Viewpoint," *Management Decision* 48(10), 1514–1528.

United Nations World Commission on Environment and Development (1987). *Our Common Future. The Brundtland Report*. Oxford: Oxford University Press.

van Marrewijk, M. (2003). "A Value Based Approach to Organization Types: Towards a Coherent Set of Stakeholder-Oriented Management Tools," *Journal of Business Ethics* 55(2), 147–158.

von Malmborg, F. (2003). "Conditions for Regional Public-Private Partnerships for Sustainable Development: Swedish Perspectives," *European Environment* 13, 133–149.

von Weltzien Høivik, H., and D. Shankar (2011). "How Can SMEs in a Cluster Respond to Global Demands for Corporate Responsibility?," *Journal of Business Ethics* 101, 175–195.

Wartick, S. L., and P. L. Cochran (1985). "The Evolution of the Corporate Social Performance Model," *Academy of Management Review* 10(4), 758–769.

Weitz, K. A., and A. Sharma (1998). "Practical Life Cycle Assessment Through Streamlining," *Environmental Quality Management* 7, 81–87.

Wendisch, N., and T. Heupel (2005). "Implementing Environmental Cost Accounting in Small and Medium-Sized Companies," in *Implementing Environmental Management Accounting: Status and Challenges*. Eds. P. Rikhardsson, M. Bennett, J. Bouma, and S. Schaltegger. Dordrecht: Springer Publishing, 193–205.

Williams, H., A. van Hooydonk, P. Dingle, and D. Annandale (2000). "Developing Tailored Environmental Management Systems for Small Businesses," *Eco-Management and Auditing* 7, 106–113.

Williamson, D., and G. Lynch-Wood (2001). "A New Paradigm for SME Environmental Practice," *The TQM Magazine* 13(6), 424–433.

Williamson, D., G. Lynch-Wood, and J. Ramsay (2006). "Drivers of Environmental Behaviour in Manufacturing SMEs and the Implications for CSR," *Journal of Business Ethics* 67, 317–330.

Wood, D. J. (1991). "Corporate Social Performance Revisited," *Academy of Management Review* 15(4), 691–718.

Yoshikawa, T., and A. A. Rasheed (2009). "Convergence of Corporate Governance: Critical Review and Future Directions," *Corporate Governance: An International Review* 17(3), 388–404.

Zobel, T. (2007). "The 'Pros' and 'Cons' of Joint EMS and Group Certification: A Swedish Case Study," *Corporate Social Responsibility and Environmental Management* 14, 152–166.

Zorpas, A. (2010). "Environmental Management Systems as Sustainable Tools in the Way of Life for SMEs and VSMEs," *Bioresource Technology* 101, 1544–1557.

II. Paper 2

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Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools

Matthew P. Johnson*
Leuphana Universität Lüneburg, Centre for Sustainability Management (CSM) Lüneburg, Germany

ABSTRACT
With the intention of integrating environmental and social practices in small and medium-sized enterprises (SMEs), a growing body of research proposes the implementation of corporate social responsibility (CSR) and environmental management tools. Collectively referred to as sustainability management tools in this paper, voluntary management approaches range from environmental and social audits, indicators, and management systems, to reporting schemes and stakeholder dialogues. While the adoption of such management tools in SMEs has been increasingly anticipated in the academic literature, the rates of awareness and implementation for these management tools are missing. Furthermore, the connections between awareness and implementation remain under-researched. Using a framework for innovation diffusion, the results from a web-based survey with 176 German SME managers investigate these connections. Rogers' model is particularly useful to identify managerial and organizational characteristics that might explain why particular SMEs are more likely to adopt sustainability management tools. Copyright © 2013 John Wiley & Sons, Ltd and ERP Environment

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Introduction

While it is still unclear how small and medium-sized enterprises (SMEs) should integrate environmental sustainability and social equality into their everyday business practices, it is apparent that such matters are gaining in political and societal importance (Revell and Blackburn, 2007; Seidel *et al.*, 2008). Environmental and social issues are also becoming central business concerns (Bansal, 2005; Revell *et al.*, 2010). Pressing environmental and social issues related to business performance, such as rising prices for energy and raw materials, eliminating waste and harmful substances in the production processes, guaranteeing health and safety at the workplace, etc., present major challenges and simultaneously considerable opportunities for business enterprises.

*Correspondence to: Matthew P. Johnson, Leuphana Universität Lüneburg, Centre for Sustainability Management (CSM), Scharnhorststrasse 1, 21335 Lüneburg, Germany. E-mail: johnson@uni.leuphana.de

At first glance, the environmental and social impacts of SMEs might be easily overshadowed by the impacts of large, multinational corporations. However, small businesses with fewer than 250 employees constitute the majority of companies in all industrialized and developing nations. The collective ecological and social impacts of countless SMEs are overwhelming. For example, it is estimated that SMEs contribute to roughly 70% of global pollution (Hillary, 2000; Revell *et al.*, 2010). Despite this revealing statistic, most SME managers have yet to implement eco-friendly practices to minimize these impacts (Revell and Blackburn, 2007; Seidel *et al.*, 2008).

Looking beyond strict legislative pressures and environmental regulations to rectify these harmful impacts from small businesses (Rutherfoord *et al.*, 2000), a number of SME-focused approaches have been proposed in the literature to support small business managers increase their overall awareness and improve their environmental and social performance. A growing body of literature (Friedman and Miles, 2002; Ammenberg and Hjelm, 2003; Lawrence *et al.*, 2006; Halila, 2007; Zobel, 2007; Seiffert, 2008; Zorpas, 2010) proposes the implementation of CSR and environmental management instruments and systems, referred to as sustainability management tools in this paper. These tools range from environmental management systems (EMS) over social audits, CSR and sustainability reports to employee training schemes. Even SME-specific tools have been developed in the academic literature, such as the *sustainability evaluation and reporting scheme* (SERS; Perrini andTencati, 2006).

With few exceptions (Graafland *et al.*, 2003; Tencati *et al.*, 2004; Hahn and Scheermesser, 2006), a closer examination of the rates of awareness and implementation of sustainability management tools in SMEs is outdated at best, and the figures on implementation for most of these tools are hard to find. Even less is known about the connections between awareness and implementation to understand why some SMEs are more likely to adopt such management tools (Halila, 2007). For these reasons, this paper compares the results of an empirical investigation on the rates of awareness and implementation of multiple sustainability management tools in SMEs. In addition, it examines various managerial and organizational characteristics that could potentially influence the rates of adoption using Rogers' (1995) stages of innovation diffusion model. These characteristics include managers' perceived relative advantages over previous practices and systems, top management support, level of engagement throughout an enterprise, and organizational size.

The paper is structured as follows: after a brief introduction of sustainability management tools and their relevance in the SME context, a framework is established, which is based on Rogers' (1995) stages of innovation diffusion model. The third section explains the methodological approach of the empirical quantitative survey with 176 German SME managers. The fourth section presents the survey results according to Rogers' model, including awareness, implementation, and the managerial and organizational characteristics that might influence adoption. The final two sections provide a discussion of the results and conclude with implications for SME management and future research.

Literature Review

Sustainability Management Tools and SMEs

Sustainability management includes the internal development of environmental and social measures as well as the external contribution to the sustainable development of society and the economy (Shrivastava & Hart, 1995; Bansal, 2005; Schaltegger and Burritt, 2005). Thus, sustainability management tools assist managers to monitor and evaluate this internal development while simultaneously engaging in a dialogue with external stakeholders on sustainable development issues (Kuhndt, 2004). A wide range of such tools have been proposed in the literature for various functional areas (e.g. accounting tools, marketing tools, production management tools, supply chain management tools) as well as cross-functional support systems affecting the overall goals of an enterprise (Schaltegger *et al.*, 2012).

Such management tools can be particularly useful in aiding managers' decision-making on important environmental and social aspects relating to organizational operations. For example, a properly executed EMS can help company personnel monitor and pinpoint environmentally harmful operations, which can lead to organizational efficiencies and internal cost savings (Hillary, 2004; Seiffert, 2008; Zorpas, 2010). Further benefits of sustainability management tools include the improvement of environmental and social performance through better overall

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awareness and communication (Gerrans and Hutchinson, 2000; Ammenberg and Hjelm, 2003; Perrini and Tencati, 2006; Rao *et al.*, 2009; Zorpas, 2010), the operationalization of sustainability strategies by creating measurement and feedback channels (Friedman and Miles, 2002; Fresner and Engelhardt, 2004; Kerr, 2006; Rao *et al.*, 2009; Parisi and Maraghini, 2010), and the facilitation of organizational learning and innovativeness through new environmental and social management practices (Dibrell *et al.*, 2011; Hansen *et al.*, 2010; Steward and Gapp, 2012).

However, tools alone will not lead to the improvement of environmental and social performance for several reasons. First, they are not substitutes for human action (Malmborg, 2003; Holton *et al.*, 2010). Second, most tools fail to integrate environmental and social aspects into the daily routines without proper management controls (Schaltegger and Burritt, 2005). Finally, many tools will not be relevant to all companies all the time (Starkey, 2000). Rather, an enterprise should choose the most appropriate tool or set of tools for its particular sustainability management needs. Therefore, tools must be practical, adaptable and consider the human factor during implementation and continued management (Liedtke and Kaiser, 2006).

A review of the literature has captured an extensive list of sustainability management tools proposed for implementation in SMEs. While most studies concentrate on one particular tool, such as an EMS (Ammenberg and Hjelm, 2003; Halila, 2007; Zobel, 2007; Seiffert, 2008; Kehbila *et al.*, 2009), this paper incorporates previously researched tools as means for comparison. This list of tools includes accounting tools, environmental and social audits, benchmarking tools, employee development tools (e.g. training, employee suggestion scheme and incentive program), labels (e.g. organic, fair trade and stewardship labels), environmental and social management systems, reporting schemes and stakeholder tools (e.g. dialogue and networking). Considering that most tools can be classified as environmentally, socially or (combined) sustainability-oriented, a total of 36 tools were identified in the literature. Table 1 provides a list of tools, their various orientations, and the highlighted articles in the SME context.

As the amount of published papers and proposed tools for SMEs steadily increases, an implicit debate regarding the applicability of such tools in SMEs persistently lingers. On one hand, advocating scholars offer various reasons for implementation of tools in SMEs, such as the owner-manager's willingness to engage in sustainability activities (Revell *et al.*, 2010; Cassells and Lewis, 2011; Hsu and Cheng, 2012). Furthermore, promising benefits from tools may encourage implementation, including the enhancement of stakeholder relationships (Biondi *et al.*, 2000; Hillary, 2004; Seiffert, 2008), the reduction of complexities of sustainable development that small business are able to comprehend (Burke and Gaughran, 2006), and the improvement of SMEs' environmental and social performance through planning and measurement controls (Gerrans and Hutchinson, 2000; Ammenberg and Hjelm, 2003; Kehbila *et al.*, 2010; Zorpas, 2010). The implementation of tools can also be fostered through local support programs and small business networks, allowing members to implement tools under the consultation of experts and with other firms' acting as cooperative peers pursuing a common goal (e.g. improved social and/or environmental performance, in Ammenberg and Hjelm, 2003; Halila, 2007; Battaglia *et al.*, 2010; Jämsä *et al.*, 2011; Steward and Gapp, 2012).

On the other hand, several authors highlight major setbacks for the widespread diffusion and adoption of tools in SMEs. First, SME managers are often quoted to have little awareness of the programs and management practices available to them dealing with environmental and social sustainability (Gerstenfeld and Roberts, 2000; Hillary, 2004; Gadenne *et al.*, 2009). Second, very few market or governmental incentives are in place to encourage SMEs in the improvement of their environmental and social practices (Friedman and Miles, 2002; Bradford and Fraser, 2008; Kehbila *et al.*, 2010; Brammer *et al.*, 2012). Third, many proposed tools were originally designed and implemented in large corporations. It is questioned in the literature whether these tools are too complex and resource-intensive for SMEs to implement (Ammenberg and Hjelm, 2003; Graafland *et al.*, 2003; Tencati *et al.*, 2004; Lawrence *et al.*, 2006; Hammann *et al.*, 2009; Jenkins, 2006; Bos-Brouwers, 2010; Cassells and Lewis, 2011; Williams and Schaefer, 2013).

Nevertheless, the literature has provided little evidence of awareness and implementation rates for most of these management tools. Thus far, the empirical research on awareness and implementation has concentrated either on environmental and social standards (e.g. ISO 14001, SA 8000, OHSAS 18001, in Graafland *et al.*, 2003; Tencati *et al.*, 2004) or on a single tool (e.g. environmental management system, in Heras and Arana, 2010). While the connection between awareness and implementation has been made in large German corporations (Schaltegger *et al.*, 2012), it has not been empirically investigated in SMEs. Therefore, the next subsection establishes a framework to make this connection based on Rogers' (1995) model on the stages in the innovation process.

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Sustainability Management Tools	Orientation	Highlighted Articles in SME Context (in alphabetical order)
Accounting	Env, Soc, Sus	Heupel and Wendisch (2003); Karvonen (2000)
Analysis	Env, R	Cote *et al.* (2006)
Audit	Env, Soc, Sus	Graafland *et al.* (2003); Perez-Sanchez *et al.* (2003); Williamson and Lynch-Wood (2001)
Balanced Scorecard	Sus	Hansen *et al.* (2010); Parisi and Maraghini (2010)
Benchmarking	Env, Soc, Sus	Altham (2007); Tencati *et al.* (2004)
Code of Conduct	Soc	Graafland *et al.* (2003); Tencati *et al.* (2004)
Corporate Citizenship	Soc	Høivik and Melé (2009); Jenkins (2006); Veleva (2010)
Ecomapping	Env	Koroljova and Voronova (2007)
Employee Training	Env, Soc, Sus	Cloquell-Ballester *et al.* (2008); Tseng *et al.* (2010)
Dialogue	Soc	Arnold (2010); Hammann *et al.* (2009); Longo *et al.* (2005); Seidel *et al.* (2008)
Design for Environment	Env	Cassells and Lewis (2011); Starkey (2000)
Indicator	Env, Soc, Sus	Kinderyte (2010); Rao *et al.* (2009); Tencati *et al.* (2004)
Label	Env, Soc, Sus	Hahn and Scheermesser (2006)
Life Cycle Assessment	Env	Masoni *et al.* (2004); Perez-Sanchez *et al.* (2003); Seidel *et al.* (2008); Starkey (2000)
Management System	Env, Q, Soc	Ammenberg and Hjelm (2003); Fresner and Engelhardt (2004); Halila (2007); Hillary (2004); Kehbila *et al.* (2009); McKeiver and Gadenne (2005); Seiffert (2008); Williams *et al.* (2000); Zobel (2007); Zorpas (2010)
Network	Sus	Battaglia *et al.* (2010); Collins *et al.* (2007); Halila (2007); Jämsä *et al.* (2011); Lawrence *et al.* (2006); Nielsen and Thomsen (2011)
Policy	Env, Q, Soc	Bradford and Fraser (2008); Dibrell *et al.* (2011); Hsu and Cheng (2012)
Report	Env, Soc, Sus	Borga *et al.* (2009); Burke and Gaughran (2007); Perrini and Tencati (2006)

Table 1. Sustainability management tools for SMEs
Abbreviations – Env (Environment); Q (Quality); R (Risk); Soc (Social); Sus (Sustainability)

Sustainability Management Tools and Stages of Innovation Diffusion

Sustainability management tools can be considered as organizational innovations. An organizational innovation is defined as *the implementation of a new organizational method in the firm's business practices, workplace organization or external relations* (OECD, 2005: p. 51). Sustainability management tools fulfill this requirement as they contain a novelty approach to integrate fresh environmental and social management practices into conventional business operations. For example, Halila (2007: p. 167) establishes an EMS as an *organizational environmental innovation* because it creates new management practices, processes and systems, or it modifies previous management practices. In another study, Hsu and Cheng (2012) apply Rogers' diffusion of innovation model to observe the level of adoption of CSR policies in Taiwanese SMEs.

Recognizing sustainability management tools as forms of organizational innovations, Rogers' (1995) stages of the innovation diffusion model offers a useful framework for examining awareness and implementation of tools. Furthermore, this model helps to make connections between these two variables by identifying managerial and organizational characteristics explaining why certain innovative tools are implemented in companies (Figure 1).

As seen in the first row of boxes in Figure 1, Rogers' (1995) model explains five stages that most enterprises will experience in the adoption of organizational innovations, which in this case refers to sustainability management

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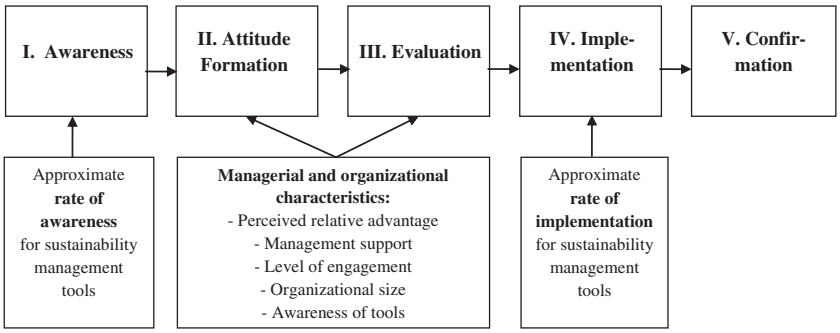

Figure 1. Adaptation of Rogers' (1995) Stages of Innovation Diffusion

tools. In the first stage, *awareness*, managers of an enterprise would become acquainted with sustainability management tools and gain a better understanding of them (Halila, 2007). According to Ozaki (2011), if the awareness stage does not occur, adoption is unthinkable. The second stage is *attitude formation*, where managers are able to form attitudes towards these tools, which can be influenced by technological, managerial and/or organizational characteristics (Tornatzky and Fleischer, 1990; Hashem and Tann, 2007; Hsu and Cheng, 2012). Depending on the circumstances, managers can form positive or negative attitudes concerning management tools, depending on managers' beliefs about the outcomes from adoption and organizational situations (Hashem and Tann, 2007). This leads to the third stage, *evaluation*, where decisions are made to adopt or reject the tools depending on the positive and negative attitudes formed (Rogers, 1995; Williams and Rao, 1998). In the fourth stage, *implementation*, management tools are implemented in an enterprise. In the final stage, *confirmation*, managers integrate the tools into their daily activities and replace the former management practices and systems (Halila, 2007).

The second row of boxes in Figure 1 illustrates how data from this study can be applied to Rogers' (1995) model. The first and third boxes show the approximate rates of awareness and implementation for sustainability management tools in SMEs, which is provided from the dataset. The middle box shows managerial and organizational characteristics that influence attitude formation and the evaluation stages. Several authors (Tornatzky and Fleischer, 1990; Hashem and Tann, 2007; Hsu and Cheng, 2012) have identified important characteristics that support or hinder the adoption of innovation. They group these into three sets of characteristics, including technological, managerial and organizational characteristics. While technological characteristics focus on a single innovation, the managerial and organizational characteristics can be applied to a wider set of innovations on an organization level. Since this paper investigates multiple sustainability management tools on an organizational level, the latter two sets of characteristics were used.

The managerial and organizational characteristics designated for this study include: (1) perceived relative advantage – managers' perceptions on the economic benefits from the implementation of sustainability management tools (Halila, 2007; Hsu and Cheng, 2012); (2) management support – the support by top management can lead to the implementation of such tools (Halila, 2007; Hashem and Tann, 2007; Hsu and Cheng, 2012); (3) level of engagement – the level of engagement and involvement from multiple functional areas in an enterprise (e.g. human resources, marketing, production); and (4) organizational size – organization size is considered an important characteristic that influences the actual implementation of tools (Hashem and Tann, 2007).

In addition, awareness of tools has been observed to have a positive influence on the implementation of tools (Hutchinson and Chaston, 1994). Several authors emphasize that raising awareness of sustainability management tools in SMEs may be the greatest driver of adoption (Bradford and Fraser, 2008; Maijala and Pohjola, 2006). All of these managerial and organizational characteristics can be positively associated with the adoption of sustainability management tools in SMEs. Therefore, this paper proposes the following five hypotheses:

H1: *Perceived relative advantage of sustainability management tools is positively associated with the adoption of these tools.*

H2: *Top management support for sustainability management is positively associated with the adoption of sustainability management tools.*

DOI: 10.1002/csr

H3: *Level of engagement of multiple business function is positively associated with the adoption of sustainability management tools.*

H4: *Organizational size is positively associated with the adoption of sustainability management tools.*

H5: *Awareness of sustainability management tools is positively associated with the adoption of these tools.*

A survey was designed to investigate the rates of awareness and implementation for multiple sustainability management tools. In addition, it examined the connections between awareness and implementation by surveying managerial and organizational characteristics that could explain why SMEs are more likely to adopt sustainability management tools. The next section explains the research design for the empirical investigation.

Methods

Operationalization of Measures

For this research a web-based questionnaire was designed, which consisted of 19 closed-ended questions. The questionnaire addressed SME managers' current awareness and implementation of 36 sustainability management tools. In addition, questions were developed to examine various managerial and organizational characteristics that could influence the adoption of sustainability management tools. These questions were presented to the respondents as close-ended questions using a five-point Likert scale. The influence of managerial and organizational characteristics on the implementation of tools is examined using a linear regression model.

Data Collection

The web-based survey was conducted with top managers in German SMEs from February to June 2012. In attempts to have an appropriate representation of SMEs from all German industry sectors, enterprises were selected based on two main criteria. First, an enterprise's annual turnover and total staff could not exceed the European Union's classification of an SME. According to the European Commission (2005), an SME has fewer than 250 employees and does not exceed €50 million in annual revenues. The sample selection was further distributed according to company size: 539 small enterprises (10 to 49 employees and maximum €10 million annual revenue) and 461 medium-sized enterprises (50 to 249 employees and maximum €50 million annual revenue) using the Hoppenstedt Firm Database (2012). Micro-sized enterprises (1 to 9 employees and maximum €2 million annual revenue) were intentionally omitted from the sample selection. Micro enterprises with very few employees usually have a low degree of formalization, which in turn have little or no need to implement formal tools to manage sustainability aspects (Graafland *et al.*, 2003; Russo & Tencati, 2009).

The second selection criterion reflected the representation of all German industry sectors. In total, SMEs from 18 industry sectors were included in the survey, for example agriculture, manufacturing, wholesale and retail trade, IT and communication, and various service sectors. The number of SMEs selected from each industry was based on the actual percentages of enterprises in each sector, which was taken the German Federal Statistics Office (2011). In several industries with low overall populations (e.g. agriculture), exceptions were made to include more enterprises (a minimum of 10 per industry sector) to improve the likelihood of representation.

Response Rate

The survey produced 176 completed questionnaires from the original 1000 surveys e-mailed. From the total sample, 68 responding managers (38.6%) are employed in small enterprises and 108 managers (61.4%) belong to medium-sized enterprises. The response rate of 17.6% is comparable with other quantitative surveys with similar research objectives in SMEs (Graafland *et al.*, 2003; Gadenne *et al.*, 2009; Brammer *et al.*, 2012). It provides a solid basis

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for investigation of organizations as a single group (Revell *et al.*, 2010). The next section will examine the results according to the rates of awareness and implementation, and the connection between them by investigating managerial and organizational characteristics as influential predictors that potentially increase the likelihood of tool adoption in SMEs.

Results

This paper examines multiple sustainability management tools adopted by SMEs. The findings are grouped into the two following subsections. First, the actual rates of awareness and implementation of these tools are closely examined. Second, the results of a regression model are presented and the hypotheses are tested.

Awareness and Implementation of Tools

The respondents indicated their awareness and implementation of 36 sustainability management tools. Table 2 gives an overview of these two variables listed in descending order according to awareness.

It becomes evident from the results in Table 2 that awareness and implementation rates of most tools are relatively low. Taking a closer look, however, it appears as though the rate of implementation steadily increases with the rate of awareness. Two techniques can be utilized to test if a relationship exists between awareness and implementation. Both techniques have already been utilized in a similar study in large German corporations (Schaltegger *et al.*, 2012). First, the ratio of implementation to awareness shows the relative percentage a tool is implemented by its degree of awareness. It is calculated by dividing the rate of implementation by the rate of awareness of every tool (as seen in the right-hand column of Table 2). This ratio can also be applied to multiple tools simultaneously. For example, the top ten tools according to awareness – i.e. quality management system, employee training – have a higher ratio of implementation to awareness (74.2%) when compared to the overall ratio (57.8%). On average, the ratio of implementation to awareness increases moving up the table.

The second technique to measure the relationship between awareness and implementation is employed by means of a correlation analysis (Schaltegger *et al.*, 2012). A preliminary correlation analysis finds an extremely positive correlation (0.97) between awareness and implementation. However, this correlation does not explain the direction of influence, or the causation between these two variables. For this reason, a second correlationanalysis was conducted on the relationship between awareness of tools and the ratio of implementation to awareness. This second analysis reflects a strong positive relationship (0.75), signifying that greater awareness of tools induces a relatively higher rate of implementation. Table 3 illustrates both tests conducted to measure this relationship, including the averages of awareness and implementation as well as the results from both analyses.

Previous studies have provided mixed reviews of the awareness and implementation of tools in SMEs. On one hand, several studies propose widespread adoption of various tools among SMEs through awareness raising programs (Fresner and Engelhardt, 2004; Burke and Gaughran, 2007; Halila, 2007; Perrini & Minoja, 2008; Seiffert, 2008; Borga *et al.*, 2009). On the other hand, several scholars have presented statistical data showing relatively low application of a limited number of surveyed certified standards and tools in SMEs, including environmental systems according to ISO 14001 and EMAS, and reporting schemes according to the Global Reporting Initiative (Graafland *et al.*, 2003; Tencati *et al.*, 2004; Hahn and Scheermesser, 2006).

This paper sheds light on this debate and delivers a clear overview of the awareness and implementation of multiple sustainability management tools in SMEs. From these results, the rates of awareness and implementation are apparently low for most tools. However, a positive correlation exists between awareness and the ratio of implementation to awareness. Several authors emphasize that raising awareness of particular tools may be the greatest driver of adoption of tools in large corporations (Schaltegger *et al.*, 2012) and SMEs (Bradford and Fraser, 2008; Maijala and Pohjola, 2006). While raising awareness can have a positive impact on the implementation of tools, this study attempts to find other factors that can influence the adoption of tools. In order to explore other influential characteristics, this paper utilizes Rogers' (1995) model of stages of innovation diffusion. This model points out various managerial and organizational characteristics that might explain why some SMEs are more likely

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	Sustainability Management Tool	Awareness (%)	Implementation (%)	Ratio of Implementation to Awareness (%)
1	Quality Management System	79.07	65.12	82.36
2	Employee Training	76.74	67.44	87.88
3	Employee Suggestion Scheme	69.77	55.81	79.99
4	Sustainable Supply Chain Management	61.63	48.84	79.25
5	Corporate Citizenship (e.g. Donations, Sponsorship)	50.58	43.02	85.05
6	Environmental Audit	47.67	21.51	45.12
7	Environmental Management System	44.77	27.91	62.34
8	Code of Conduct	44.77	29.65	66.23
9	Employee Incentive Program	44.19	30.81	69.72
10	Risk Analysis	44.19	27.91	63.16
11	Environmental Indicators	30.81	17.44	56.60
12	Environmental Report	30.23	12.79	42.31
13	Sustainability Audit	25.58	8.14	31.82
14	Sustainability Report	25.00	5.81	23.24
15	Sustainability Indicators	24.42	8.72	35.71
16	Social Accounting	23.84	13.95	58.52
17	Environmental Accounting	23.26	11.05	47.51
18	Social Indicators	21.51	10.47	48.68
19	Sustainability Balanced Scorecard	20.35	4.07	20.00
20	Environmental Policy	20.35	8.72	42.85
21	Eco-Efficiency Analysis	19.19	1.74	9.07
22	Eco-Efficiency Indicators	19.19	5.81	30.28
23	Eco-Balance / Life Cycle Assessment	18.60	4.07	21.88
24	Sustainability Network	18.02	12.79	70.98
25	Sustainability Benchmarking	16.86	4.65	27.58
26	Eco-/ Organic Labels	16.28	2.91	17.87
27	Design for the Environment	13.37	4.65	34.78
28	Social Report	13.37	4.07	30.44
29	Social Audit	10.47	2.91	27.79
30	Sustainability Labels	10.47	4.07	38.87
31	Social Management System	9.88	4.07	41.19
32	Social / FairTrade Labels	9.88	1.16	11.74
33	Ecological Benchmarking	9.30	4.65	50.00
34	Stakeholder Dialogue	8.14	5.23	64.25
35	Social Benchmarking	7.56	2.33	30.82
36	Ecomapping	4.07	1.16	28.50

Table 2. Awareness and implementation of sustainability management tools in German SMEs

Awareness and Implementation of Sustainability Management Tools	Survey Results of 36 Tools
Average Awareness (36 tools)	28.15%
Average Implementation (36 tools)	16.26%
Average Awareness-Implementation Gap (Avg. Awareness minus Avg. Implementation)	11.89%
Average Ratio of Implementation to Awareness	57.77%
Correlation of Awareness and Implementation (Pearson)	0.97**
Correlation of Awareness and Ratio of Implementation to Awareness	0.75**

Table 3. Averages and correlations between awareness and implementation
**Statistically significant at $p < 0.05$

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to adopt sustainability management tools. The next section combines the influence of awareness along with other managerial and organizational characteristics for the adoption of tools in SMEs.

Managerial and Organizational Characteristics

In order to understand which managerial and organizational characteristics have the greatest influence on the implementation of tools, a linear regression model was carried out. The dependent variable for the analysis is the total sum of implemented tools per enterprise with a minimum of at least one tool. Five managerial and organizational characteristics were entered as the independent variables for the analysis, including:

- *Total awareness* – the sum of awareness per respondent (minimum of one tool).
- *Perceived relative advantage* – the mean of nine perceived economic effects (from 1 'negative effect' to 5 'positive effect' on a Likert scale) from tool implementation, including company reputation, competitiveness, costs, customer acquisition and retention, employee motivation, employee productivity, internal operations, product and service innovation, and sales. This is a reliable measure to test its influence on implementation of multiple tools as the alpha value for these variables is 0.920.
- *Management support* – the mean of support (from 1 'no support' to 5 'major support' on a Likert scale) for two leadership functions, including top management and strategic planning. The alpha value (0.60) is below the recommended value of 0.70 as established by Pallant (2001). This low value could be a result of using only two items for measuring management support. Nevertheless, it was left in the regression model since the item total correlations for this measure were not less than 0.30 compared to the other items (Hashem and Tann, 2007).
- *Level of engagement* – the mean of the level of engagement (from 1 'no engagement' to 5 'high engagement' on a Likert scale) from ten functional areas in the enterprise, including accounting and finance, CSR and sustainability, human resources, logistics, marketing and sales, production, public relations, purchasing, quality assurance, and research and development.

These variables also have a satisfactory degree of reliability for the regression model, as the alpha value for these variables is 0.872.

- *Organizational size* – the size is measured according to total full-time employees. While the survey only examines SMEs, the amount of employees ranges from 10 to 249 within the sample. It is perceived that larger SMEs are more likely to adopt sustainability management tools.

Table 4 presents the results of the regression analysis.

As shown in Table 4, the result of the regression analysis is statistically significant yielding an adjusted R-square of 0.561. This result implies a considerable portion of variation in the total amount of implemented tools per enterprise can be explained by the managerial and organizational characteristics. According to the standard

	N	df	R^2	Adj. R^2	Sig.
Model Summary	151	150	0.575	0.561	0.000
Independent variables	Regr. Coeff. B		Stand. Regr. Coeff. ß	Sig.	VIF
Constant	-6.168			0.001	1.252
Total Awareness	0.414		0.603	0.000	1.180
Perceived Relative Advantage	1.409		0.179	0.003	1.887
Top Management Support	0.188		0.040	0.595	1.811
Level of Engagement	0.282		0.054	0.458	1.098
Organizational Size	0.008		0.185	0.001	1.252

Table 4. Regression analysis on managerial and organizational characteristics
Dependent Variable = Total Implementation

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regression coefficient (ß), three independent variables have significant degrees of influence, including the awareness of tools (0.603), followed by organizational size (0.185), and perceived relative advantage (0.179). The remaining variables neither have a high regression coefficient nor were they significant.

The outcome of the regression analysis further confirms from the previous section that managers' awareness of sustainability management tools is the major determinant for the implementation of tools in SMEs. Furthermore, it reveals that additional factors play an important role in application of tools, including the organizational size and the optimistic perception of relative advantage from the implementation of sustainability management tools over the previous management practices. The following discussion and conclusions compare the overall results to previous literature and offers implications for SME management, public policy and future research.

Discussion

This paper addresses the rates of awareness and implementation of sustainability management tools in SMEs, and it makes a connection between them. It examines the influential determinants of adoption, including awareness itself and other facilitating managerial and organizational characteristics. While not all of these characteristics are not major determinants of the implementation of such tools, the results provide hints for further development of sustainability management tools in SMEs. The findings also provide key insights on the extent that tools are being implemented in practice. To the author's knowledge, this is the first paper to contain both awareness and implementation rates and to link these variables with influential managerial and organizational characteristics that partially explain the adoption of tools in SMEs.

Even though the awareness and implementation rates are low for the majority of surveyed tools, several exceptions are highlighted. Sustainability management tools with comparatively high rates of awareness and implementation are those already established in the conventional business management literature (e.g. quality management system, employee training, supply chain management, codes of conduct, risk analysis). Nevertheless, these tools are conformable to environmental and social sustainability goals and measures. For example, a properly executed quality management system can lead companies to minimizing waste, thus reducing negative environmental impacts and unwanted financial burdens simultaneously. Principally, a quality management system according to ISO 9001 is compatible with an EMS according to ISO 14001. These two management systems can be harmoniously integrated into one, which has also been researched in the SME context (Douglas and Glen, 2000; Fresner and Engelhardt, 2004; Tsai and Chou, 2009).

Two tools, an EMS and corporate citizenship, are exceptions to the conventional management approach since they do not originate from traditional business management practices. However, these tools have been in existence for well over 20 years. They have been implemented by small businesses basically since their conception, and they have generated greater rates of awareness versus other environmental and social management tools (Hutchinson and Chaston, 1994; Brammer *et al.*, 2012). Other specific environmental and social management tools, such as eco-efficiency analysis and life cycle assessment, are hardly known and rarely implemented in SMEs (Cote *et al.*, 2006; Seidel *et al.*, 2008).

A novel insight in this paper is the connection made between awareness and implementation by using Rogers' (1995) stages of innovation diffusion model. Extending the managerial and organizational characteristics from Tornatzky and Fleischer (1990) to include awareness as a predicting variable, it is apparent that the major determinant for the implementation is awareness itself. The strong positive correlation between awareness and the ratio of implementation to awareness also provides a compelling case that the greater awareness of tools leads to a higher probability of implementation in SMEs. The regression model further supports the rationale that awareness strongly increases the number of tools implemented in SMEs. Previous literature states that awareness raising programs targeted at SMEs may be the best chance for higher adoption rates of sustainability management tools (Bradford and Fraser, 2008; Maijala and Pohjola, 2006; Ozaki, 2011). After all, without awareness, implementation cannot occur (Ozaki, 2011). However, the fact remains that SMEs are mostly unaware of the options available to them, and they may remain unwilling to implement as long as the perceived relative advantages of tools are not emphasized (Friedman and Miles, 2002; Simpson *et al.*, 2004; Revell *et al.*, 2010; Brammer *et al.*, 2012).

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Conclusions

Implications for SME Management

Several major implications for SME managers can be drawn from the results and discussion sections in this paper. Firstly, this study provides managers with a wide-ranging overview on the level of awareness and implementation for multiple sustainability management tools in SMEs. Most studies have only demonstrated successful implementation of individual tools in a handful of case study enterprises. With the exception of several studies covering norms and standards (Graafland *et al.*, 2003; Tencati *et al.*, 2004; Hahn and Scheermesser, 2006), previous research has fallen short of providing figures on awareness and implementation rates for multiple sustainability management tools in SMEs.

Even though the paper does not go into depth on any particular tool, it is a good starting point for managers to become familiar with the options available to them. It draws immediate attention to the prevalent management tools being adopted in SMEs. In a sense, it serves to raise awareness for SME managers interested in various approaches to measure and eventually improve their enterprises' social and environmental performance. Managers equipped with this sort of information are able to make informed decisions, which in turn positively affect the development of their own sustainability program. Secondly, the most frequently implemented sustainability management tools are modified versions of conventional management tools, such as quality management systems and employee training and incentive programs. SME managers addressing sustainability management for the first time might consider implementing such tools from conventional business approaches and incorporate social and environmental aspects to them gradually. From a strategic perspective, these tools can help develop a sustainability program at its own pace that fits the economic goals of the company. In contrast to conventional management approaches, specialized environmental and social management tools, such as an eco-efficiency analysis and life cycle assessment, suffer from low levels of implementation for good reason. Either modified versions of these tools should be designed or new approaches need to be considered to tackle more advanced issues of sustainability management in SMEs.

Finally, several key managerial and organizational characteristics have been investigated on their degree of influence on the implementation of multiple sustainability management tools. The two most pertinent characteristics for SME managers are the awareness of tools and the positively perceived relative advantages of tools. Awareness is key to improving the likelihood of implementation (Ozaki, 2011). In combination with the highlighted relative advantages, the benefits of tools should go hand-in-hand with awareness raising (Brammer *et al.*, 2012).

Other environmental characteristics not included in this study, such as external support from consultants, networks and governmental agencies, might play an influential part in the implementation of multiple tools. External parties could further promote awareness in SMEs. They could encourage implementation through the promotion of the relative advantages of tools, including lower costs, greater reputation and overall competitiveness. In particular, they bring a fresh external perspective and expertise that SME managers might not possess at the time internally.

Implications for Public Policy

In the introduction of this paper, it was mentioned that approaches to sustainability management school consider approaches beyond strict legislative mandates and regulations to address sustainability issues. Even though the current rates of implementation of tools are low, which could rectify many of these problems, governments should first attempt to raise awareness through soft policies before they resort to hard, strict policy making on sustainability issues (Steurer *et al.*, 2012) Considering the low rates of implementation of sustainability management tools in SMEs, local and national government agencies could become more involved in awareness raising programs. Steurer *et al.* (2012) highlight EU member states' awareness raising initiatives through various informational instruments, including educational activities (e.g. conferences, seminars, training), information resources (e.g. websites, brochures, reports), and government-sponsored guidelines (e.g. German Corporate Governance Code). In some cases, SMEs require financial assistance to implement sustainability management tools (Revell and Blackburn, 2007; Seidel *et al.*, 2008). From time to time, several German states have offered partial financial assistance to SMEs for consultation, auditing and first-time registration of an EMS according to the Eco-Management and Audit Scheme (EMAS).

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Government sponsored awareness raising campaigns could be mobilized through existing business networks (Collins *et al.*, 2007; Halila, 2007) and public-private partnerships, such as the case for EcoProfit (Martinuzzi *et al.*, 2000; Fresner, 2004), which can serve as platforms to facilitate the diffusion of sustainability management tools in SMEs. Both of these platforms have been observed in the literature provide a cost-effective way for SMEs to become aware and oftentimes implement appropriate management tools (Ammenberg and Hjelm, 2003; Collins *et al.*, 2007; Halila, 2007; Battaglia *et al.*, 2010; Revell *et al.*, 2010). Educational workshops offered by such networks and partnerships have great success in attracting interested parties in many local and regional municipalities.

Future Research

This paper establishes a basis for future studies to measure trends of adoption from awareness to implementation for multiple sustainability management tools in SMEs. This paper expands on various types of sustainability management tools appropriate for SME implementation. In particular, it serves as a basis for longitudinal studies to observe the trends for awareness and implementation rates over the course of time to examine the adoption rates in SMEs.

While a limited number of studies can be found on SME-specific tools (e.g. *EKOSCAN*, in Heras and Arana, 2010; EPM-KOMPASS, in Günther and Kaulich, 2005; *Sustainability Evaluation and Reporting System*, in Perrini and Tencati, 2006), further research and development of SME-specific tools is still warranted. This paper offers a foundation to investigate further SME-specific tools, especially using Rogers' (1995) stages in the innovation process. Future research could expand on the facilitating characteristics to include innovation characteristics (e.g. compatibility, complexity, trialability, observability) and environmental characteristics (e.g. external support organizations). While innovation characteristics are typically applied to one innovation at a time, they could provide a basis for comparison between various sustainability management approaches.

Furthermore, tools could be adapted to fit innovation, organizational and environmental characteristics to improve the likelihood of adoption. Until now, such an adaptation has only been observed for an EMS (Gerstenfeld and Roberts, 2000; Burke and Gaughran, 2007; Tsai and Chou, 2009; Heras and Arana, 2010) and sustainability reports (Perrini and Tencati, 2006; Borga *et al.*, 2009).

The success of widespread adoption of sustainability management tools rests upon two key factors: raising awareness of tools with SME managers and promoting the relative benefits from the implementation of tools. While other managerial and organizational characteristics not included in this study (e.g. degree of formalization, in Hashem and Tann, 2007) may also help predict the likelihood that tools will be adopted, it is first and foremost a matter of raising awareness in SMEs to promote adoption.

References

Altham W. 2007. Benchmarking to trigger cleaner production in small businesses: Drycleaning case study. *Journal of Cleaner Production* **15**(9): 798–813.

Ammenberg J, Hjelm O. 2003. Tracing business and environmental effects of environmental management systems: A study of networking small and medium-sized enterprises using a joint environmental management system. *Business Strategy and the Environment* **12**(3): 163–174. DOI: 10.1002/bse.357

Arnold M. 2010. Stakeholder dialogues for sustaining cultural change. *International Studies of Management and Organization* **40**(3): 61–77. DOI: 10.2753/IMO0020-8825400304

Bansal P. 2005. Evolving sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal* **26**: 197–218. DOI: 10.1002/smj.441

Battaglia M, Bianchi L, Frey M, Iraldo F. 2010. An innovative model to promote CSR among SMEs operating in industrial clusters: Evidence from an EU project. *Corporate Social Responsibility and Environmental Management* **17**(3): 133–141. DOI: 10.1002/csr.224

Biondi V, Frey M, Iraldo F. 2000. Environmental management systems and SMEs: Motivations, opportunities and barriers related to EMAS and ISO 14001 implementation. *Greener Management International* **29**: 55–69.

Borga F, Citterio A, Noci G, Pizzurno E. 2009. Sustainability report in small enterprises: Case studies in Italian furniture companies. *Business Strategy and the Environment* **18**(2): 162–176. DOI: 10.1002/bse.561

Bos-Brouwers HEJ. 2010. Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice. *Business Strategy and the Environment* **19**(7): 417–435. DOI: 10.1002/bse.652

Bradford J, Fraser EDG. 2008. Local authorities, climate change and small and medium enterprises: Identifying effective policy instruments to reduce energy use and carbon emissions. *Corporate Social Responsibility and Environmental Management* **15**(3): 156–172. DOI: 10.1002/csr.151

Brammer S, Hoejmose S, Marchant K. 2012. Environmental management in SMEs in the UK: Practices, pressures and perceived benefits. *Business Strategy and the Environment* **21**(7): 423–434. DOI: 10.1002/bse.717

Burke S, Gaughran WF. 2006. Intelligent environmental management for SMEs in manufacturing. *Robotics and Computer-Integrated Manufacturing* **22**(6): 566–575. DOI: 10.1016/j.rcim.2005.11.008

Burke S, Gaughran WF. 2007. Developing a framework for sustainability management in engineering SMEs. *Robotics and Computer-Integrated Manufacturing* **23**(6): 696–703. DOI: 10.1016/j.rcim.2007.02.001

Cassells S, Lewis K. 2011. SMEs and environmental responsibility: Do actions reflect attitudes? *Corporate Social Responsibility and Environmental Management* **18**(3): 186–199. DOI: 10.1002/csr.269

Cloquell-Ballester VA, Monterde-Diaz R, Cloquell-Ballester VA, Torres-Sibille AC. 2008. Environmental education for small- and medium-sized enterprises: Methodology and E-learning in the Valencian region. *Journal of Environmental Management* **87**(3): 507–520.

Collins E, Lawrence S, Pavlovich K, Ryan C. 2007. Business networks and the uptake of sustainability practices: The case of New Zealand. *Journal of Cleaner Production* **15**(8/9): 729–740. DOI: 10.1016/j.jclepro.2006.06.020

Cote R, Booth A, Louis B. 2006. Eco-efficiency and SMEs in Nova Scotia, Canada. *Journal of Cleaner Production* **14**(6/7): 542–550.

Dibrell C, Craig J, Hansen E. 2011. Natural environment, market orientation, and firm innovativeness: An organizational life cycle perspective. *Journal of Small Business Management* **49**(3): 467–489.

Douglas A, Glen D. 2000. Integrated management systems in small and medium enterprises. *Total Quality Management* **11**(4/6): 686–690. DOI: 10.1080/09544120050008075

European Commission. 2005. The new SME definition: User guide and model declaration. http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf [2 April 2012].

Fresner J. 2004. Small and medium sized enterprises and experiences with environmental management. *Journal of Cleaner Production* **12**(6): 545–547.

Fresner J, Engelhardt G. 2004. Experiences with integrated management systems for two small companies in Austria. *Journal of Cleaner Production* **12**(6): 623–631.

Friedman AL, Miles S. 2002. SMEs and the environment: Evaluating dissemination routes and handholding levels. *Business Strategy and the Environment* **11**(5): 324–341. DOI: 10.1002/bse.335

Gadenne DL, Kennedy J, McKeiver C. 2009. An empirical study of environmental awareness and practices in SMEs. *Journal of Business Ethics* **84**(1): 45–63. DOI: 10.1007/s10551-008-9672-9

German Federal Statistics Office. 2011. Statistical Yearbook 2011. https://www.destatis.de/DE/ Publikationen/StatistischesJahrbuch/StatistischesJahrbuch2011.pdf?__blob=publicationFile [5 January 2012].

Gerrans P, Hutchinson B. 2000. Sustainable development and small and medium-sized enterprises: A long way to go. In *Small and Medium-Sized Enterprises and the Environment*, Hillary R (ed). Greenleaf Publishing: Sheffield; 75–81.

Gerstenfeld A, Roberts H. 2000. Size matters: Barriers and prospects for environmental management in small and medium-sized enterprises. In *Small and Medium-Sized Enterprises and the Environment*, Hillary R (ed). Greenleaf Publishing: Sheffield; 106–118.

Graafland J, van de Ven B, Stoffele N. 2003. Strategies and instruments for organising CSR by small and large businesses in the Netherlands. *Journal of Business Ethics* **47**: 45–60.

Günther E, Kaulich S. 2005. The EPM-KOMPAS: An instrument to control the environmental performance in small and medium-sized enterprises (SMEs). *Business Strategy and the Environment* **14**(6): 361–371. DOI: 10.1002/bse.437

Hahn T, Scheermesser M. 2006. Approaches to corporate sustainability among German companies. *Corporate Social Responsibility and Environmental Management* **13**: 150–165. DOI: 10.1002/csr.100

Halila F. 2007. Networks as a means of supporting the adoption of organizational innovations in SMEs: The case of environmental management systems (EMSs) based on ISO 14001. *Corporate Social Responsibility and Environmental Management* **14**(3): 167–181. DOI: 10.1002/csr.127

Hammann EM, Habisch A, Pechlaner H. 2009. Values that create value: Socially responsible business practices in SMEs – empirical evidence from German companies. *Business Ethics: A European Review* **18**(1): 37–51.

Hansen EG, Sextl M, Reichwald R. 2010. Managing strategic alliances through a community-enabled balanced scorecard: The case of Merck Ltd, Thailand. *Business Strategy and the Environment* **19**(6): 387–399. DOI: 10.1002/bse.689

Hashem G, Tann J. 2007. The adoption of ISO 9000 standards within the Egyptian context: A diffusion of innovation approach. *Total Quality Management* **18**(6): 631–652. DOI: 10.1080/14783360701349435

Heras I, Arana G. 2010. Alternative models for environmental management in SMEs: The case of Ekoscan vs. ISO 14001. *Journal of Cleaner Production* **18**(8): 726–735. DOI: 10.1016/j.jclepro.2010.01.005

Heupel T, Wendisch N. 2003. Green success: Process-based environmental cost accounting: Implementation in SMEs in Germany. In *Environmental Management Accounting: Purpose and Progress*, Bennett PM, Rikhardsson PM, Schaltegger S (eds). Kluwer Academic Publishers: Dordrecht; 333–364.

Hillary R. 2000. *Small and Medium-Sized Enterprises and the Environment*. Greenleaf Publishing: Sheffield.

Hillary R. 2004. Environmental management systems and the smaller enterprise. *Journal of Cleaner Production* **12**(6): 561–569. DOI: 10.1016/j.jclepro.2003.08.006

Høivik HvW, Mele´ D. 2009. Can an SME become a global corporate citizen? Evidence from a case study. *Journal of Business Ethics* **88**: 551–563.

Holton I, Glass J, Price ADF. 2010. Managing for sustainability: Findings from four company case studies in the UK precise concrete industry. *Journal of Cleaner Production* **18**(2): 152–160.

Hsu JL, Cheng MC. 2012. What prompts small and medium enterprises to engage in corporate social responsibility? A study from Taiwan. *Corporate Social Responsibility and Environmental Management* **19**(5): 288–305. DOI: 10.1002/csr.276

Hutchinson A, Chaston I. 1994. Environmental management in Devon and Cornwall's small and medium sized enterprise sector. *Business Strategy and the Environment* **3**(1): 15–22.

Jämsä P, Tähtinen J, Ryan A, Pallari M. 2011. Sustainable SMEs network utilization: The case of food enterprises. *Journal of Small Business and Enterprise Development* **18**(1): 141–156. DOI: 10.1108/14626001111106479

Jenkins H. 2006. Small business champions for corporate social responsibility. *Journal of Business Ethics* **67**(3): 241–256. DOI: 10.1007/s10551-006-9182-6

Karvonen M. 2000. Environmental accounting as a tool for SMEs in environmentally induced economic risk analysis. *Eco-Management and Auditing* **7**(1): 21–28.

Kehbila AG, Ertel J, Brent AC. 2009. Strategic corporate environmental management within the South African automotive industry: Motivations, benefits, hurdles. *Corporate Social Responsibility and Environmental Management* **16**(6): 310–323. DOI: 10.1002/csr.188

Kehbila AG, Ertel J, Brent AC. 2010. Corporate sustainability, ecological modernization and the policy process in the South African automotive industry. *Business Strategy and the Environment* **19**(7): 453–465. DOI: 10.1002/bse.669

Kerr IR. 2006. Leadership strategies for sustainable SME operation. *Business Strategy and the Environment* **15**(1): 30–39. DOI: 10.1002/bse.451

Kinderyte L. 2010. Methodology of sustainability indicators determination for enterprise assessment. *Environmental Research, Engineering and Management* **52**(2): 25–31.

Koroljova A, Voronova V. 2007. Eco-mapping as a basis for environmental management systems integration at small and medium enterprise. *Management of Environmental Quality* **18**(5): 542–555. DOI: 10.1108/14777830710778300

Kuhndt M. 2004. Sustainable business development. In *Eco-Efficiency and Beyond*, Seiler-Hausmann JD, Liedtke C, von Weizsäcker EU (eds). Greenleaf Publishing: Sheffield; 64–72.

Lawrence SR, Collins E, Pavlovich K, Arunachalam M. 2006. Sustainability practices of SMEs: The case of NZ. *Business Strategy and the Environment* **15**(4): 242–257. DOI: 10.1002/bse.533

Liedtke C. Kaiser K. 2006. Nachhaltiges Wirtschaften in der Praxis: Projekte und Erfahrungen des Wuppertal Institut für Klima, Umwelt und Energie. In *Berufliche Bildung für nachhaltiges Wirtschaften*, Tiemeyer E, Wilbers K (eds). Bertelsmannverlag: Bielefeld; 186–204.

Longo M, Mura M, Bonoli A. 2005. Corporate social responsibility and corporate performance: The case of Italian SMEs. *Corporate Governance* **5**(4): 28–42. DOI: 10.1108/14720700510616578

Maijala A, Pohjola T. 2006. Web-based environmental management systems for SMEs: Enhancing the diffusion of environmental management in the transportation sector. In *Sustainability Accounting and Reporting*, Schaltegger S, Bennett M, Burritt R (eds). Springer: London; 655–677.

Malmborg F. 2003. Conditions for regional public-private partnerships for sustainable development? Swedish perspectives. *European Environment* **13**(3): 133–149. DOI: 10.1002/eet.317

Martinuzzi A, Huchler E, Obermayr B. 2000. EcoProfit: Promoting partnerships between small and medium-sized enterprises and local authorities. *Greener Management International* **30**: 83–96.

Masoni P, Sara B, Scimia E, Raggi A. 2004. VerdEE: A tool for adoption of life cycle assessment in small and medium sized enterprises in Italy. *Progress in Industrial Ecology: An International Journal* **1**(3): 203–228.

McKeiver C, Gadenne D. 2005. Environmental management systems in small and medium businesses. *International Small Business Journal* **23**(5): 513–537. DOI: 10.1177/0266242605055910

Nielsen AE, Thomsen C. 2011. Sustainable development: The role of network communication. *Corporate Social Responsibility and Environmental Management* **18**: 1–10. DOI: 10.1002/csr.221

Pallant J. 2001. *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows*, Version 10. Open University Press: Buckingham.

Parisi C, Maraghini P. 2010. Operationalising sustainability: How small and medium sized enterprises translate social and environmental issues into practice. In *Business Performance Measurement and Management*, Taticchi P (ed). Springer: Berlin; 131–147.

Perez-Sanchez D, Barton JR, Bower D. 2003. Implementing environmental management in SMEs. *Corporate Social Responsibility and Environmental Management* **10**(2): 67–77. DOI: 10.1002/csr.37

Perrini F, Minoja M. 2008. Strategizing corporate social responsibility: Evidence from an Italian medium-sized, family-owned company. *Business Ethics: A European Review* **17**(1): 47–63.

Perrini F, Tencati A. 2006. Sustainability and stakeholder management: The need for new corporate performance evaluation and reporting systems. *Business Strategy and the Environment* **15**(5): 296–308. DOI: 10.1002/bse.538

OECD. 2005. *Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data*. OECD Publishing: Paris.

Ozaki R. 2011. Adopting sustainable innovation: What makes consumers sign up to green electricity? *Business Strategy and the Environment* **20**(1): 1–17. DOI: 10.1002/bse.650

Rao P, Singh AK, O'Castillo O, Intal PS Jr, Sajid A. 2009. A metric for corporate environmental indicators...for small and medium enterprises in the Philippines. *Business Strategy and the Environment* **18**(1): 14–31. DOI: 10.1002/bse.555

Revell A, Blackburn R. 2007. The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors. *Business Strategy and the Environment* **16**(6): 404–420. DOI: 10.1002/bse.499

Revell A, Stokes D, Chen H. 2010. Small businesses and the environment: Turning over a new leaf? *Business Strategy and the Environment* **19**: 273–288. DOI: 10.1002/bse.628

Rogers EM. 1995. *Diffusion of Innovations*, 4th ed. Free Press: New York.

Russo A, Tencati A. 2009. Formal vs. Informal CSR Strategies: Evidence from Italian Micro, Small, Medium-sized, and Large Enterprises. *Journal of Business Ethics* **85**: 339–353.

Rutherfoord R, Blackburn RA, Spence LJ. 2000. Environmental management and the small firm: An international comparison. *International Journal of Entrepreneurial Behaviour and Research* **6**: 310–325.

Schaltegger S, Burritt R. 2005. Corporate sustainability. In *The International YearBook of Environmental and Resource Economics 2005/2006: A Survey of Current Issues*, Folmer H, Tietenberg T (eds). Edward Elgar: Cheltenham; 185–222.

Schaltegger S, Windolph SE, Herzig C. 2012. Applying the known: A longitudinal analysis of the knowledge and application of sustainability management tools in large German companies. *Society and Economy* **34**(4): 549–579.

Seidel M, Seidel R, Tedford D, Cross R, Wait L. 2008. A systems modeling approach to support environmentally sustainable business development in manufacturing SMEs. *World Academy of Science, Engineering and Technology* **48**: 121–129.

Seiffert MEB. 2008. Environmental impact evaluation using a cooperative model for implementing EMS (ISO 14001) in small and medium-sized enterprises. *Journal of Cleaner Production* **16**(14): 1447–1461. DOI: 10.1016/j.jclepro.2007.10.001

Shrivastava P, Hart S. 1995. Creating sustainable corporations. *Business Strategy and the Environment* **4**(3): 154–165. DOI: 10.1002/bse.3280040307

Simpson M, Taylor N, Barker K. 2004. Environmental responsibility in SMEs: Does it deliver competitive advantage? *Business Strategy and the Environment* **13**(3): 156–171. DOI: 10.1002/bse.398

Starkey R. 2000. Environmental management tools. Some options for small and medium-sized enterprises. In *Small and Medium-Sized Enterprises and the Environment*, Hillary R (ed). Greenleaf Publishing: Sheffield; 96–105.

Steurer R, Martinuzzi A, Margula S. 2012. Public policies on CSR in Europe: Themes, instruments, and regional differences. *Corporate Social Responsibility and Environmental Management* **19**(4): 206–227. DOI: 10.1002/csr.264

Steward H, Gapp R. 2012. Achieving effective sustainable management: A small-medium enterprise case study. *Corporate Social Responsibility and Environmental Management*. DOI: 10.1002/csr.1305

Tencati A, Perrini F, Pogutz S. 2004. New tools to foster corporate socially responsible behavior. *Journal of Business Ethics* **53**: 173–190.

Tornatzky LG, Fleischer M. 1990. *The Process of Technological Innovation*. Lexington Books: Lexington, MA.

Tsai W, Chou W. 2009. Selecting management systems for sustainable development in SMEs: A novel hybrid model based on DEMATEL, ANP, and ZOGP. *Expert Systems with Applications* **36**(2): 1444–1458. DOI: 10.1016/j.eswa.2007.11.058

Tseng YF, Wu YCJ, Wu WH, Chen CY. 2010. Exploring corporate social responsibility education: The small and medium-sized enterprise viewpoint. *Management Decision* **48**(10): 1514–1528.

Veleva VR. 2010. Managing corporate citizenship: A new tool for companies. *Corporate Social Responsibility and Environmental Management* **17**(1): 40–51. DOI: 10.1002/csr.179

Williams L, Rao K. 1998. Information technology adoption: Using classical adoption models to predict AEI software implementation. *Journal of Business Logistics* **19**(1): 5–16.

Williams H, van Hooydonk A, Dingle P, Annandale D. 2000. Developing tailored environmental management systems for small businesses. *Eco-Management and Auditing* **7**: 106–113.

Williams S, Schaefer A. 2013. Small and medium-sized enterprises and sustainability: Managers' values and engagement with environmental and climate change issues. *Business Strategy and the Environment* **22**(3): 173–186. DOI: 10.1002/bse.1740

Williamson D, Lynch-Wood G. 2001. A new paradigm for SME environmental practice. *The TQM Magazine* **13**(6): 424–433. DOI: 10.1108/EUM0000000006179

Zobel T. 2007. The 'pros' and 'cons' of joint EMS and group certification: A Swedish case study. *Corporate Social Responsibility and Environmental Management* **14**(3): 152–166. DOI: 10.1002/csr.125

Zorpas A. 2010. Environmental management systems as sustainable tools in the way of life for SMEs and VSMEs. *Bioresource Technology* **101**: 1544–1557.

III. Paper 3

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Implementation of Sustainability Management and Company Size: A Knowledge-Based View

Jacob Hörisch, Matthew P. Johnson* and Stefan Schaltegger
Leuphana Universität Lüneburg, Centre for Sustainability Management (CSM) Lüneburg, Germany

ABSTRACT

Implementing corporate sustainability strategies requires knowledge and application of sustainability management tools. While much progress has been made in developing such tools in both small and medium-sized enterprises (SMEs) and large companies, the literature claims company size positively affects application. However, the role of knowledge as a mediating factor has not yet been investigated. Using the knowledge-based view as a theoretical underpinning, this paper draws on empirical survey data from SMEs and large companies in Germany. It analyzes how company size affects the degree of knowledge and application of sustainability management tools. Even though the results reaffirm that SMEs know and apply significantly less tools, company size does not influence the share of tools applied once they are known. Thus, knowledge is identified as a key difference between SMEs and large companies as well as an important mediator to promote sustainability management. Copyright © 2014 John Wiley & Sons, Ltd and ERP Environment

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Keywords: sustainability management; company size; knowledge-based view; small and medium-sized enterprise (SME); large company; implementation

Introduction

IT IS WIDELY ACKNOWLEDGED THAT THE CONCEPT OF SUSTAINABLE DEVELOPMENT AFFECTS ALL BUSINESS ENTERPRISES (HART, 1996; Welford, 1998; Bansal, 2005). Both large companies and small and medium-sized enterprises (SMEs) are influenced by universal sustainability issues, such as rising energy prices, growing concerns about the health and safety of employees, carbon emissions or the reduction of industrial and commercial waste. At the same time, companies of all sizes are challenged to take responsibility for their business activities and the related impacts on the environment and society. This responsibility can be expressed in the form of adherence to laws and regulations (e.g. health and safety legislations, recycling and waste management laws), forced reactions to public pressures (e.g. reacting to societal pressures to retain the license to operate) and proactive initiatives and strategies of the company (e.g. strong commitment to energy efficiency, resource productivity and work–life balance).

However, corporate sustainability does not only require the development of strategies, but also necessitates the implementation of sustainability-related measures to operationalize these strategies (cf. Bowen, 2002). In the context of this paper, we focus on the implementation of sustainability measures, which is expressed as the knowledge and application of sustainability management tools (Hahn and Scheermesser, 2006). Sustainability management tools can be defined as management instruments and systems that support companies to implement corporate sustainability

*Correspondence to: Matthew P. Johnson, Leuphana Universität Lüneburg, Centre for Sustainability Management (CSM), Lüneburg, Germany.
E-mail: johnson@uni.leuphana.de

(Hahn and Scheermesser, 2006). They usually help companies to achieve a specific sustainability related objective, such as the provision of information in the form of a life cycle assessment (Schaltegger *et al.*, 2002). Several main purposes of sustainability management tools are to assist managers in the development, evaluation and control of environmental, social and economic performance measures as well as to facilitate the communication with internal and external stakeholders (Johnson, 2013). Examples of sustainability management tools can be found in the appendix. Knowledge of sustainability management tools can be acquired for various reasons (e.g. operationalizing a sustainability strategy; Kerr, 2006), and is obtained both intentionally (e.g. by providing further education within a company or hiring a qualified person in sustainability management) and unintentionally (e.g. as a side effect of being member in a business network; Hansen and Klewitz, 2012). From the application of such tools, we can learn about how strongly a company engages in sustainability management. Sustainability management tools cover a broad range of topics and business functions, including tools for product development and planning (e.g. eco-design), measuring and comparing (e.g. eco-efficiency analysis) and involving stakeholders in corporate sustainability (e.g. stakeholder dialog; Graafland *et al.*, 2003; Tencati *et al.*, 2004; Hahn and Scheermesser, 2006).

Sustainability management tools have been developed for both large and small companies. However, much of the literature proposing such tools focuses on large companies or does not specify company size (e.g. Ammenberg and Hjelm, 2003; Graafland *et al.*, 2003). Some tools, such as internal emission trading schemes, are exclusively applicable in large companies (Hörisch, 2013). One justification of the focus on large companies is their big impacts on the economy, environment and society. In the context of sustainability transitions, the multi-level perspective theory emphasizes the systemic importance of large companies for socio-technical transitions and environmental innovation (Geels, 2011).

However, it is somewhat surprising that SMEs are not addressed more systematically, given their crucial importance for sustainable development. In fact, the vast majority of business enterprises fall into the SME category (Moore and Manring, 2009), i.e. have fewer than 250 employees and do not exceed € 50 million annual revenue (European Commission, 2005). Roughly 80% of all globally registered enterprises can be classified as SMEs (Moore and Manring, 2009). While on the one hand SMEs provide economic stability and social security to many regions in developed countries (Morsing and Perrini, 2009), on the other hand a growing amount of evidence reveals that SMEs collectively contribute to approximately 70% of global pollution (Hillary, 2004; Revell *et al.*, 2010).

Addressing this critical relevance of SMEs for sustainable development, specific SME-friendly sustainability management tools have been designed and proposed, and the application of existing sustainability management tools in SMEs has been increasingly discussed in recent years (Ammenberg and Hjelm, 2003; Graafland *et al.*, 2003; Hillary, 2004; Tencati *et al.*, 2004; Burke and Gaughran, 2007; Zobel, 2007; Seiffert, 2008; Zorpas, 2010). For example, streamlined versions of environmental management systems (EMSs) have been developed to fit the budgetary and personnel constraints of even the smallest of enterprises (Hillary, 2004; Heras and Arana, 2010; Zorpas, 2010).

Despite this recent progress, it has been observed in the literature that SMEs are less engaged in sustainability management when compared to large companies, and thus they are less likely to apply sustainability management tools (Gallo and Christensen, 2011; Uhlaner *et al.*, 2011; Galani *et al.*, 2012). Several factors explain the limited application of such tools based on company size, including organizational visibility, availability of (slack) resources and scale of operations (Bowen, 2002; Brammer and Pavelin, 2006; Udayasankar, 2008; Zhu *et al.*, 2008; Takahashi and Nakamura, 2010; Galani *et al.*, 2012). Depending on the management tool, large firms with slack resources at their disposal are more likely to accept the initial costs and commit the necessary personnel to implement (Brammer and Pavelin, 2006; Galani *et al.*, 2012). While explanations provided by firm size and related attributes (e.g. availability of resources) exist, empirical research has not investigated the mediating effect of knowledge on the application of sustainability management tools. Furthermore, empirical research that systematically compares the actual application of sustainability management tools in SMEs and large companies does not exist.

This paper addresses this research gap by empirically examining whether and how size matters for the implementation of sustainability management, which entails the knowledge and application of corresponding tools. The paper extends previous understanding on firm size to address the mediating role of knowledge and the application of tools. It provides implications for management and future research. Knowledge can be understood in this paper as awareness (also known as 'knowing about' or explicit knowledge; Grant, 1996). In contrast to expertise (also known as 'knowing how' or tacit knowledge; Grant, 1996), which focuses more on an individual's level of knowledge, awareness can be investigated on an organizational level. Using the theoretical underpinning from the knowledge-based view (KBV) on the firm level, this paper examines the differences between implementation of

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sustainability management in SMEs and large companies. This raises the question of whether knowledge can explain the potential differences between large companies and SMEs in applying sustainability management tools.

The next section reviews the prior literature on sustainability management tools, firm size and the knowledge and application of management tools. Based on the KBV, three hypotheses are developed. The third section presents the methodology for comparing data from two surveys on knowledge and application of tools. The fourth section examines the results of the statistical analysis. The final two sections provide a discussion and an outlook for practical developments and future research on sustainability management tools in both SMEs and large companies.

Literature Review

Sustainability Management and Influence of Company Size

Sustainability management can be defined 'as the formulation, implementation, and evaluation of both environmental and socioeconomic sustainability-related decisions and actions' (Starik and Kanashiro, 2013, p. 12). It involves the simultaneous integration of ecological, social and economic sustainability aspects and practices into an enterprise's core operations and requires a company to contribute to the sustainable development of society and economy (Bansal, 2005; Schaltegger and Burritt, 2005).

A growing body of literature proposes various ways to address environmental and social sustainability challenges. For example, these approaches include the development of innovative and proactive environmental strategies for a business (Aragón-Correa, 1998; Bowen, 2002), establishing learning processes throughout an organization (von Malmborg, 2002; Tseng *et al.*, 2010), joining sustainability-oriented business networks to share knowledge and exchange best practices in environmental and social management (Halila, 2007; Lawrence *et al.*, 2006; Collins *et al.*, 2007; Moore and Manring, 2009), and the application of corresponding sustainability management tools (Graafland *et al.*, 2003; Tencati *et al.*, 2004; Hahn and Scheermesser, 2006; Parker *et al.*, 2009).

This paper concentrates on the knowledge and application of sustainability management tools in both large enterprises and SMEs, since the application of such tools provides a good indication of what companies actually do, i.e. whether and to what extent they transform their management efforts towards sustainability (cf. Rigby and Bilodeau, 2009). Thus, the application of sustainability management tools can be used as a proxy for the actual implementation of sustainability management in enterprises.

The extensive number of sustainability management tools makes it difficult for academics and practitioners to maintain a comprehensive overview of the existing approaches. Several authors have organized such tools in well-arranged categories. For example, Kuhndt (2004) categorizes tools into three groups, including tools for analysis and evaluation (e.g. life-cycle assessment), tools for action (e.g. environmental management system) and tools for communication (e.g. sustainability report). For this paper, we scanned the prevalent CSR and sustainability management literature and selected tools that have been proposed for application in both large enterprises and SMEs. A listing of these tools can be found in the appendix.

Delving into the reasons for the implementation of sustainability management, many studies accentuate that company size influences the level of engagement for sustainability-oriented strategies and practices (Aragón-Correa, 1998; Brammer and Millington, 2006; Darnall *et al.*, 2010; Fitjar, 2011; Gallo and Christensen, 2011; Uhlaner *et al.*, 2011). Even though several studies highlight that SMEs are able to formulate proactive strategies to stakeholder pressures (Aragón-Correa *et al.*, 2008; Clemens *et al.*, 2008; Darnall *et al.*, 2010), their implementation of sustainability management is assessed to be comparatively low (Bowen, 2002; Graafland *et al.*, 2003; Tencati *et al.*, 2004; Revell *et al.*, 2010; Johnson, 2013). For example, Graafland *et al.* (2003) emphasize that large companies are more likely to apply formal CSR management tools, e.g. in the form of sustainability reporting, whereas SMEs tend to find informal ways to manage CSR-related activities. Similarly, several authors (Brammer and Pavelin, 2006; Gallo and Christensen, 2011; Galani *et al.*, 2012) found that large companies are more likely to implement support mechanisms and reporting of sustainability than SMEs.

The existing literature identifies two possible reasons for this greater engagement in large companies. First, large companies possess more (slack) resources to deal with sustainability issues than SMEs. Second, they are expected to be more exposed to public pressures (Esrock and Leichty, 1998; Brammer and Pavelin, 2006). However, depending on the specific circumstances, smaller firms might react more positively to these external pressures and adopt more proactive strategies (Clemens *et al.*; 2008; Darnall *et al.*, 2010).

DOI: 10.1002/bse

Several authors highlight that examining implementation by company size can be broken down into various firm-level attributes, including organizational visibility, the scale of operations and resource availability (Bowen, 2002; Brammer and Pavelin, 2006; Udayasankar, 2008; Zhu *et al.*, 2008; Takahashi and Nakamura, 2010; Galani *et al.*, 2012). Large enterprises typically have higher scales of operations with vast production facilities, which allow them to reallocate resources to apply tools (Udayasankar, 2008). As a consequence, large enterprises, facing greater public pressures and having greater levels of slack resources at their disposal, are more likely to implement sustainability management (Bowen, 2002; Udayasankar, 2008). Given their lower visibility, smaller scale of operations and lower levels of human and financial resources, SMEs typically engage less in voluntary environmental and social initiatives (Spence, 1999; Udayasankar, 2008).

Despite these existing investigations on company size and sustainability management, little is known about how the differences in company size influence the application of sustainability management tools in large enterprises and SMEs. More specifically, it has not been investigated so far whether differences exist regarding the degree to which companies know about these tools, or whether large and small enterprises differ in the extent to which they apply the knowledge they possess. To address this research gap, the KBV will be examined as an extension of the resource-based view (RBV) to uncover the influence of knowledge on the implementation of sustainability management in the context of firm size.

The Importance of Knowledge Acquisition for Sustainability Management

Previous research has frequently addressed the implementation of sustainability management from the perspective of the RBV (e.g. Hart, 1995; Darnall and Edwards, 2006; Zhu *et al.*, 2008; Chakrabarty and Wang, 2012; Falkenberg and Brunsæl, 2011; Uhlaner *et al.*, 2011; Galani *et al.*, 2012; Torugsa *et al.*, 2013). The RBV argues that firms achieve competitive advantages through the application of valuable resources at their disposal. In order to realize these competitive advantages, the resources should be valuable, rare, inimitable and non-substitutable (Wernerfelt, 1984). According to the RBV, one key reason why larger companies might be more likely to implement sustainability management involves their greater availability of (slack) resources (Spence, 1999; Lepoutre and Heene, 2006; Udayasankar, 2008). Company resources can be identified as 'assets, capabilities, processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness' (Barney, 1991, p. 101). Resources can be separated into those that are tangible and property based (Miller and Shamsie, 1996; Wiklund and Shepherd, 2003), and those that are intangible and knowledge-based (e.g. ways that a firm can transform tangible resources to create competitive advantages; Wiklund and Shepherd, 2003). With regard to the implementation of sustainability management, first, resources allow companies to acquire knowledge about sustainability management (Hutchinson and Chaston, 1994; Spence, 1999). Second, financial or human resources are normally required to apply corresponding tools.

This conventional view of firm size's influence on sustainability management according to the RBV has been contested in the literature (Aragón-Correa *et al.*, 2008; Clemens *et al.*, 2008; Darnall *et al.*, 2010). Even though SMEs clearly have lower amounts of slack resources when compared to large companies, they might possess favorable organizational capabilities enabling them to proactively address environmental issues. These organizational capabilities include shared vision throughout an enterprise, simplified decision-making routes and greater innovation propensity (Aragón-Correa *et al.*, 2008; Darnall *et al.*, 2010; Hofmann *et al.*, 2012).

The KBV can be seen as an extension of the RBV. Proponents of the KBV consider knowledge as the most important strategic resource in a firm because it can streamline other tangible resources in an efficient and effective way, thus improving a company's overall performance and increasing a firm's ability to be innovative (Kogut and Zander, 1992; Grant, 1996). Furthermore, the KBV includes the notion of knowledge acquisition (i.e. organizational learning), which helps explain how new information can be assimilated to improve overall company performance (Eisenhardt and Santos, 2002).

In the context of sustainability management, the KBV may help to determine the level of engagement for sustainability (cf. Roy and Thérin, 2008; Uhlaner *et al.*, 2011). While knowledge is typically investigated on an individual basis, it can also be acquired, stored and used at the organizational level through the means of information management, communication, cooperation and mutual advantage (Kogut and Zander, 1992; Eisenhardt and Santos, 2002). Using a KBV perspective, Roy and Thérin (2008, p. 250) argue in the context of SME's environmental commitment that knowledge is the key resource for creating competitive advantages, since 'the ability to acquire and use knowledge' is of central importance for innovating and improving performance. Given the relative novelty of sustainability management and many of its tools, it can be expected that knowledge on sustainability management tools is not

DOI: 10.1002/bse

available by coincidence, but it has to be actively acquired. Knowledge on sustainability issues can be used to address sustainability issues in an informed and advantageous manner (Aragón-Correa *et al.*, 2008).

In sum, the above literature review reveals that the relationship between firm size, the extent of knowledge and the application of sustainability management tools has not been investigated in the literature thus far. To address this research gap, this paper draws upon three hypotheses comparing knowledge and application of management tools in large companies and SMEs.

Developing Hypotheses on Knowledge and Application of Tools

Applying the previous research to the specific context of sustainability management tools, the first two hypotheses on knowledge and application serve to develop the third hypothesis. The third hypothesis intentionally builds on the previous ones, and as a consequence it can be regarded as the central proposition in this article. It focuses on the mediating role of knowledge on the application of sustainability management tools.

It has been addressed in the literature that SMEs have low levels of knowledge of sustainability management (Hutchinson and Chaston, 1994; Spence, 1999; Friedman and Miles, 2002; Hillary, 2004; Lepoutre and Heene, 2006; Revell and Blackburn, 2007). The low awareness of the environmental impacts of their enterprises and the lack of the necessary financial and human resources in SMEs hinder their acquisition of knowledge on sustainability management (Bradford and Fraser, 2008; Roy and Thérin, 2008; Lee, 2009; Zorpas, 2010).

Since they are not aware of their negative impacts or do not perceive them as significant problems, SME owner-managers are typically inexperienced to properly address sustainability issues. This inexperience has been expressed in the literature as low levels of 'eco-literacy' (Hutchinson and Hutchinson, 1997; Gerstenfeld and Roberts, 2000; Revell and Rutherfoord, 2003, p. 27). 'Eco-literacy' also hampers enterprises' ability to seek and acquire knowledge about sustainability management (Lepoutre and Heene, 2006). With regard to knowledge of sustainability issues, we can therefore expect SMEs to be less aware of the range of sustainability management tools than large companies. Thus, the first hypothesis is formulated as follows.

H1: *SMEs have knowledge of fewer sustainability management tools than large enterprises.*

Previous research on large companies reveals the key role knowledge plays for the application of sustainability management tools (Schaltegger *et al.*, 2012). If SMEs know fewer sustainability management tools, they will most likely apply fewer tools than larger enterprises (Johnson, 2013). Indeed, several papers indicate that firm size is positively correlated with the application of specific sustainability management tools. For example, Hutchinson and Chaston (1994) found that, since SMEs are not aware of the existing regulations and options available to them, they apply fewer environmental management tools. Further studies have reported similar findings on environmental and social management systems and reporting schemes (Graafland *et al.*, 2003; Gallo and Christensen, 2011; Galani *et al.*, 2012). Therefore, the second hypothesis is formulated as follows.

H2: *SMEs apply fewer sustainability management tools than large enterprises.*

After addressing the first two hypotheses, this paper investigates the differences with regard to the relationship between knowledge and application of sustainability management tools in large enterprises and SMEs. Moreover, it explores the underlying reasons for these potential differences. In accordance with the KBV, if the lack of knowledge is the decisive factor separating the two groups of enterprises, large enterprises should know and thus apply significantly more sustainability management tools than SMEs. However, if the knowledge of sustainability management tools is controlled for, the KBV does not provide any reason to expect that company size influences the number of tools a company applies. It can be expected that the ratio of the number of tools applied and number of tools known should be similar between the two groups, as the KBV does not suggest that SMEs use less of the knowledge they possess than large enterprises. From a KBV, knowledge is thus expected to strongly mediate the relationship between company size and the application of sustainability management tools. Building on the KBV, the third and most central hypothesis is drawn as follows.

H3: *Differences in the application of sustainability management tools between large companies and SMEs are primarily explained by the differences in knowledge.*

The next section will further explain the research design and the variables which will be used to test these hypotheses.

DOI: 10.1002/bse

Methodology

Data Collection

The hypotheses formulated in the previous section have been examined with two datasets obtained from online surveys on the knowledge and application of sustainability management tools in both large companies and SMEs. The surveys were conducted in Germany, the largest European economy, where SMEs play a particularly important role. In Germany more than 99% of all registered enterprises can be classified as SMEs, and they employ approximately 60% of the German workforce and contribute circa 36% of the gross domestic product (Moore and Manring, 2009).

The first survey addressed the 500 largest enterprises and additionally the 50 largest banks and the 30 largest insurance companies in Germany (by revenue/total assets/gross premiums). To identify these companies, the company database 'Welt 500' was used (Welt online, 2012). Additionally, all companies listed in one of the two most important German stock indices (DAX and MDAX) were contacted, even if they were not included in the Welt 500 database. To avoid double entries, subsidiaries that do not manage sustainability issues independently were excluded from the survey population.

The remaining companies were initially contacted by phone to verify the most appropriate respondent. In a second step, the selected personnel were provided with a personalized access code to the online questionnaire by email. Overall, such emails were sent to 384 companies, 152 of which participated in the survey between February and April 2012. The response rate of this survey is thus equal to 39.7%. Ex post, one company had to be excluded from the sample for the purpose of this paper, since it did not complete all relevant questions. Therefore, the resulting response rate for this paper is equal to 39.3%. The preferred contact personnel within the companies were sustainability or CSR managers, since they are most likely to have a good overview of the implementation of sustainability management in large companies. In fact, 50.7% of the respondents were affiliated to the sustainability or CSR departments. In some cases, however, the person in charge of sustainability issues was based in another department (40.0%, including 18.4% PR/communications) or no departmental affiliation was indicated (9.2%).

The second survey addressed German SMEs of all industries. The target group of companies was taken from the 'Hoppenstedt database' (Hoppenstedt, 2012), which includes detailed information on company size according to annual revenue and employee amounts, and it holds contact information for more than 300 000 German businesses in every industry sector. In accordance with the EU definition of SMEs (European Commission, 2005), companies with revenues of more than € 50 million or more than 250 employees were excluded from the selection in the database. To gain a sufficiently large sample, 1000 companies representing all major industry sectors were sent an email invitation with a link to the web-based questionnaire. The amount included from each sector depended on the proportion of companies in each industry, which was found in the German Statistical Yearbook (German Federal Statistical Office, 2011). Within each sector, companies were randomly selected.

Overall, 177 SMEs completed the online survey, which was available from February to May 2012. This corresponds to a response rate of 17.7%. Similar to the above mentioned survey among the largest German companies, the questionnaire was directed to the persons in charge of sustainability management. Since most SMEs do not have distinct sustainability or CSR departments, 39.0% of the respondents belonged to top management. 13.0% of the respondents were quality or environmental managers. Another 17.5% of the respondents held other positions (e.g. human resources, marketing), and 30.5% did not indicate their own position.

In summary, the complete data set analyzed in this paper comprises of 328 companies. Thus, it fulfills the validity criteria set out by Bartlett *et al.* (2001) for performing meaningful statistical analyses. The overall response rate equals 23.7%. Even though internet-based surveys typically achieve lower response rates compared to mail surveys (Cook *et al.*, 2000), this response rate is within the standard deviation range that Baruch and Holtom (2008) identify for surveys on organizations published in high quality peer-reviewed journals.

Operationalization of Measures

To guarantee comparability, the variables introduced in the hypotheses from the previous section were provided in the same manner in both surveys. Investigating the awareness and application of sustainability management tools that are applicable in SMEs and large companies, the respondents were asked to indicate in a list of sustainability management tools those tools that are known in their company and those that are applied. The surveys included

DOI: 10.1002/bse

questions on 31 such tools. The selection of tools was based on an extensive review of the literature on sustainability management tools and included only tools that are equally applicable in both SMEs and large enterprises, such as environmental management systems (cf. Schaltegger *et al.*, 2002; Hahn and Scheermesser, 2006). For each of these tools, the companies could indicate whether they know and whether they apply the respective tool (e.g. that they use an environmental management system). Finally, the variables 'knowledge' and 'application' were established by calculating the percentage of these 31 tools a company knows (or respectively applies). A complete list of the tools investigated is displayed in the appendix.

Since various studies demonstrate that industry affiliation influences a company's sustainability management (Steger *et al.*, 2007; Gallo and Christensen, 2011), the companies were asked to state their main business operations. Based on this information, manufacturing companies were segregated from companies in service and trade using a dummy variable, as manufacturing companies face different sustainability challenges than companies in service or trade. To control for possible legislative and cultural influences, the sample was restricted to German companies.

Sample Description

Tables 1 and 2 display the descriptive statistics of the final sample, regarding revenue and industry affiliation. As indicated in Table 1, the data on annual revenues is not normally distributed. Since a normal distribution could not be obtained by logarithmizing the data, a dummy variable was introduced, which separated SMEs (revenue $<$ € 50 million) and large enterprises (cf. Woolbridge, 2009). Concerning industry affiliation, no substantial differences could be found between the two samples (Table 2). Manufacturing companies make up approximately half of the sample in both datasets (53.1% in the SME sample; 50.9% in the sample of large companies). Roughly one-third of the companies belong to the finance and services industry (33.9% versus 32.5%). The share of wholesale and trade companies is slightly lower among the SMEs included in the sample (13.0% versus 16.6%).

To make sure the standard errors for the interval-scaled variables are normally distributed, normal distribution of the standard errors for 'awareness' and 'application' was confirmed using histograms and Q–Q plots. Additionally, the critical values that Kline (2005) states for skewness ($skew_{critical\ value} < 3$; $kurtosis_{critical\ value} < 7$) were used to test whether 'awareness' and 'application' are sufficiently close to normal distribution. With values substantially below these critical values ($skew_{awareness} = 0.378$; $skew_{application} = 0.754$; $kurtosis_{awareness} = -1.108$; $kurtosis_{application} = -0.345$) both variables clearly meet Kline's (2005) criteria.

Annual turnover/total assets/gross premiums (in million €)	Frequency	Percentage	Sample
0–10	79	24.1	SME
>10–50	98	29.9	SME
>50–250	6	1.8	Large comp.
>250–1000	7	2.1	Large comp.
>1000–5000	79	24.1	Large comp.
>5000	59	18.0	Large comp.
Total	*328*	*100.0*	

Table 1. Annual turnover/total assets/gross premiums of the companies surveyed

Industry affiliation	Frequency	Percentage (total)	Percentage (SMEs)	Percentage (large comp.)
Manufacturing	171	52.1	53.1	50.9
Wholesale and trade	48	14.7	13.0	16.6
Finance and services	109	33.2	33.9	32.5
Total	*328*	*100.0*	*100.0*	*100.0*

Table 2. Industry affiliation of the companies surveyed

DOI: 10.1002/bse

	Mean	s.d.	1	2	3	4
1. Manufacturing	–	–	1.000			
2. Company size	–	–	−0.021	1.000		
3. Awareness	46.6%	0.304	0.085	0.698**	1.000	
4. Application	27.4%	0.210	0.144**	0.661**	0.821**	1.000

Table 3. Means, standard deviations and correlations
$n = 328$;
**1% significance level.

Table 3 shows the correlation matrix of the final variables included along with descriptive statistics for the interval-scaled variables.

Results

As described earlier, the KBV was used as a theoretical basis for deriving hypotheses on the application of sustainability management tools in SMEs and large enterprises. In this section, these hypotheses will be tested using IBM SPSS AMOS 21.0.0 for structural equation modeling.

The model displayed in Figure 1 analyzes the concepts of 'knowledge of sustainability management tools' and 'application of sustainability management' simultaneously, in order to test the hypotheses in a single two-stage model. Using the criteria by Browne and Cudeck (1993) as well as Loehlin (2004), the model is highly significant ($C_{\min}/df = 0.146$; RMSEA 0.000). Furthermore, it explains a high share of variance of both endogenous variables (knowledge 50%; application 70%). No problems arose with multicollinearity in the regression models included in Figure 1, as the variance inflation factor (VIF) values are consistently below 2.

Hypothesis 1 suggests that *SMEs have knowledge of fewer sustainability management tools than large enterprises*. This can clearly be confirmed, as the model displays a highly significant positive influence of firm size on 'knowledge of sustainability management tools'. The descriptive statistics lead to the same conclusion, as the large companies included in the sample on average know 69.5% of the 31 tools, whereas the SMEs are only aware of 27.0% of these tools.

Comparing the average percentage of sustainability management tools a company applies for large companies and SMEs, hypothesis 2 can be confirmed as well, since large companies apply on average 42.4% of the tools, as opposed to 14.6% for SMEs. The structural equation model confirms this finding, as the total effect of company size is clearly positive and relevant in size and all partial effects are positive and significant.

Indirect effect: $b_{zx}b_{yz} = 0.43 \times 0.47 = 0.20$.
Direct effect: $b_{yx} = 0.08$.
Total effect: $b_{zx}b_{zy} + b_{yx} = 0.28$.

Comparing the direct with the indirect effect reveals that the indirect effect accounts for 71.4% of the total effect. This suggests that knowledge acts as a strong mediator between company size and the application of sustainability

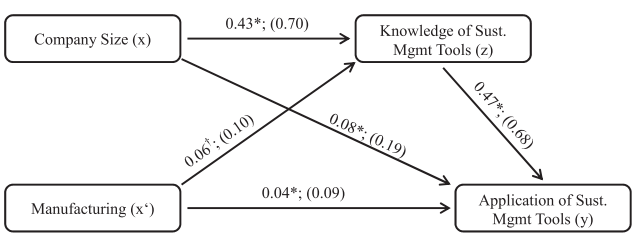

Figure 1. Hypothesized structural model

DOI: 10.1002/bse

management tools. As predicted in hypothesis 3, the differences in the application of sustainability management tools can thus be primarily explained by differences in knowledge. The direct effect of 'company size' on 'application' is rather small compared to the indirect, mediating effect of knowledge. The Sobel test reveals that the mediating effect of knowledge is highly significant, since the *t*-value clearly exceeds the critical value of 1.96 (Sobel, 1982).

Standard error (SE) of indirect effect:

$$\begin{aligned} \text{SE } b_{zx\times yz} &= \sqrt{\left(b_{yz}^2 \times \text{SE } b_{zx}^2 + b_{zx}^2 \times \text{SE } b_{yz}^2\right)} \\ &= \sqrt{(0.471^2 \times 0.024^2 + 0.426^2 \times 0.030^2)} \\ &= 0.017. \end{aligned}$$

t-test:

$$\begin{aligned} t &= b_{zx\times yz}/\text{SE } b_{zx\times yz} \\ &= 0.20/0.017 \\ &= 11.765. \end{aligned}$$

Again, the effect can also be observed using descriptive statistics, as the average percentage of tools a company applies out of the tools it is aware of does not differ substantially between large companies (63.09%) and SMEs (58.48%). Hypothesis 3 can therefore be confirmed.

Discussion

This paper investigates the role of knowledge about sustainability management tools as a mediating factor between company size and implementation of sustainability management. The empirical analysis finds several indications to support the KBV in the context of the implementation of sustainability management, and how it explains the application of sustainability management tools according to firm size.

First, the data shows that large companies know significantly more sustainability management tools than SMEs. Thus, comparing the average knowledge about sustainability management tools in SMEs and large companies provides a first indication that firm size is indeed essential for acquiring sustainability management knowledge. Breaking company size down into particular firm-level attributes, previous literature points towards several possibilities why large companies have more knowledge than SMEs. According to the RBV, large companies possess more financial and human resources that enable them to gather information, develop expertise concerning sustainability management tools and unlock the potential benefits associated with them (Bowen, 2002; Udayasankar, 2008).

However, other theoretical approaches, such as legitimacy theory (Patten, 1992; Suchman, 1995; Adams *et al.*, 1998; Michelon, 2011) and absorptive capacity (Cohen and Levinthal, 1990; Eisenhardt and Santos, 2002; Roy and Thérin, 2008), might also be able to explain these differences. For example, legitimacy theory could be used to argue that larger companies are far more publicly exposed and thus face disproportionate amounts of public pressure, which encourages them to become more informed about sustainability management tools. Absorptive capacity could explain that larger firms have more extensive knowledge bases for sustainability management, and thus know more about the available options in this area (Hansen and Klewitz, 2012).

Second, the analysis reveals that larger companies apply significantly more sustainability management tools, even though these tools are applicable to SMEs as well. Prior research revealed a strong link between the knowledge and application of sustainability management tools (Schaltegger *et al.*, 2012). Our paper finds additional support for this observation, since the factor by which large companies apply more tools than SMEs is nearly identical to the factor by which they know more tools. Thus, the analysis of the difference in application between SMEs and large companies may be justified by the fact that large enterprises have a greater access to knowledge, which seems to be the most important driver for the differences in application of sustainability management tools between SMEs and large companies.

DOI: 10.1002/bse

Similar to the observed differences in knowledge of tools, the KBV might not be the only theoretical approach able to explain these observations. Once again, it could be argued that large companies are more engaged with the application of sustainability management tools because they potentially experience higher levels of visibility and public pressure (cf. Dowling and Pfeffer, 1975; Patten, 1992; Suchman, 1995; Adams *et al.*, 1998). When large enterprises are more visible to media, NGOs and governmental scrutiny, they might be more likely to respond to stakeholder demands and apply sustainability management tools (Uhlaner *et al.*, 2011). Conversely, the connection between visibility and firm size has been contested, as small firms can be equally visible as large companies (Bowen, 2002; Udayasankar, 2008). Moreover, large enterprises might have greater access to resources and power to resist external stakeholder pressures than SMEs (Brammer and Millington, 2006; Darnall *et al.*, 2010).

Third, the analysis reveals that the differences in application of sustainability management tools are mainly due to differences in knowledge. The indirect, mediating effect of knowledge is roughly three times stronger than the direct effect of company size. This indicates that the mentioned differences in application can be indeed explained by the KBV. Consequently, the share of tools a company applies out of those it knows does not differ significantly between large and small companies. This provides additional support for the explanatory power of the KBV in the context of implementing sustainability management, since the KBV does not suggest that companies that have access to more knowledge use more of this knowledge. In contrast, if the differences in knowledge and application of sustainability management tools were mainly caused by external pressures, we could expect larger companies to also apply more of the tools they know, due to their stronger exposure to external pressures (cf. Hackston and Milne, 1996; Michelon, 2011).

From previous literature, we found that the application of sustainability management tools in SMEs could also be inhibited by a lack of human and financial resources (Ammenberg and Hjelm, 2003; Graafland *et al.*, 2003; Hillary, 2004; Tencati *et al.*, 2004; Fitjar, 2011). Our findings suggest, however, that with regard to differences between SMEs and large companies human and financial resources are primarily important for acquiring the relevant knowledge. If a particular tool is known by a company and it is generally suitable for SMEs and large enterprises, there do not appear to be substantial differences between large and small enterprises in the probability that this tool will be applied. Indeed, the main difference seems to be that SMEs are frequently unaware of the existing tools and probably do not possess (or at least do not devote) the resources to become well informed about these tools.

For the case of the actual implementation, our results confirm previous findings that sustainability management in large companies is more advanced than in SMEs (Hillary, 2000; Revell and Rutherfoord, 2003; Worthington and Patton, 2005; Brammer and Pavelin, 2006; Galani *et al.*, 2012). Moreover, our findings provide additional support for the view that a lack of knowledge is the key reason that SMEs seem to be lagging behind large enterprises with regard to sustainability management (Worthington and Patton, 2005; Vives, 2006; Roy and Thérin, 2008). In contrast to previous work that solely builds on SME data (Revell *et al.*, 2010; Johnson, 2013), the findings presented in this paper are grounded on a direct comparison of data from both SMEs and large enterprises.

In summary, this paper finds support for the KBV in the context of implementing sustainability management. It identifies knowledge about sustainability management tools to be a crucial factor between strategy and implementation. Knowledge is of utmost importance for a company's degree of applying sustainability management tools, and it is a key difference between SMEs and large enterprises. This prominent role of knowledge may guide practitioners and academics in the continual development and implementation of sustainability management in enterprises regardless of their size.

Conclusions

This paper emphasizes the strategic importance of knowledge acquisition and use for the implementation of sustainability management. SMEs and large enterprises alike apply a relatively high share of the tools they know (approximately 60% of the tools surveyed for this analysis). Thus, those managers who know these tools must perceive a valuable benefit of their application in most cases. Today, large companies seem to be more engaged in the implementation of sustainability management than SMEs, which can be explained by the fact that they have access to a crucial resource, i.e. knowledge. To maintain this competitive advantage over SMEs, sustainability departments in large companies need to constantly seek and acquire firsthand information on the advances of sustainability management tools.

DOI: 10.1002/bse

The implementation of corporate sustainability strategy requires operational knowledge about tools for implementation. As knowledge does drive the application of tools, more attention should be paid to raising awareness in SMEs. SME managers need to become better informed about the relevant sustainability management tools, and thus find opportunities and pathways to gather information about these tools. Based on the results of this paper, several strategic possibilities for SMEs can be discussed to improve their awareness and knowledge acquisition. These strategic possibilities include increasing the internal knowledge bases or relying on external knowledge bases for help (e.g. joining business networks on sustainability management).

First, SMEs need to develop strategies to increase their internal knowledge bases on sustainability management (Roy and Thérin, 2008; Johnson, 2013). Since human and financial resources are limited in SMEs, increasing knowledge and application of tools have to be coupled with an effective management strategy. As a roadmap for the effective implementation of sustainability management, SMEs should first increase their awareness on specialized issues and identify the specific knowledge requirements before fully investing in the application of corresponding sustainability management tools (Perez-Sanchez *et al.*, 2003).

Second, SMEs can strategically turn to external knowledge sources to compensate for the lack of internal resources (Roy and Thérin, 2008). Business networks and trade associations can help SMEs increase their awareness of available tools as well as of the potential benefits from application (Ammenberg and Hjelm, 2003; Perez-Sanchez *et al.*, 2003; Lawrence *et al.*, 2006; Halila, 2007). Other external parties, such as suppliers, customers, research institutes and university departments, can provide useful sources of knowledge for resource-deprived SMEs (Roy and Thérin, 2008; Hansen and Klewitz, 2012).

However, previous research revealed that most SMEs are additionally unaware about the related benefits stemming from sustainability activities (Revell *et al.*, 2010; Brammer *et al.*, 2012). Thus, they might not be easily motivated to join voluntary networks and seek the relevant information of their own accord. From a political perspective, providing information and raising awareness needs to be accompanied by setting up a legal or public–private-partnership framework that provides external incentives and benefits to engage for sustainability and creates external pressure (Hansen and Klewitz, 2012).

The political sphere can also support SMEs in the task of knowledge acquisition by directly providing access to knowledge about sustainability management tools. Examples include governmental supported awareness raising activities such as educational seminars and workshops, easily accessible informational sources (e.g. websites, brochures and reports) and government sponsored guidelines (Steurer *et al.*, 2012). These various approaches could be further mobilized with the help of regional business networks (Collins *et al.*, 2007).

To address these practical implications in greater detail and to overcome the limitations of this paper, future research is necessary. First, this paper only investigated internal effects (size and industry affiliation) to explain the application of sustainability management tools. Along with company size, future studies could examine if and how external effects, such as membership in sustainability networks, play a role for the implementation of sustainability management and the acquisition of according knowledge.

A further exploration could investigate the capacities and capabilities of large and small enterprises to acquire knowledge and apply sustainability management tools in more detail. Even though large companies tend to possess greater amounts of resources (i.e. knowledge) to apply management tools, SMEs may possess certain capabilities to help improve their implementation of sustainability management, such as entrepreneurial vision, flatter hierarchies and flexible management decision-making (Aragón-Correa *et al.*, 2008; Hofmann *et al.*, 2012). By contrast, large enterprises have entire departments and multiple managers dedicated to sustainability management, while most SMEs dedicate one manager already wearing multiple hats to sustainability tasks. More research is necessary to explore how these capabilities might influence the level of knowledge and application of sustainability management in both SMEs and large enterprises.

Furthermore, it could be argued that this research implicitly demands all companies to apply all available sustainability management tools, regardless of the company-specific contexts. This is obviously not desirable since some tools are not suitable for every company, but suitability might for instance depend on industry affiliation (i.e., manufacturing industries require other tools than service industries). Some of these management tools might be more universal for the implementation of sustainability management than others, so it is not necessary or maybe even not desirable for a company to apply all available tools. Future research should therefore investigate in more detail which tools are most important in specific industry contexts.

In summary, these implications demonstrate that not only politicians and practitioners but also academics are challenged to support the implementation of sustainability management. The development of new company-tailored and

DOI: 10.1002/bse

sector-specific tools for both large enterprises and SMEs seems appropriate. Further developments should consider the applicability and access to information concering tools in SMEs. Such tools tailored to small businesses are relatively scarce and only little SME-specific information is available to support implementation of sustainability management.

References

Adams CA, Hill W, Roberts CB. 1998. Corporate social reporting practices in Western Europe: legitimating corporate behavior? *The British Accounting Review* **30**(1): 1–21.

Ammenberg J, Hjelm O. 2003. Tracing business and environmental effects of environmental management systems: a study of networking small and medium-sized enterprises using a joint environmental management system. *Business Strategy and the Environment* **12**(3): 163–174. DOI: 10.1002/bse.357

Aragón-Correa JA. 1998. Strategic proactivity and firm approach to the natural environment. *Academy of Management Journal* **41**(5): 556–567.

Aragón-Correa JA, Hurtado-Torres N, Sharma S, Garcia-Morales VJ. 2008. Environmental strategy and performance in small firms: a resource-based perspective. *Journal of Environmental Management* **86**(1): 88–103.

Bansal P. 2005. Evolving sustainably: a longitudinal study of corporate sustainable development. *Strategic Management Journal* **26**: 197–218. DOI: 10.1002/smj.441

Barney J. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**(1): 99–120.

Bartlett JE, Kotrlik JW, Higgins CC. 2001. Organizational research: determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal* **19**(1): 43–50.

Baruch Y, Holtom BC. 2008. Survey response rate levels and trends in organizational research. *Human Relations* **61**(8): 1139–1160.

Bowen FE. 2002. Does size matter? Organizational slack and visibility as alternative explanations for environmental responsiveness. *Business and Society* **41**(1): 118–124.

Bradford J, Fraser EDG. 2008. Local authorities, climate change and small and medium enterprises: identifying effective policy instruments to reduce energy use and carbon emissions. *Corporate Social Responsibility and Environmental Management* **15**(3): 156–172. DOI: 10.1002/csr.151

Brammer S, Hoejmose S, Marchant K. 2012. Environmental management in SMEs in the UK: practices, pressures and perceived benefits. *Business Strategy and the Environment* **21**(7): 423–434. DOI: 10.1002/bse.717

Brammer S, Millington A. 2006. Firm size, organizational visibility and corporate philanthropy: an empirical analysis. *Business Ethics: a European Review* **15**(1): 6–18.

Brammer S, Pavelin S. 2006. Corporate reputation and corporate social performance: the importance of fit. *Journal of Management Studies* **43**(3): 35–55.

Browne M, Cudeck R. 1993. Alternative ways of assessing equation model fit. In Testing Structural Equation Models, Bollen KA, Scott JS (eds). Sage: Newbury Park, CA; 136–162.

Burke S, Gaughran WF. 2007. Developing a framework for sustainability management in engineering SMEs. *Robotics and Computer-Integrated Manufacturing* **23**(6): 696–703. DOI: 10.1016/j.rcim.2007.02.001

Chakrabarty S, Wang L. 2012. The long-term sustenance of sustainability practices in MNCs: a dynamic capabilities perspective of the role of R&D and internationalization. *Journal of Business Ethics* **110**(2): 205–217.

Clemens B, Bamford CE, Douglas TJ. 2008. Choosing strategic responses to address emerging environmental regulations: size, perceived influence and uncertainty. *Business Strategy and the Environment* **17**(8): 493–511. DOI: 10.1002/bse.601

Cohen WM, Levinthal DA. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* **35**(1): 128–152.

Collins E, Lawrence S, Pavlovich K, Ryan C. 2007. Business networks and the uptake of sustainability practices: the case of New Zealand. *Journal of Cleaner Production* **15**(8/9): 729–740. DOI: 10.1016/j.jclepro.2006.06.020

Cook C, Heath F, Thompson RL. 2000. A meta-analysis of response rates in web- or internet based surveys. *Educational and Psychological Measurement* **60**: 821–836.

Darnall N, Edwards D. 2006. Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure. *Strategic Management Journal* **27**(4): 301–320.

Darnall N, Henriques I, Sadorsky P. 2010. Adopting proactive environmental strategy: the influence of stakeholders and firm size. *Journal of Management Studies* **47**(6): 1072–1094.

Dowling J, Pfeffer J. 1975. Organizational legitimacy: social values and organizational behavior. *The Pacific Sociological Review* **18**(1): 122–136.

Eisenhardt KM, Santos FM. 2002. Knowledge-based view: a new theory of strategy. In Handbook of Strategy and Management, Pettigrew A, Thomas H, Whittington R (eds). Sage: London; 139–164.

Esrock SL, Leichty GB. 1998. Social responsibility and corporate web pages: self-presentation or agenda-setting? *Public Relations Review* **24**(1): 305–319.

European Commission. 2005. The New SME Definition: User Guide and Model Declaration. http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf [2 April 2012].

Falkenberg J, Brunsæl P. 2011. Corporate social responsibility: a strategic advantage or a strategic necessity? *Journal of Business Ethics* **99**: 9–16.

Fitjar RD. 2011. Little big firms?: corporate social responsibility in small businesses that do not compete against big ones. *Business Ethics: a European Review* **20**(1): 30–44.

Friedman AL, Miles S. 2002. SMEs and the environment: evaluating dissemination routes and handholding levels. *Business Strategy and the Environment* **11**(5): 324–341. DOI: 10.1002/bse.335

Galani D, Gravas E, Stavropoulos A. 2012. Company characteristics and environmental policy. *Business Strategy and the Environment* **21**(4): 236–247. DOI: 10.1002/bse.731

Gallo PJ, Christensen LJ. 2011. Firm size matters: an empirical investigation of organizational size and ownership on sustainability-related behaviors. *Business and Society* **50**(2): 315–349.

Geels FW. 2011. The multi-level perspective on sustainability transitions: responses to seven criticisms. *Environmental Innovation and Societal Transitions* **1**: 24–40.

German Federal Statistical Office. 2011. Statistical Yearbook 2011. https://www.destatis.de/DE/Publikationen/StatistischesJahrbuch/StatistischesJahrbuch2011.pdf?__blob=publicationFile [5 January 2013].

Gerstenfeld A, Roberts H. 2000. Size matters: barriers and prospects for environmental management in small and medium-sized enterprises. In Small and Medium-Sized Enterprises and the Environment Business Imperatives, Hillary R (ed.). Greenleaf: Sheffield; 106–118.

Graafland J, van de Ven B, Stoffele N. 2003. Strategies and instruments for organising CSR by small and large businesses in the Netherlands. *Journal of Business Ethics* **47**(1): 45–60.

Grant RM. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal* **17**: 109–122.

Hackston D, Milne M. 1996. Some determinants of social and environmental disclosures in New Zealand. *Accounting, Auditing and Accountability Journal* **9**(1): 77–108.

Hahn T, Scheermesser M. 2006. Approaches to corporate sustainability among German companies. *Corporate Social Responsibility and Environmental Management* **13**: 150–165. DOI: 10.1002/csr.100

Halila F. 2007. Networks as a means of supporting the adoption of organizational innovations in SMEs: the case of environmental management systems (EMSs) based on ISO 14001. *Corporate Social Responsibility and Environmental Management* **14**(3): 167–181. DOI: 10.1002/csr.127

Hansen EG, Klewitz J. 2012. Publicly mediated inter-organizational networks: a solution for sustainability-oriented innovation in SMEs? In Entrepreneurship, Innovation and Sustainability, Wagner M (ed.). Greenleaf: Sheffield; 254–278.

Hart SL. 1995. A natural-resource-based view of the firm. *Academy of Management Review* **20**(4): 986–1014.

Hart SL. 1996. Beyond greening: strategies for a sustainable world. In The Earthscan Reader in Business and Sustainable Development, Starkey R, Welford R (eds). Earthscan: London; 7–19.

Heras I, Arana G. 2010. Alternative models for environmental management in SMEs: the case of Ekoscan vs. ISO 14001. *Journal of Cleaner ;Production* **18**(8): 726–735. DOI: 10.1016/j.jclepro.2010.01.005

Hillary R. 2000. Introduction. In Small and Medium-Sized Enterprises and the Environment. Business Imperatives, Hillary R (ed.). Greenleaf: Sheffield; 1–12.

Hillary R. 2004. Environmental management systems and the smaller enterprise. *Journal of Cleaner Production* **12**: 561–569. DOI: 10.1016/j.jclepro.2003.08.006

Hofmann KH, Theyel G, Wood CH. 2012. Identifying firm capabilities as drivers of environmental management and sustainability practices: evidence from small and medium-sized manufacturers. *Business Strategy and the Environment* **21**(8): 530–545. DOI: 10.1002/bse.739

Hoppenstedt. 2012. Hoppenstedt Database for Higher Learning Facilities. http://www.hoppenstedt-hochschuldatenbank.de/ [10 January 2012].

Hörisch J. 2013. Combating climate change through organisational innovation: an empirical analysis of internal emission trading schemes. *Corporate Governance* **13**(5): 569–582.

Hutchinson A, Chaston I. 1994. Environmental management in Devon and Cornwall's small and medium sized enterprise sector. *Business Strategy and the Environment* **3**(1): 15–22. DOI: 10.1002/bse.3280030102

Hutchinson A, Hutchinson F. 1997. Environmental Business Management: Sustainable Development in the New Millennium. McGraw Hill: London.

Johnson MJ. 2013. Sustainability management and small and medium-sized enterprises: managers' awareness and implementation of innovative tools. *Corporate Social Responsibility and Environmental Management*. DOI: 10.1002/csr.1343

Kerr IR. 2006. Leadership strategies for sustainable SME operation. *Business Strategy and the Environment* **15**(1): 30–39. DOI: 10.1002/bse.451

Kline RB. 2005. Principles and Praxis of Structural Equation Modeling. Guilford: New York.

Kogut B, Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* **3**(3): 383–397.

Kuhndt M. 2004. Sustainable business development. In Eco-efficiency and Beyond, Seiler-Hausmann JD, Liedtke C, von Weizsäcker EU (eds). Greenleaf: Sheffield; 64–72.

Lawrence SR, Collins E, Pavlovich K, Arunachalam M. 2006. Sustainability practices of SMEs: the case of New Zealand. *Business Strategy and the Environment* **15**(4): 242–257. DOI: 10.1002/bse.533

Lee KH. 2009. Why and how to adopt green management into business organizations?: the case study of Korean SMEs in manufacturing industry. *Management Decision* **47**(7): 1101–1121.

Lepoutre J, Heene A. 2006. Investigating the impact of firm size on small business social responsibility: a critical review. *Journal of Business Ethics* **67**(3): 257–273.

Loehlin JC. 2004. Latent Variable Models. Hillsdale: Erlbaum.

Michelon G. 2011. Sustainability disclosure and reputation: a comparative study. *Corporate Reputation Review* **14**(2): 79–96.

Miller D, Shamsie J. 1996. The resource-based view of the firm in two environments: the Hollywood film studios from 1936 to 1965. *Academy of Management Journal* **39**: 519–543.

Moore SB, Manring SL. 2009. Strategy development in small and medium sized enterprises for sustainability and increased value creation. *Journal of Cleaner Production* **17**(2): 276–282. DOI: 10.1016/j.jclepro.2008.06.004

Morsing M, Perrini F. 2009. CSR in SME: do SMEs matter for the CSR agenda? *Business Ethics: a European Review* **18**(1): 1–6.

Parker CM, Redmond J, Simpson M. 2009. A review of interventions to encourage SMEs to make environmental improvements. Environment and Planning C: Government and Policy **27**(2): 279–301. DOI: 10.1068/c0859b.

Patten DM. 1992. Intra-industry environmental disclosures in response to the Alaskan oil spill: a note on legitimacy theory. *Accounting, Organizations and Society* **17**(5): 471–475.

Perez-Sanchez D, Barton JR, Bower D. 2003. Implementing environmental management in SMEs. *Corporate Social Responsibility and Environmental Management* **10**(2): 67–77. DOI: 10.1002/csr.37
Revell A, Blackburn R. 2007. The business case for sustainability?: an examination of small firms in the UK's construction and restaurant sectors. *Business Strategy and the Environment* **16**(6): 404–420. DOI: 10.1002/bse.499
Revell A, Rutherfoord R. 2003. UK environmental policy and the small firm: broadening the focus. *Business Strategy and the Environment* **12**(1): 26–35. DOI: 10.1002/bse.347
Revell A, Stokes D, Chen H. 2010. Small businesses and the environment: turning over a new leaf? *Business Strategy and the Environment* **19**(5): 273–289. DOI: 10.1002/bse.628
Rigby D, Bilodeau B. 2009. Management Tools and Trends 2009. Bain: Boston, MA.
Roy MJ, Thérin F. 2008. Knowledge acquisition and environmental commitment in SMEs. *Corporate Social Responsibility and Environmental Management* **15**: 249–259. DOI: 10.1002/csr.145
Schaltegger S, Burritt R. 2005. Corporate sustainability. In The International Yearbook of Environmental and Resource Economics 2005/2006. A Survey of Current Issues, Folmer H, Tietenberg T (eds). Elgar: Cheltenham; 185–222.
Schaltegger S, Herzig C, Kleiber O, Müller J. 2002. Sustainability Management in Business Enterprises: Concepts and Instruments for Sustainable Organisation Development. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Bonn.
Schaltegger S, Windolph S, Herzig C. 2012. Applying the known. A longitudinal analysis of the knowledge and application of sustainability management tools in large German companies. *Society and Economy* **34**(4): 549–579.
Seiffert MEB. 2008. Environmental impact evaluation using a cooperative model for implementing EMS (ISO 14001) in small and medium-sized enterprises. *Journal of Cleaner Production* **16**(14): 1447–1461. DOI: 10.1016/j.jclepro.2007.10.001
Sobel ME. 1982. Asymptotic confidence intervals for indirect effects in structural equation models. In Sociological Methodology, Leinhardt S (ed.). American Sociological Association: Washington, DC; 290–312.
Spence L. 1999. Does size matter? The state of the art in small business ethics. *Business Ethics: a European Review* **8**(3): 163–174.
Starik M, Kanashiro P. 2013. Toward a theory of sustainability management: uncovering and integrating the nearly obvious. *Organization and Environment* **26**(1): 7–30.
Steger U, Ionescu-Somers A, Salzmann O. 2007. The economic foundations of corporate sustainability. *Corporate Governance* **7**(2): 162–177.
Steurer R, Martinuzzi A, Margula S. 2012. Public policies on CSR in Europe: themes, instruments, and regional differences. *Corporate Social Responsibility and Environmental Management* **19**(4): 206–227. DOI: 10.1002/csr.264
Suchman MC. 1995. Managing legitimacy: strategic and institutional approaches. *Academy of Management Review* **20**(3): 571–610.
Takahashi T, Nakamura M. 2010. The impact of operational characteristics on firm's EMS decisions: strategic adoption of ISO 14001 certifications. *Corporate Social Responsibility and Environmental Management* **17**(4): 215–229. DOI: 10.1002/csr.199
Tencati A, Perrini F, Pogutz S. 2004. New tools to foster corporate socially responsible behavior. *Journal of Business Ethics* **53**(1/2): 173–190.
Torugsa NA, O'Donohue W, Hecker R. 2013. Proactive CSR: an empirical analysis of the role of its economic, social and environmental dimensions on the association between capabilities and performance. *Journal of Business Ethics* **115**(2): 383–402.
Tseng YF, Wu YCJ, Wu WH, Chen CY. 2010. Exploring corporate social responsibility education: the small and medium-sized enterprise viewpoint. *Management Decision* **48**(10): 1514–1528.
Udayasankar K. 2008. Corporate social responsibility and firm size. *Journal of Business Ethics* **83**(2): 167–175.
Uhlaner LM, Berent-Braun MM, Jeurissen RJM, de Wit G. 2011. Beyond size: predicting engagement in environmental management practices of Dutch SMEs. *Journal of Business Ethics* **109**(4): 411–429.
Vives A. 2006. Social and environmental responsibility in small and medium enterprises in Latin America. *The Journal of Corporate Citizenship* **21**: 39–50.
von Malmborg FB. 2002. Environmental management systems, communicative action and organizational learning. *Business Strategy and the Environment* **11**(5): 312–323. DOI: 10.1002/eet.317
Welford RJ. 1998. Corporate environmental management, technology and sustainable development: postmodern perspectives and the need for a critical research agenda. *Business Strategy and the Environment* **7**(1): 1–12. DOI: 10.1002/(SICI)1099-0836(199802)7:1<1::AID-BSE132>3.0.CO;2-7
Welt online. 2012. Die 500 größten Unternehmen in Deutschland. http://top500.welt.de/ [11 June 2013].
Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**: 171–180.
Wiklund J, Shepherd D. 2003. Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal* **24**: 1307–1314. DOI: 10.1002/smj.360
Woolbridge JM. 2009. Introductory Econometrics: a Modern Approach. South-Western Cengage Learning: Mason, OH.
Worthington I, Patton D. 2005. Strategic intent in the management of the green environment within SMEs: an analysis of the UK screen-printing sector. *Journal of Business Ethics* **67**(3): 317–330.
Zhu Q, Sarkis J, Lai KG, Geng Y. 2008. The role of organizational size in the adoption of green supply chain management practices in China. *Corporate Social Responsibility and Environmental Management* **15**(6): 322–337. DOI: 10.1002/csr.173
Zobel T. 2007. The 'pros' and 'cons' of joint EMS and group certification: a Swedish case study. *Corporate Social Responsibility and Environmental Management* **14**(3): 152–166. DOI: 10.1002/csr.125
Zorpas A. 2010. Environmental management systems as sustainable tools in the way of life for SMEs and VSMEs. *Bioresource Technology* **101**: 1544–1557.

Appendix

Table A. Sustainability management tools considered

Quality management system	Eco-design/Design for the Environment
Social Management System	Sustainability report
Environmental management system	Social report
Sustainability Balanced Scorecard	Environmental report
Eco-efficiency analysis	Environmental statement
Risk analysis	Sustainability label
Sustainability benchmarking	Eco-label
Eco-benchmarking	Social/fair label
Social benchmarking	Incentive system
Eco-balance/life cycle assessment	Proposal system
Sustainability indicators	Further education
Eco-efficiency indicators	Stakeholder dialogue
Social indicators	Environmental audit
Environmental indicators	Social audit
Social cost accounting	Sustainability audit
Environmental cost accounting	

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IV. Paper 4

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Knowledge Acquisition in Sustainability-oriented SMEs:

Exploring the Effects of Internal Support Factors and External Cooperation

Matthew P. Johnson

Centre for Sustainability Management

Leuphana University Lüneburg

Scharnhorststraße 1, 21335 Lüneburg, Germany

johnson@uni.leuphana.de

Abstract

This paper investigates the range and depth of acquisition practices for sustainability knowledge in small and medium-sized enterprises (SMEs). In addition, it explores the effects of internal support factors and external forms of cooperation that might improve these knowledge acquisition practices in SMEs. The results of a multiple case study approach demonstrate that the internal factors – shared vision, employee qualifications, room for learning and top management support – have the ability to enhance the acquisition practices for sustainability knowledge. Additionally, several forms of external cooperation, including enterprise-university cooperation, business networks and strategic alliances, can improve the overall communication efforts with external partners, and thus they can improve knowledge attained from these partnerships. Overall, this paper reveals that a concerted effort, both inside and outside the firm, can lead to synergistic improvements in acquisition practices, which may expand the capacity for small firms to gather knowledge on sustainability issues.

Keywords

Knowledge acquisition; small and medium-sized enterprise (SME); sustainability management; internal support factors; external cooperation; environmental management system (EMS)

Introduction

Companies of all sizes are increasingly being confronted with various sustainability issues that have an impact on their bottom line, e.g. rising energy prices, depletion of nonrenewal resources, CO2 emissions, occupational health and safety, and transparency along the supply chain. It is becoming more apparent that management of sustainability issues is not merely a management fashion (Abrahamson, 1991), rather it serves as a possibility to encourage companies to improve their environmental and social performance and contribute to a sustainability-oriented future (Schaltegger and Burritt, 2005). According to the Brundtland Commission, sustainable development is "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations World Commission on Environment and Development, 1987: 8). The term 'business sustainability' has thus emerged to consider the development and integration of economic, environmental and social aspects in an organization's short- and long-term planning (Dyllick and Hockerts, 2002; Schaltegger and Burritt, 2005).

Such a development will require the contribution of all organizations, not just the large, multi-national companies. Small and medium-sized enterprises (SMEs) will also have to play a major role in sustainable transitions (Loorbach and Wijsmann, 2013). It is also emphasized in the literature that sustainable development can only be achieved if all companies embrace it (Hillary, 2000; Bansal, 2005; Schaltegger and Burritt 2005). From a SME-perspective, the collective effects that SMEs have on economies, societies and environment should not go overlooked (Hillary, 2000; McKeiver and Gadenne, 2005). For instance, it has been estimated that SMEs contribute up to 70% of global industrial pollution (Hillary, 2004; Revell et al., 2010). Thus, the challenge here lies in finding ways for SMEs to improve their environmental and social performance by reducing their negative impacts, while increasing its overall economic success (Schaltegger and Burritt, 2005).

In order to facilitate an effective response to sustainability-related issues, several SME-specific approaches have been proposed in the literature. These include creating sustainability-oriented strategies geared towards SMEs (Aragón-Correa et al., 2008; Parisi and Maraghini, 2010; Russo and Tencati, 2009), joining sustainability networks and forming strategic partnerships (Collins et al., 2006; Hansen and Klewitz, 2012) as well as applying sustainability management tools and standards (Graafland et al., 2003; Johnson, 2013). While these approaches might vary, they all share the basic need to acquire knowledge and use it effectively to implement these solutions (Roy and Thérin, 2008).

Roy and Thérin (2008) explore various knowledge acquisition practices in relation to the level of environmental commitment in SMEs. While their study provide an excellent point of departure for further investigation on knowledge acquisition practices, the findings do not provide more in-depth insights on the range of possibilities for each practice or draw connections to supporting factors that could affect these practices. Factors supporting knowledge acquisition practices, including internal

support factors and cooperation with external partners in this study, have been explored in mainstream innovation research (Caloghirou et al., 2004), but they have not been yet investigated in the sustainability context.

Thus, this paper investigates the range and depth of acquisition practices for sustainability knowledge in sustainability-oriented small and medium-sized enterprises (SMEs). Furthermore, it qualitatively explores the extent to which internal support factors and external cooperation opportunities affect these acquisition practices. In doing so, it combines several research streams to capture a wider picture of knowledge acquisition for sustainability management tools in SMEs, including absorptive capacity (Cohen and Levinthal, 1990; Roy and Thérin, 2008), internal support factors (Christmann, 2000; Hoffmann et al., 2012) and cooperation with external stakeholders (Caloghirou et al., 2004). For this study, the following research questions are addressed:

- *How do SMEs acquire knowledge for sustainability management?*
- *To what extent do internal support factors and forms of external cooperation affect knowledge acquisition practices for sustainability management in SMEs?*

In order to investigate these questions in an explorative manner, a multiple case study approach was chosen for this research, as it allows for studying and comparing various phenomena in similar contexts (c.f. Chalmers and Balan-Vnuk, 2012). Ten cases studies were selected according to their adoption and experience with an environmental management system (EMS). The cases could be classified as either beginner or expert companies. Five beginner cases were part of a one-year workshop to implement an EMS. Five expert cases were chosen as they have five or more years' experience with an EMS. By establishing these two groups amongst ten case companies, this paper was able to observe variations of knowledge acquisition practices for sustainability management as well as the contrasts in the supporting factors.

This paper is structured as follows: the next section provide a review of the literature on sustainability management tools in SMEs as well as a synthesis of the three main research streams relating to knowledge acquisition in SMEs, including absorptive capacities, internal support factors and forms of external cooperation. The third section will explain how this multiple case study research was conducted. The fourth section will highlight the main findings for knowledge acquisition practices, including how internal support factors and external cooperation affect knowledge acquisition practices. Section 5 will provide a discussion for knowledge acquisition for sustainability management in SMEs. The final section will highlight some main implications for future research and practice.

Literature Review

Knowledge of Sustainability Management in SMEs

Sustainability management involves the integration of environmental, social and sustainability performance measures into an enterprise's conventional management policies, structures and processes (Schaltegger and Burritt, 2005; Starik and Kanashiro, 2013). In this context, sustainability management facilitates the integration of these multiple items by introducing additional environmentally and socially oriented managerial tasks, including strategic planning, implementation, assessment and communication of environmental and social systems (Epstein, 2008; Schaltegger et al., 2012). While various sustainability management strategies and tools were designed to fulfill different tasks, all approaches have one thing in common, which is the "essential need to acquire expertise and knowledge to adequately evaluate and implement these solutions" (Roy and Thérin, 2008: 250). Nonetheless, the literature often cites that SMEs have low levels of expertise on sustainability-related issues, and they especially lack the knowledge about management tools to improve sustainability performance (Friedman and Miles, 2002; Hillary, 2004; Revell and Blackburn, 2007). These setbacks can impair an enterprise's ability to acquire knowledge and expertise to deal with these issues (Lepoutre and Heene, 2006; Revell and Blackburn, 2007). Even several empirical studies (Graafland et al., 2003; Hahn and Scheermesser, 2006; Johnson, 2013) find that most sustainability management approaches suffer from low rates of knowledge and application in SMEs. However, a positive relationship between the variables knowledge and application exists, which signifies that the more knowledge one has on sustainability management tools, the more likely they will apply them (Johnson, 2013; Schaltegger et al., 2012).

The strategic importance of knowledge for the application of sustainability management is further emphasized in a recent study (Hörisch et al., 2014). Even though SMEs know and apply significantly less sustainability tools and standards when compared to large enterprises, the results reveal that both groups apply a comparatively moderate degree of them (approximately 60% for both groups). Knowledge is considered as the main determinant for the application of sustainability management tools, more so than company size and availability of other tangible resources (Hörisch et al., 2014).

If in fact knowledge is the most important resource that drives application of such tools, strengthening sustainability knowledge becomes even more essential. Several internal and external awareness raising efforts have been suggested in the literature. From an internal management perspective, SMEs should try to increase their knowledge base on sustainability management and turn to external knowledge sources to compensate for the lack of internal resources (Perez-Sanchez et al., 2003; Roy and Thérin, 2008). From an external perspective, political campaigns could promote awareness through educational seminars and trainings, which could be reinforced by the provision of informational resources (e.g. websites, reports and brochures) to increase the adoption rates of tools (Bradford and Fraser, 2008; Steurer et al. 2012).

According to knowledge based view (Grant, 1996; Kogut and Zander, 1992), knowledge is considered the most important resource of an enterprise since it has the ability to combine and coordinate other tangible resources in an effective manner that improves a firm's innovativeness and overall competitive advantage (Grant, 1996; Inkpen, 1998; Kogut and Zander, 1992). Since it is established that knowledge positively affects application of sustainability management tools (Hörisch et al., 2014; Johnson, 2013; Schaltegger et al., 2012), the next subsections focus on the knowledge acquisition practices and factors that affect knowledge acquisition in the literature. At the moment, very little is known about these practices and factors in sustainability management, especially in the SME context. The next section thus highlights the available research on knowledge acquisition practices and related tools for sustainability management in SMEs.

Knowledge Acquisition Practices in SMEs

In order to improve the overall sustainability-relevant knowledge in a firm, managers are continually searching for, identifying and applying new techniques, structures and processes to promote learning and increase acquisition of knowledge (Cohen and Levinthal, 1990; Inkpen, 1998; Roy and Thérin, 2008). Knowledge acquisition refers to a firm's ability to identify and obtain external knowledge to improve its own operations (Zahra and George, 2002). By establishing knowledge acquisition processes, an enterprise is "better equipped to understand new knowledge, recognize changes in the environment and seize opportunities" (Roy and Thérin, 2008: 251). By improving these knowledge acquisition efforts, a firm can thus increase its potential absorptive capacity.

Potential absorptive capacity as a concept is useful to understand knowledge acquisition since it allows researchers to evaluate an enterprise's ability to appreciate new knowledge and assimilate it in an effective way (Zahra and George, 2002). However, this potential capacity does not automatically imply enhanced performance, as it must be realized through transformation and exploitation capabilities (Zahra and George, 2002). If the knowledge base of a SME is restricted by, i.e. the lack of resources, it can be extended through strategic selection and incorporation of external knowledge sources (Caloghirou et al., 2004; Roy and Thérin 2008). Thus, SMEs may rely on external sources for knowledge on sustainability issues such as using the internet or communicating with external stakeholders.

Knowledge acquisition practices specific to sustainability management in SMEs can be categorized into two groups of knowledge sources – scanning activities and communication with external stakeholders (Roy and Thérin, 2008). Scanning activities can provide SMEs with up-to-date knowledge on technological and market developments as well as best sustainability practices, which include the use of the internet, skimming industry and sustainability journals, attendance at conferences and receiving external professional training. The use of the internet acts as a revolving door where SMEs can either receive information through various websites or exchange it through contact with external parties via e-

mail (Caloghirou et al., 2004) or more recently via social media (Meske and Stieglitz, 2013). The internet also provides affordable and often time-saving access to other sources of information.

The second source of knowledge is characterized through the communication with external stakeholders, including customers and suppliers, competitors, consultants, public agencies, research institutions and universities. Roy and Thérin (2008) found that SMEs with a greater environmental commitment are more open to communication with external parties on environmental issues. This proactive approach to communication thus leads to an increased knowledge to meet sustainability challenges. They emphasize the need to develop relevant skills and capabilities to expand the knowledge bases for environmental management; however, they do not further explore these capabilities. Therefore, this paper includes internal support factors and extended forms of cooperation with external stakeholders as factors affecting the extent of knowledge acquisition for sustainability management in SMEs.

Internal Support Factors and External Cooperation

To support these knowledge acquisition practices and extend the knowledge base of the firm, several authors emphasize the importance of internal support factors as well as forms of external cooperation (Bosch et al., 1999; Caloghirou et al., 2004; Jansen et al., 2005; Kogut and Zander, 1992). Internal support factors, also known as complementary assets (Christmann, 2000), can have a positive effect on the amount and rate of knowledge acquisition in an enterprise. These factors can thus facilitate a firm's acquisition and assimilation of knowledge (Lane et al., 2006). For this paper, the effects of internal support factors center on knowledge acquisition. An example of an internal support factor from the knowledge management literature is the investment in research and development (R&D). A portion of the R&D activities could be labeled "discovery capabilities" (Caloghirou et al., 2004), which can expand the existing knowledge base and assist in creating new knowledge in a firm (Caloghirou et al., 2004; Simon, 1999). However, Roy and Thérin, (2008) found that in-house R&D plays an inadequate role in supporting acquisition of sustainability sustainability in SMEs, and therefore, this particular support factor was not further investigated.

Several internal support factors are provided in the literature to acquire knowledge and promote sustainability in SMEs. These support factors include shared vision throughout an entire firm (Aragón et al., 2008; Tilleman, 2012), employees' qualifications (Caloghirou et al., 2004; Darnall and Edwards, 2006; Darnall et al., 2010), education and training (Hofmann et al., 2012; Lourenço et al., 2012), flexibility (Darnall et al., 2010) and previous adoption of management systems and tools (Darnall et al., 2006). Such capabilities can be considered complementary assets in this context if they can promote learning, support knowledge acquisition, and assist in the evaluation and application of management tools to foster sustainability management in SMEs (Darnall and Edwards, 2006). In order to extend the knowledge base of the firm, the limited literature highlights the importance of addressing these internal support factors.

Shared vision refers to the company's overall vision for sustainability and the close integration and communication between the owner-manager and the employees (Aragón-Correa et al., 2008). In a sustainability context, this includes how an owner-manager's vision leads to an individual's identification and involvement with sustainability efforts (Tilleman, 2012). Employee qualifications are as equally important as their involvement for knowledge acquisition for sustainability management. When an employee is highly qualified, especially in matters of sustainability management, they can recognize opportunities immediately and acquire the necessary additional knowledge faster and more effectively (Caloghirou et al., 2004). Education and training can be considered a capability to assist knowledge acquisition in such that it gives employees the basis to identify knowledge and use it in an effective way (Caloghirou et al., 2004). The higher the levels of education and training on sustainability in a firm, the more the firm can acquire and exploit knowledge for its own uses, which Caloghirou et al. (2004) have coined as a learning capability.

Flexibility has been cited as one of the unique support factors found in SMEs (Darnall et al., 2010). In this sense, flexibility means the ability to shift gears and refocus in a timely fashion to make necessary organizational changes. Since many SMEs have less formal management structure, this affords them to make sudden adjustments and acquire new knowledge according to the directional shift. Finally, the prior application of tools, such as a environmental management system, allows SMEs to quickly identify and assimilate more complex knowledge that it might not have been able to without previous experience (Caloghirou et al., 2004; Darnall and Edwards, 2006). Furthermore, previous adoption might also reduce implementation cost for new tools if knowledge-based processes for the tool already exist (Darnall and Edwards, 2006).

Another factor that could influence knowledge acquisition for sustainability management is the possibilities offered through the establishment of cooperative partnerships with external stakeholders (Caloghirou et al., 2004; Hansen and Klewitz, 2012). Such forms of external cooperation include enterprise-university cooperation and sustainability-oriented networks (Collins et al., 2006; Halila, 2007). Further cooperation opportunities present themselves in the form of strategic alliances and public-private partnerships (Hansen and Klewitz, 2012). Such cooperation is more than just informal communication and exchange between customers, suppliers and competitors, but rather expressed as coordinated platforms and networks transferring knowledge in an organized way. Knowledge acquisition does not strictly have to be a burden born by a single enterprise, but it can be coordinated and shared between firms and other partnering organizations (Caloghirou et al., 2004). In turn, an enterprise's absorptive capacity can be increased through such networks and partnerships (Hansen and Klewitz, 2012). Similar to internal support factors, it is a firm's openness to cooperation that enables learning, which enhances a firm's knowledge base (Caloghirou et al., 2004).

This literature review has captured various knowledge acquisition practices, internal support factors and forms of external cooperation. An overview of these practices, capabilities and cooperation can be observed in Figure 1 below. While previously literature hints how these knowledge acquisition practices contribute to improving the potential absorptive capacity of a firm, they do not go into detail how these practices are carried out and how supporting factors promote these practices.

Knowledge Acquisition Practices	**Support Functions**
Scanning Activities	**Internal Support Factors**
▪ Internet ▪ Databases ▪ Journals ▪ Attending conferences ▪ External training	▪ Shared Vision ▪ Employee skills ▪ Education & training ▪ Flexibility ▪ Previous adoption of tools
Communication with…	**External Cooperation**
▪ Research labs & universities ▪ Competitors ▪ Customers and Suppliers ▪ Consultants ▪ Public agencies	▪ Enterprise-university cooperation ▪ Sustainability-oriented networks ▪ Strategic alliances ▪ Public private partnership

Figure 1 – Overview of Knowledge Acquisition Practices and Support Functions

This paper investigates these areas – knowledge acquisition practices by scanning and communication, internal support factors and forms of external cooperation – regarding application of sustainability management tools in SMEs. Before the results of the qualitative analysis are presented, the next section explains the research methods and presents some basic quantitative metrics of the case study enterprises.

Methods

For a comprehensive investigation of these areas, an exploratory multiple case study approach was chosen for this research purpose. This selected method not only permits a deeper analysis on knowledge acquisition and the linkages to the support factors, but it also allows for comparing amongst the cases (Chalmers and Balan-Vnuk, 2012; Yin, 2003). Ten case studies were selected according to two main criteria. First, the enterprise must fall into the EU definition of an SME, i.e. 249 employees or less and no greater than 50 million Euro annual turnover (European Commission, 2005). Second, each enterprise has adopted an EMS. The second criterion was considered important as to create an analogous point of reference among all cases, which each company acquires knowledge for the same sustainability management tool, namely an EMS. Furthermore, the interview partners in each company are comparable, which are the environmental management officers in each case. Table 1 below provides a general description of the case enterprises selected for this case study.

Company	Description	Size / Ownership	Years with an EMS	Expertise Level
Rehab Clinic (RC)	Neurological and orthopedic rehabilitation clinic	Medium / public	1	Beginner
Food Processing & Packaging (FP)	Processing and packaging of organic grains and baking mixes	Medium / private	1	Beginner
Laundry Service (LS)	Professional laundry service for large industrial customers	Medium / private	1	Beginner
Wood Products (WP)	International manufacturer of sustainable wood products	Medium / private	1	Beginner
Snack Foods (SF)	Domestic manufacturer of cereals and snack foods	Medium / private	1	Beginner
Porcelain Manufacturer (PM)	International manufacturer of wholesale and retail porcelain	Medium / private	5	Expert
Mail-order business (MB)	Domestic mail-order warehouse of eco-certified office supplies	Medium / public	14	Expert
Tea & Herbs Producer (TH)	International organic producer of tea, coffee and herbs	Medium / Private	17	Expert
Brewery (BR)	Domestic producer of organic beer and soft drinks	Medium / private	19	Expert
Organic Bakery (OB)	Organic bakery with regional delivery of baked goods	Medium / private	19	Expert

Table 1 – Description of Case Study Companies

According to the second criterion, i.e. having implemented an EMS, the ten case studies could be sorted into two groups – beginners and experts. The main difference between the two groups was the level of experience with the EMS and the integration of economic and social criteria for an integrative sustainability management approach. Table 1 highlights the years of experience with an EMS and which category the enterprise fell into (expert or beginner).

On one hand, the five beginner companies included in this study were part of a university-initiated workshop series over a one year period to accompany them in the initial stages of EMS implementation. Throughout this one year, the participants, i.e. the company-designated environmental officers, provided both verbal and written details (e.g. environmental management protocols) on a continual basis; which helped with the conceptualization of this study. The interviews were then held at the end of the workshop to reflect all the practices conducted over the year.

On the other hand, the five expert companies were selected for the reasons that they have had an established and certified EMS for at least five years or more. In several cases, these companies have continually applied an EMS for more than 15 years. While these companies did not participate in the same university-initiated workshops with the beginner companies, they were contacted multiple times before the interview, providing both verbal and written communication (e.g. environmental management protocols, environmental statements and sustainability reports) on knowledge acquisition practices.

Prior to the exploratory interviews, all companies (beginner and expert cases alike) completed a short survey on sustainability management approaches known and applied, as well as the knowledge acquisition practices, including the frequencies. Table 2 provides an overview of these tools, practices and frequencies for every beginner and expert case company. 'Y' indicates an active engagement of knowledge practice. 'L' indicates an infrequent engagement of knowledge practices or on an ad hoc basis. Finally, 'N' indicates that they do not engage in a particular knowledge practice.

At the top of Table 2, it appears that some general knowledge for most of the sustainability management tools is present in almost every case company (out of 21 total tools were provided). Two exceptions are case companies FP and PM, which know 14 and 16 tools respectively. However, it is interesting to observe the number of tools applied. The expert companies apply significantly more tools that they know (average rate of knowledge to application is 72.2%) than the beginner companies (average 36.5%), which is essentially twice the amount of tools applied when compared to what they know. One reason for this significant difference between knowledge and application could be that most expert companies have more than fifteen years' experience with an EMS, whereas the beginner companies have only one year experience. Nevertheless, the qualitative findings explore and reveal emerging patterns between expert and beginner cases in their knowledge acquisition practices.

Practice	**RC**	**FP**	**LS**	**WP**	**SF**	**PM**	**MB**	**TH**	**BR**	**OB**
Level of expertise	B	B	B	B	B	E	E	E	E	E
Management tools *known* (out of 21 surveyed)	19	14	21	21	21	16	20	20	21	20
Management tools *applied* (out of 21 surveyed)	8	7	5	6	9	9	15	15	13	18
Rate of Knowledge to Application (%)	42%	50%	24%	29%	43%	56%	75%	75%	62%	90%
Scanning the Internet	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Skimming journals	Y	Y	Y	Y	Y	L	Y	L	Y	Y
Newsletter subscriptions	Y	N	N	Y	Y	N	Y	Y	Y	Y
Attending conferences	L	N	L	Y	Y	Y	L	L	L	Y
External Training	L	N	L	Y	L	Y	L	L	L	Y
Communication w/ customers	L	Y	Y	Y	Y	Y	L	L	L	Y
Communication w/ suppliers	L	Y	Y	Y	Y	Y	L	L	Y	Y
Communication w/ competitors	L	L	L	Y	Y	L	N	L	N	Y
Communication w/ universities	Y	Y	Y	Y	Y	L	L	Y	L	Y
Communication w/ consultants	Y	N	N	N	L	L	L	L	L	Y

(Notes: B = beginner; E = Expert; Y = yes, actively engage (daily, weekly, monthly) in the practice; L = limited (yearly), as-needed engagement in the practice; N = no, they do not engage in the practice)

Table 2 – Knowledge Acquisition Practices for Sustainability Management in Case Companies

The most frequently engaged practices for knowledge acquisition for sustainability management in both expert and beginner companies are scanning the internet (all 10 respondents), skimming industry and sustainability journals (8 out of 10 respondents) and subscribing to sustainability newsletters (7 out of 10 respondents). From active communication with external stakeholders, the most common stakeholder to communicate with are suppliers (7 out of 10 respondents), followed by customers (6 out of 10 respondents) and universities (5 out of 10 respondents). The other knowledge acquisition practices (attending conferences, communication with consultants and competitors) were not used frequently. With the exception of the skimming of journals, expert cases seem to be more actively engage in scanning activities, whereas beginner case seem to be more actively involved in communication with external parties. However, beginner cases' communication with universities is likely influenced by the involvement of a yearlong workshop to introduce a sustainability management system in their business

In the final stage of exploration, interviews were conducted with the environmental officers and sustainability managers in each case company between May and July, 2014. For these interviews, a semi-structured interview protocol was used (Eisenhardt, 1989). While these interviews were purposefully set up to cover the three categorical themes of investigation, namely knowledge acquisition practices, internal support factors and forms of external cooperation, room for flexibility was integrated into the interviews to find out what was uniquely done in each case company. While it was important to discover which knowledge acquisition practices work best in SMEs, the novelty of this research project lies in finding out the range and depth of these acquisition practices, and how internal and external support factors contribute to the overall effectiveness of these practices.

All interviews were fully transcribed, coded using MAXQDA® Data Analysis Software, and further analyzed and compared with other company documents, such as an environmental management protocols, and sustainability reports, on the individual knowledge acquisition practices, internal support factors and forms of external cooperation. The results section qualitatively examines the knowledge acquisition practices in greater detail. In addition, a connection is made between these practices, internal support factors and forms of external cooperation, for the implementation of sustainability management in SMEs.

Results

Due to the qualitative nature of the findings, it was possible to examine the knowledge acquisition practices in greater depth and find if any recognizable distinctions between expert and beginner companies emerge. The first subsection investigates knowledge acquisition practices further. These practices can be split between scanning activities (use of internet, skimming journals, external training and conference attendance) and communication with external parties (customers, suppliers, competitors, universities and consultants). The communication practices between beginner and expert companies are provided in the following subsection.

Scanning Activities for Sustainability Management

First of all, all cases use the internet to scan for sustainability-related knowledge; however, differences were noticed between beginners and experts. Beginners use the internet as the first source for many sustainability issues, especially on specific issues at particular points in time. This problem-specific search seems to be driven individually – both individual inquiries one at a time and just one individual in the beginner companies acquiring knowledge via the internet. Conversely, expert companies utilize the internet in a more structured way, which involves multiple persons in the enterprise, and subscribing to online news sites to let information come to them.

A similar pattern emerges between beginner and expert companies with the scanning of journals. It appears a structure is in place with expert companies. Most beginner companies skim journals to find new knowledge on sustainability management, but again no structure or system is in place. According to the environmental officers in beginner companies, skimming journals is a task that belongs outside the normal working hours. On the contrary, expert companies appear to have a better defined system in place to collect and distribute sustainability journals and magazines throughout the company.

Similar to scanning internet and journals, attending conferences to acquire new knowledge on sustainability management is approached differently between expert and beginner companies. Beginner companies view such attendance as an act to acquire knowledge for the individual. Most beginner companies admit that no one else in the firm is currently attending sustainability-related conferences and meeting. This is different for expert companies. Attending conferences is not just a responsibility for individuals to acquire knowledge, rather it is seen as place to enhance skills and motivate employees, which can thus translate to improvements inside the companies.

Most case companies, both beginner and expert, see it as a priority to acquire sustainability knowledge through external workshops. Thus, most case companies set up organized training schedule; however in different forms. On one hand, beginner companies have not put too much though on how to further involve the topic of sustainability management into external training. On the other hand, expert companies have a structure in place and have set a budget aside for external training of employees, especially on sustainability-related subjects. This structure is not informally based on individual needs, but primarily used when employees are motivated to acquire additional knowledge and skills.

In short, scanning activities in expert companies appear to be collective, involving multiple individuals and providing an established structure that can be detected in most cases. Due to the lack of experience with an EMS, beginner companies see more the single tasks to perform and acquire the knowledge on an individual, ad hoc basis. There is little or no established structure for scanning activities in beginner companies, apparently jumping from one inquiry or problem to the next. Table 3 provides a comparison between beginner and expert cases in the patterns for scanning activities.

Scanning Activities	Beginners	Experts
Scanning the internet	Individually driven – both distinct problems searched and a single person involved; not clear if and how knowledge is passed to others.	Setting up subscriptions to online newsletters and allowing information come to them. Passing it on to others appears structured.
Skimming journals	One person managing and acquiring knowledge through journals. Not clear how journals are circulated in the company.	The most structured scanning activity. Journals regularly distributed, which reach all involved parties in the firm.
Attending conferences	Usually performed on an individual, ad hoc basis, mostly by one person to acquire knowledge for the firm.	A responsibility of multiple persons in firm. Seen as a scheme to motivate others and search for new innovations.
Visiting external trainings	Widely practiced but only loosely related to sustainability, rather topics such as quality or safety.	Yearly scheduling driven by employee motivation company needs. Individuals bring back knowledge to firm.

Table 3 – Comparison between beginners and expert cases in scanning activities

External Communication for Sustainability Management

The results reveal how communication is handled differently with external parties between beginner and expert companies. For starters, beginner companies appear to exchange knowledge more frequently with customers; however, this is usually conducted in a reactive and unstructured way. On the contrary, expert companies appear to have less frequent, yet more intense dialogues with their customers. Several expert cases strive for regularly schedule communication with customers, in which they conduct yearly meetings with them. While the frequency of exchange with customers might be limited, it appears to be managed in a more structured way. So it is more frequent and less structured communication for beginner cases versus less frequent and more structured for expert cases.

Furthermore, communication with suppliers allow relevant knowledge to be exchanged on environmental, social and quality issues in the upstream supply chain. Such communication is usually held in regular intervals (typically once a year) in expert cases, and these deliver relevant knowledge on items such as environment, quality and social issues and even comments back from the supplier. Such knowledge is seen as a value-added commodity from the audit that is carried out. For the most part though, the qualitative results show that communication with suppliers is relatively the same from practice and value recognized between beginner and expert cases. Expert companies appear slightly more advanced and knowledgeable on additional aspects to exchange with suppliers, where the level of communication for sustainability management is perhaps more productive for knowledge acquisition through audits. Nonetheless, beginner companies do see the value in additional dialogue with suppliers on sustainability issues.

A conclusive pattern did not emerge between beginner and expert cases on their communication with competitors. Only two general observations could be established. First, most communication from competitors take place within a particular industry (e.g. organic food processing). Second, several case companies (BR, WP) do not have direct competitors on the market, since their products are so unique, which makes it difficult to find industry best practices. Nevertheless, these two case companies still exchange with other companies in their region as well as the sustainability role models in the entire market, not just in one particular industry.

Communication with consultants also appears relatively the same between expert and beginner companies. Most companies admit that they will use experts for projects where superior knowledge is necessary; however, this occurs widely on an as-needed basis. While most acknowledge the level of expertise consultants may offer, it appears that other communication with other stakeholders is preferred over consultants.

Finally, all beginner companies admitted to a frequent exchange with universities, which is distorted by the fact that all these cases were involved with an ongoing program to adopt an environmental management system in their business. Nonetheless, the beginners as well as a couple expert companies see the value of communication for knowledge acquisition for sustainability management. One of the prime sources of new knowledge is through projects where students are involved. Even though students might lack the professional experience, they usually bring new knowledge directly from the classroom with them to a project or internship. As one expert company admits:

Table 4 gives an overview of the communication patterns between beginner and expert companies. While several exceptions to these patterns exist (i.e. communication with competitors and consultants), several varying tendencies formed between both beginner and expert case groups. For example, communication with customers appears more frequent but less structured with beginner companies, whereas experts engage in more structured but therefore less frequent through organized dialogue with customers. The next two sub-sections will reveal how particular factors support knowledge acquisition

Communication Practices	Beginners	Experts
Communication with customers	More frequent, less structured. Acquisition is limited mostly to reacting to customer demands.	More structured, less frequent. Acquisition is broader as it facilitates exchange of ideas in an organized dialogue with customers.
Communication with suppliers	Frequent; receiving continuous knowledge, which is produced along the supply chain.	Frequent; slightly more structured in acquisition, as witnessed with audits, which serve as a value-added activity for knowledge.
Communication with competitors	No emerging pattern between beginner and expert cases. Two observations made: (1) industries with competition, knowledge with competitors is openly exchanged; and (2) industries with no competition, knowledge sought for through role models in sustainability.	
Communication with consultants	No emerging pattern between beginner and expert cases. Other knowledge acquisition practices and communication are preferred over consultants, only when advanced knowledge is required.	
Communication with universities	Ongoing communication with universities to remain current with sustainability changes.	Less communication, more project based. Several experts use a dual-study program to bring knowledge directly into firm from university.

Table 4 – Comparison between beginners and expert cases in communication practices

Internal Support Factors for Knowledge Acquisition

The internal support factors facilitating knowledge acquisition include shared vision, employee qualifications, education and training, flexibility and previous adoption of management systems and tools. These capabilities are mentioned to some extent in all ten case companies. Furthermore, two additional capabilities for knowledge acquisition are found, including room for learning and top management support.

First, shared vision is created when employees then feel involved and help contribute to overall goals. In the sense of knowledge acquisition, this would translate into employees knowing why obtaining knowledge for sustainability management is important and then actively acquiring it. A benefit from a certified EMS according to EMAS is the active involvement of employees. The expert companies show that meeting this objective bring real benefits for their enterprises and assists largely to increased knowledge acquisition and diffusion throughout the company. On the contrary, beginner cases have much less experience with an EMS, and involving employees to make a coordinated effort for knowledge acquisition has not yet taken place. Mostly, they see the opportunities in creating such an atmosphere, but they also see a lot of work of involving employees for the first time in this way. As one beginner company admits:

Second, depending on the level of employee qualifications, employees might vary in their ability to recognize opportunities for sustainability and to acquire the necessary additional knowledge. Expert companies indicate to place a great importance on qualified employees for sustainability management. Measures taken to improving employees' qualifications include offering in-house training opportunities and hiring new persons with exceptional skills in sustainability management. Several expert companies even admit that highly qualified persons submit an application due to the existing sustainability philosophy in place. While qualified persons are very important, these companies recognize that employees must be motivated to acquire new knowledge. Beginner companies also place a high importance on employee qualifications for sustainability management, but they are still in the process of identifying the right persons and skills as the EMS implementation continues. Identifying the right employees for certain tasks is key, as one firm explains:

Third, the higher the levels of education and training on sustainability in a firm, the more the firm can acquire and exploit knowledge for its own uses, coined as a 'learning capability' (Caloghirou et al. 2004). Expert companies tend to use learning capabilities to promote from within, as one states:

For several beginner companies, no additional training or education on environmental and sustainability management exists at the moment for regular staff. Only two of the five beginner cases offer an introductory training on environmental management (FP and LS). For the other beginner cases, they state that environmental training will be held in the future; however, it appears more as a chore competing with other tasks than a capability for strengthening learning and knowledge acquisition for sustainability management.

Fourth, flexibility as a capability means the ability to shift gears and refocus in order to make necessary changes in the firm. Since many SMEs have more informal management structure, this allows them to make sudden adjustments and acquire new knowledge pertaining to the directional shift. Interestingly, most case companies did not mention flexibility as a capability for sustainability management. In fact only one expert case company and one beginner case company explained how flexibility is an advantage for knowledge acquisition in the firm.

Fifth, previous adoption of management tools is observed in most companies. While all cases agree that previous experience plays a major role in knowledge base and foster acquisition, it appears that expert companies go one step further by making a strong managerial connection between all tools, systems and standards implemented in the firm. Likewise, several beginner companies see the importance in making this connection, but it has not occurred in such a form as experts at the moment.

Two additional capabilities emerge in this study, including room for learning and top management support. Beginner and expert companies alike all emphasize the importance of creating room for knowledge acquisition on sustainability management. In the expert companies, this room is allotted by

creating a completely new job for a sustainability manager versus just having an environmental officer that has many other responsibilities in the company, which was the case in all beginner companies. Furthermore, providing room for learning is not just limited to one person, but open to all employees of the firm. This room is presented in the allowance of attending conferences and external training sessions as well as the ability to use work time to acquire knowledge on sustainability task. However, this appears to still not be a fully exploited capability in beginner companies.

Top management support is an extremely important support factor for knowledge acquisition on sustainability management in SMEs. Such support might be considered a lever that allows all the other capabilities to take form. This is particularly important in SMEs, which already have limited resources and manpower to allocate on sustainability activities. Without this support, sustainability management will not be developed. Interestingly, seven of the ten companies, both beginner and expert cases (MB, FP, OB, BR, WP, TH and SF), are solely focused on organic products and eco-friendly services, which has gained full management support from the outset. Nevertheless, the top management of the three conventional companies (RC, PM and LS) also stand behind sustainability management. As one company emphasizes: In the end, the only difference between beginner and expert cases with regard to top management support for sustainability management tools is timing. Most expert companies decided in the last five years or more to implement an EMS and continually build its sustainability management from there. The beginner companies, while also producing and selling sustainable products during the same span, decided to start implementing sustainability management tools very recently. This makes all the difference in regard to level of knowledge and application of sustainability management tools.

Table 5 provides an overview of the internal support factors for knowledge acquisition and the patterns that are revealed between beginner and expert companies. While one exception (flexibility) exists to these varying patterns between beginner and expert companies, many varying tendencies can be observed between both groups.

Internal Support Factors	Beginners	Experts
Shared Vision	Realize the benefits from this capability, but still in early phases in employee involvement, which is mostly passive at the moment.	Realize the benefits, and actively involved their employees through training and events for synergistic knowledge acquisition.
Employee Qualifications	In development stages of growing these skills and qualifications. Challenge of matching the right employees to develop the right skills.	Encourage increasing qualifications in existing employees as well as hiring ones with exceptional skills for sustainability management. Employee motivation is equally important to skills.
Education & Training	Little training for sustainability management offered, seen more as a chore than a capability.	Use formal, regular education and training to promote employees.
Flexibility	No emerging pattern between beginner and expert cases. Infrequently exploited capability (just 2 cases) for knowledge acquisition of sustainability management.	
Previous Adoption of Management Systems	Experience with previous applied systems aids in knowledge acquisition for additional tools, but systems are not integrated.	Utilizes previous systems experience and integrates applied systems and tools, which function together harmoniously.
Room for Learning	Creating free room for knowledge acquisition extremely valued, but other managerial tasks often compete time wise. No sustainability manager position created in the firm.	Room for learning allotted for every employee and coordinated by sustainability manager (independent position). Such managers focus entirely on sustainability issues and act as knowledge agents in the firm.
Top Management Support	Top management support is relatively new for such tools, so other capabilities such as creating a shared vision and room for learning need further development.	Top management support for five plus years. This reflects the further development of many internal support factors for knowledge acquisition (shared vision and training).

Table 5 – Comparison between beginners and expert cases on internal support factors

Forms of External Cooperation

Several forms of cooperation that SMEs engage in to support knowledge acquisition practices include enterprise-university cooperation, active participation in networks and involvement in strategic alliances. Unlike the communication practices with external stakeholders, these cooperation forms imply a strong commitment to external partners, allowing more structure knowledge acquisition (Caloghirou et al. 2004). An additional cooperation possibility, forming sustainability communities, was established during the study. These four cooperation forms will be explained individually.

First, cooperation between enterprises and universities can be found in all case enterprises, only in different forms and levels of intensity. From a limited, project-oriented connection to one university to setting up multiple cooperatives with various higher learning institutes, all case companies confirm the

importance of such cooperation for knowledge acquisition in sustainability management. Professors and researchers bring expert knowledge to these case companies and provide feedback on the actual developments in this area. Students offer a fresh perspective as well as being highly motivated to solve sustainability-related problems in a business setting. While most beginner companies think along the lines of projects with universities, several expert companies establish long-term relationships with university partners. One of the prime sources of knowledge is through cooperative projects where students are involved.

Second, most companies actively participate in some sort of industry networks. These networks vary from local to nation-wide collaborations. Expert companies are very much involved with nation-wide organizations, where participating firms originate from various industries. In turn, they find innovative ideas that they would never have dreamed of in their own branch. Whereas expert companies branch out to national networks, beginner companies stay closer to home and cooperate mostly within other companies their own industry. The beginner cases find that this type of network allows them to collect the most knowledge for sustainability management in a short time, since it is closely related to their business.

Third, the involvement in strategic alliances and public private partnerships is not practiced in most beginner companies. Therefore, it is difficult to establish any emerging patterns between experts and beginners cases for this sort of cooperation. Expert cases engage in such alliances, in which the cooperation was mostly formed between suppliers and customers to help develop new technologies and products, in which close cooperation was necessary. One expert case company has a supplier development system in place, which allows the firm to acquire knowledge on a regular basis from its suppliers through routine exchanges:

Finally, a newly discovered channel for cooperation is through the formation of sustainability communities, which only was discovered in the expert companies. While none of the beginner companies were actively involved in such cooperation, the reason for it is not clear. Perhaps more research could shed light on this area. As for expert companies, is seems that such communities are created with other companies and local officials to bring sustainability forward. This also creates a positive atmosphere to generate knowledge.

Table 6 provides an overview the various channels for cooperation for knowledge acquisition and the patterns that are revealed between beginner and expert companies. These are the overlying tendencies formed between beginner and expert groups.

Form of Cooperation	Beginners	Experts
Enterprise-University Cooperation	Short-term relationships, usually based on the current need of the company.	Long-term relationships with multiple university partners. Acquisition of knowledge stems from programs involving students.
Network Participation	Mostly local, industry based networks where they acquire knowledge closely related to their business.	Open to both local and nation-wide networks, inside and outside of own industry. Find wide array of sustainability solutions that might never have acquired in own industry.
Strategic Alliances	Exists in one case. Rather frequent but casual communication with suppliers and customers is preferred.	More prevalent (four of five cases). Several companies developed formal supplier development program, in which knowledge can be acquired directly through alliance.
Sustainability Communities	Not observed in the beginner companies.	Communities created between local companies, officials and leaders. Creates an open atmosphere where knowledge is acquired in new ways.

Table 6 – Comparison between beginners and expert cases on forms of cooperation

Discussion

While the previous literature gives a good overview of knowledge acquisition practices carried out in SMEs (Roy and Thérin, 2008), this paper provides a more detailed explanation on how these practices are handled. This exploratory approach was able to specify exactly how such practices are conducted, and how many persons are involved in knowledge acquisition. For example, using the internet is accomplished on a continuum between an individual, ad hoc activity and a structured approach providing a continuous flow of new knowledge through newsletters with less effort by one individual, while encouraging more sharing with various employees in a firm. This latter approach creates a synergy effect to knowledge acquisition. Through a concerted effort, SMEs can increase their knowledge bases by involving many employees versus handling it from an individual approach.

On one hand, environmental officers in beginner companies appear to conduct individual searches when they have a special need for more knowledge on a subject. While it is not questioned in this paper whether these individuals keep the acquired knowledge for themselves or pass it on to others through meetings, training and so on, it appears that no structure or system is established to distribute particular knowledge to others in the enterprise. Beginner companies consider such knowledge acquisition practices as an individual task. On the other hand, environmental officers in expert companies act as knowledge acquirers and distributors, so that knowledge reaches as many people as necessary in the firm. Expert companies do not just see knowledge acquisition as an individual task, but rather something that is accomplished on a company-wide level involving as many persons as deemed necessary.

Furthermore, expert companies appear to effectively manage these scanning activities, partially allowing knowledge on sustainability management to come to them versus having to do sporadic and lengthy searches.

Regarding the level of structure of knowledge acquisition practices for sustainability management, it appears that expert companies find more synergistic and effective ways to gain new knowledge. This has been especially demonstrated through the scanning activities use of the internet, newsletter and journal subscriptions, as well as the communication with customers and suppliers. From a bird's eye view, knowledge acquisition occurs somewhere on a spectrum between individual, impromptu scanning and communication to a well-structured system with multiple staff involved, facilitating the full potential of knowledge that can be recognized and acquired. While expert cases typically subscribe the latter portion of the scale, sustainability management is a constantly moving target (Schaltegger and Burritt 2005). Knowledge that was acquired five plus years ago might have little relevance today. Companies must continue to place an emphasis on effective systems for knowledge acquisition to stay current on sustainability issues. Alternatively, newcomers to this field will most likely not remain idle at the other end of the spectrum. Most beginner cases expressed their intentions to set up such systems, even if they have not yet put them to practice. Furthermore, beginners can emulate the best practices of expert cases.

This discussion of results attempts to build bridges between such beginner and expert practices, and it provides linkages to the supporting functions to such practices. For starters, the internal support factors – company-wide shared vision – can lead to improving knowledge acquisition practices, such as scanning the internet, skimming journals, attending conferences and external trainings. When main goals are clearly communicated and supported from top management, employees understand why they are acquiring knowledge and they are more likely to contribute and share it with others in the firm (Tilleman, 2012).

Second, qualified and motivated staff involved in the knowledge acquisition process will act as a catalyst to strengthen the knowledge acquisition practices. Qualified personnel can better recognize which knowledge is important to the company. Third, the emphasis on education and training improves knowledge acquisition as well as employee qualifications. This learning capability works especially well when employees are encouraged to bring the knowledge they learn and apply it to their particular work atmosphere. When such employees understand the firm's overall vision and are properly trained on sustainability issues, the more likely they become involved in the system, aiding to acquire knowledge and pass it on to others. Thus, this creates a synergistic effect in the enterprise.

Furthermore, the previous adoption of management systems, such as an EMS, can be extremely helpful to better understand and attain proper knowledge for new methods and tools. In particular, it helps to reduce time for acquiring new knowledge as previous experience guides the knowledge and application processes of new tools. However, it is grasped in this paper that applying tools is not enough. Rather

managers should strive to find a connection between them in order to create operational efficiencies and find overlaps of knowledge from them. By doing so, the responsible employees can find ways to link knowledge and learning from one system into the next.

Two new internal support factors were discovered, including creating room for learning and top management support. Providing room for learning also has a positive influence on the knowledge acquisition practices. The more room employees have to learn about sustainability management through use of the internet, scanning journals, attending conferences and receiving external training, the greater the absorptive capacity is for a firm, especially when this room is allotted to multiple employees. Top management support is indicated by all cases as the most important capability, which allows all the other capabilities to flourish. As found in other studies, the support of top management encourages knowledge acquisition and leads to the application of sustainability management tools (Halila, 2007; Hsu and Cheng, 2012; Johnson, 2013).

According to the forms of cooperation, the extent of knowledge acquisition from external partners can be related to the existence of a partnership. For many beginner cases, communication with external partners seems to be occurring on a more frequent basis; however, the type of exchange is less structured and limited in the sense information flows between partners. In contrast, expert cases pursue more structured, long-term relationships with various stakeholders (universities for example), depending on knowledge stemming from open dialogues and even audits. The frequency of communication does not indicate an effective acquisition of knowledge, but rather the close ties to stakeholders through established cooperation and networks are essential. Moreover, expert cases appear to be open to knowledge outside of their own industries, which opens up new ideas and opportunities for them. Nevertheless, more research is need to understand the linkages between communication and cooperation, and their effects on overall knowledge acquisition.

Conclusions

Bridging the divide of knowledge acquisition practices from individual to concerted efforts, the possibilities to increase absorptive capacities in SMEs becomes more transparent. Even though it takes time to gain the experience and to establish the internal support factors supporting knowledge acquisition for sustainability management, this paper stresses that a concentration on a proper mix of internal support factors (e.g. shared vision and employee training) and external cooperation forms (e.g. enterprise-university cooperation) should facilitate this process. In order to improve the efforts towards knowledge acquisition, possible suggestions for SME management are to involve employees and promote education and learning, even if just in-house training. If possible, a simple, but clearly communicated approach to acquire and pass on knowledge creates tremendous opportunities for

increasing the knowledge base for sustainability in a SME. Most beginner companies admitted this is a desired goal, but they are still in the planning stages at the moment.

If feasible for a SME, a good starting point to promote internal support factors would be through the creation of the sustainability manager position in the firm. When such a position is in place, it can be directly linked to improving knowledge accumulation in the company. All expert companies admitted that the sustainability manager position allows room for learning and sharing with others. If not feasible, other employee coordination and involvement methods are available. Such methods include regular employee meetings (e.g. Friday luncheons), suggestion schemes and idea management (e.g. letterboxes for suggestions). Administration of these methods might also be costly and time consuming, but if executed properly, they do provide additional avenues for knowledge acquisition and sharing within the company.

Knowledge acquisition practices, whether they involve scanning the internet or receiving professional training from external sources, must still be in line with the vision and support from top management of the company. The case companies in this study were selected because they all strive for sustainability management in their respective businesses. While most of the recommendations in this paper will be of little practical use to an enterprise without a sustainability orientation, the results and preceding discussion provide novel insights for a newcomer striving to enhance its knowledge acquisition practices for sustainability management and application of related tools. Again, all these efforts require particular internal support factors to facilitate acquisition practices for sustainability.

Limitations and Future Research

This paper chiefly focuses on knowledge acquisition practices. While several insights could be extended to how knowledge is shared throughout an enterprise, more research is needed on the other dimensions of absorptive capacity, especially in the transformation and exploitation (for an overview, see Zahra and George, 2002; Lane et al., 2006). Future studies could also link all these dimensions together to assess how the total interlinked system might provide sustainable competitive advantages to firms with best practices and capabilities in all these dimensions.

In addition, future research could advance this study by exploring these internal support factors and forms of cooperation individually and in various industrial contexts. From an individual perspective, further case studies could investigate if certain internal support factors and forms of external cooperation have an impact on knowledge acquisition practices in SMEs. For example, Hansen and Klewitz (2012) have conducted such a study on one form of cooperation, i.e. public private partnerships, and how it affects the absorptive capacity in ecologically innovative SMEs. From research on various industrial contexts, it could be investigated if particular internal support factors, such as employee qualifications

and flexibility, are more prevalent for knowledge acquisition in specific industries compared to other ones, which this study did not control for industry affiliation.

In conclusion, this paper calls attention to various knowledge acquisition practices for sustainability management, and connects them to supporting internal factors and forms of external cooperation. The results highlight that certain acquisition practices (e.g. use of the internet, skimming journals) might be enhanced through particular internal factors (e.g. shared vision, room for learning, etc.). Furthermore, the extent of internal support or external cooperation relies heavily on the level of backing from top management. Several forms of cooperation improve the knowledge acquisition versus informal communication with the same external parties (for example enterprise-university cooperation versus informal exchange with researchers and students). If properly established, the internal support and external forms of cooperation may allow knowledge acquisition to occur on a more effective and structured level.

References

Abrahamson E (1991) Managerial Fads and Fashions: The diffusion and rejection of innovations. *Academy of Management Review* 16(3): 586-612.

Ammenberg J and Hjelm O (2003) Tracing business and environmental effects of environmental management systems: A study of networking small and medium-sized enterprises using a joint environmental management system. *Business Strategy and the Environment* 12(3): 163-174.

Aragón-Correa JA, Hurtado-Torres N, Sharma S and García-Morales VJ (2008) Environmental strategy and performance in small firms: A resource-based perspective. *Journal of Environmental Management* 86(1): 88-103.

Bansal P (2005) Evolving Sustainably: A longitudinal study of corporate sustainable development. *Strategic Management Journal* 26(3): 197–218.

Borga F, Citterio A, Noci G and Pizzurno E (2009) Sustainability report in small enterprises: Case studies in Italian furniture companies. *Business Strategy and the Environment* 18(3): 162-176.

Bradford J and Fraser ED (2008) Local authorities, climate change and small and medium enterprises: Identifying effective policy instruments to reduce energy use and carbon emissions. *Corporate Social Responsibility and Environmental Management* 15(3): 156-172.

Burke S and Gaughran WF (2007) Developing a framework for sustainability management in engineering SMEs. *Robotics and Computer-Integrated Manufacturing* 23(6): 696-703.

Caloghirou Y, Kastelli I and Tsakanikas A (2004) Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance? *Technovation* 24(1): 29-39.

Chalmers DM and Balan-Vnuk E (2012) Innovativing not-for-profit social ventures: Exploring the microfoundations of internal and external absorptive capacity routines. *Inernational Small Business Journal* 31(7): 785-810.

Christmann P (2000) Effects of 'best practices' of environmental management on cost advantage: The role of complementary assets. *Academy of Management journal*, 43(4): 663-680.

Cohen WM and Levinthal DA (1990) Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35(1): 128-152.

Collins E, Lawrence S, Pavlovich K and Ryan C (2006) Business networks and the uptake of sustainability practices: The case of New Zealand. *Journal of Cleaner Production* 15(8): 729-740.

Darnall N and Edwards D (2006) Predicting the cost of environmental management system adoption: The role of capabilities, resources and ownership structure. *Strategic Management Journal* 27(4): 301-320.

Darnall N, Henriques I and Sadorsky P (2010) Adopting proactive environmental strategy: The influence of stakeholders and firm size. *Journal of Management Studies* 47(6): 1072-1094.

Eisenhardt KM (1989) Building theories from case study research. *Academy of Management Review* 14(4): 532-550.

Epstein MJ (2008) *Making sustainability work: Best practices in managing and measuring corporate social, environmental and economic impacts.* London: Greenleaf Publishing.

Epstein MJ and Roy M-J (2001) Sustainability in action: Identifying and measuring the key performance drivers. *Long Range Planning* 34(5): 585-604.

European Commission (2005) The new SME definition: User guide and model declaration. Available at: http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_use_guide_en.pdf. (accessed 15 April 2014).

Fresner J and Engelhardt G (2004) Experiences with integrated management systems for two small companies in Austria. *Journal of Cleaner Production* 12(6): 623-631.

Friedman AL and Miles S (2002) SMEs and the environment: Evaluating dissemination routes and handholding levels. *Business Strategy and the Environment* 11(5): 324-341.

Graafland J, van de Ven B and Stoffele N (2003) Strategies and instruments for organising CSR by small and large businesses in the Netherlands. *Journal of Business Ethics* 47(1): 45-60.

Grant RM (1996) Toward a Knowledge-Based Theory of the firm. *Strategic Management Journal* 17(2): 109-122.

Hahn T and Scheermesser M (2006) Approaches to corporate sustainability among German companies. *Corporate Social Responsibility and Environmental Management* 13(3): 150-165.

Halila F (2007) Networks as a means of supporting the adoption of organizational innovations in SMEs: The case of Environmental Management Systems (EMSs) based on ISO 14001. *Corporate Social Responsibility and Environmental Management* 14(3): 167-181.

Hansen EG and Klewitz J (2012) The role of an SME's green strategy in public-private eco-innovation initiatives: The case of Ecoprofit. *Journal of Small Business & Entrepreneurship* 25(4): 451-477.

Hillary R (2000) *Small and Medium-Sized Enterprises and the Environment*. Sheffield: Greenleaf Publishing.

Hillary R (2004) Environmental management systems and the smaller enterprise. *Journal of Cleaner Production* 12(6): 561-569.

Hofmann KH, Theyel G and Wood CH (2012) Identifying Firm Capabilities as Drivers of Environmental Management and Sustainability Practices: Evidence from Small and Medium-Sized Manufacturers. *Business Strategy and the Environment* 21(8): 530-545.

Hörisch J, Johnson MP and Schaltegger S (2014) Implementation of Sustainability Management and Company Size: A Knowledge-Based View. *Business Strategy and the Environment*. DOI: 10.1002/bse.1844.

Hsu JL and Cheng MC (2012) What prompts small and medium enterprises to engage in corporate social responsibility? A Study from Taiwan. *Corporate Social Responsibility and Environmental Management* 19(5): 288-305.

Inkpen AC and Dinur A (1998) Knowledge management processes and international joint ventures. *Organization Science* 9(4): 454-468.

Jansen JJ, van den Bosch FA and Volberda HW (2005) Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Academy of Management Journal* 48(6): 999-1015.

Johnson MP (2013) Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools. *Corporate Social Responsibility and Environmental Management.* DOI: 10.1002/csr.1343.

Kogut B and Zander U (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science* 3(3): 383-397.

Lane PJ, Koka BR and Pathak S (2006) The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review* 31(4): 833-863.

Lepoutre J and Heene A (2006) Investigating the impact of firm size on small business social responsibility: A critical review. *Journal of Business Ethics* 67(3): 257-273.

Loorbach D and Wijsman K (2013) Business transition management: Exploring a new role for business in sustainability transitions. *Journal of Cleaner Production* 45: 20–28.

Lourenço F, Jones O and Jayawarna D (2012) Promoting sustainable development: The role of entrepreneurship education. *International Small Business Journal* 31(8): 841-865.

McKeiver C and Gadenne D (2005) Environmental management systems in small and medium businesses. *International Small Business Journal* 23(5):513–537.

Meske C and Stieglitz S (2013) Adoption and use of social media in small and medium-sized enterprises. In: Harmsen F and Proper H (eds) *Practice-Driven Research on Enterprise Transformation*. Berlin: Springer, pp. 61-75.

Parisi C. and Maraghini P (2010) Operationalising Sustainability: How Small and Medium Sized Enterprises Translate Social and Environmental Issues into Practice. In: Tatichhi P (ed) *Business Performance Measurement and* Management. Springer: Berlin, pp. 131-147.

Perez-Sanchez D, Barton JR and Bower D (2003) Implementing environmental management in SMEs. *Corporate Social Responsibility and Environmental Management* 10(2): 67-77.

Perrini F and Tencati A (2006) Sustainability and stakeholder management: The need for new corporate performance evaluation and reporting systems. *Business Strategy and the Environment* 15(5): 296-308..

Revell A and Blackburn R (2007) The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors. *Business strategy and the environment* 16(6): 404-420.

Revell A and Rutherfoord R (2003) UK environmental policy and the small firm: Broadening the focus. *Business Strategy and the Environment* 12(1): 26-35.

Revell A, Stokes D and Chen H (2010) Small businesses and the environment: Turning over a new leaf? *Business Strategy and the Environment* 19(5): 273-288.

Roy MJ and Thérin F (2008) Knowledge acquisition and environmental commitment in SMEs. *Corporate Social Responsibility and Environmental Management* 15(5): 249-259.

Russo A and Tencati A (2009) Formal vs. Informal CSR Strategies: Evidence from Italian Micro, Small, Medium-sized, and Large Firms. *Journal of Business Ethics* 85(2): 339-353.

Schaltegger S and Burritt R (2005) Corporate Sustainability. In: Folmer H and Tietenberg T (eds) *The International Yearbook of Environmental and Resource Economics 2005/2006: A Survey of Current Issues*. Cheltenham: Edward Elgar, pp. 185-222.

Schaltegger S, Windolph SE and Herzig C (2012) A longitudinal analysis of the knowledge and application of sustainability management tools in large German companies. *Society and Economy* 34(4): 549-579.

Starik M and Kanashiro P (2013) Toward a theory of sustainability management: Uncovering and integrating the nearly obvious. *Organization & Environment* 26(1): 7-30.

Steurer R, Martinuzzi A and Margula S (2012) Public Policies on CSR in Europe: Themes, Instruments, and Regional Differences. *Corporate Social Responsibility and Environmental Management* 19(4): 206-227.

Tilleman S (2012) Is Employee Organizational Commitment related to Firm Environmental Sustainability? *Journal of Small Business & Entrepreneuship* 25(4): 417-431.

United Nations World Commission on Environment and Development (1987) *Our Common Future. The Brundtland Report*. Oxford: Oxford University Press.

Yin RK (2003) Case Study Research: Design and Methods. Third Edition. Thousand Oaks: Sage.

Zahra SA and George G (2002) Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review* 27(2): 185-203.

V. Paper 5

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Software and Web-Based Tools for Sustainability Management in Micro-, Small- and Medium-Sized Enterprises

Matthew Johnson[1], Jantje Halberstadt[2], Stefan Schaltegger[3] and Tobias Viere[4],

Abstract

Recently, new approaches to organizational level sustainability management and reporting have emerged in the form of software and web-based applications. At first glance, it appears that such software and web-tools are applicable in small and medium-sized enterprises (SMEs) since they offer user-friendly and cost-effective alternatives to implement, manage and report on company-wide sustainability activities. Nevertheless, it remains academically and practically uncertain if such technologies will be adopted by a great number of SMEs. Using the Technology-Organization-Environment (TOE) model as a theoretical framework and empirical data from a recent survey with 1,250 German SMEs, the first part of this paper investigates various firm-internal and external factors that might influence managers' decisions to adopt or reject this new technology. As a result, this paper can help determine which factors play a role in the adoption of sustainability management software and web-tools in SMEs.

The second part of this paper argues that despite the availability of the current sustainability management software on the market, these practical solutions have overlooked a certain type of business, namely micro-enterprises and startup companies. Based on existing tools and the examination in the first part, we propose a conceptual framework of an IT-supported sustainability analysis and reporting scheme for micro-enterprises and startups. Based on the previous research on sustainability management software in SMEs, the paper explains the main content and layout of such a web-based tool.

Keywords: Sustainability management software; Small and medium-sized enterprises; Quick-Check; Technology-Organization-Environment (TOE) framework; Web-based tools

[1] Centre for Sustainability Management, Leuphana University Lüneburg, 21335 Lüneburg, Germany, johnson@uni.leuphana.de
[2] Centre for Sustainability Management, Leuphana University Lüneburg, 21335 Lüneburg, Germany, jantje.halberstadt@leuphana.de
[3] Centre for Sustainability Management, Leuphana University Lüneburg, 21335 Lüneburg, Germany, schaltegger@uni.leuphana.de
[4] Institute for Industrial Ecology, University of Applied Sciences Pforzheim, 75175 Pforzheim, Germany, tobias.viere@hs-pforzheim.de,

Part I: Adoption of Sustainability Management Software in SMEs

1.1 Background

Large and small businesses are increasingly confronted with sustainability issues, such a rising energy costs and health and safety issues of employees. At the same time, companies of all sizes are challenged by regulations, public scrutiny, and changing consumer preferences to take responsibility for their company endeavors and the linked effects to environment and society. Sustainability management can address these issues through proactive sustainability strategies and company-led initiatives, such as improved energy efficiency, company-wide environmental management, integrative sustainability reporting, etc. (Hörisch et al. 2014). Depending on the particular industry and challenges an enterprises faces, various management tools have been developed to support managers assess, measure and communicate these sustainability activities (Johnson 2013; Schaltegger et al. 2012).

While large multi-national corporations development and implement a range of sustainability management strategies and tools, small and medium-sized enterprises (SMEs) are oftentimes lacking the necessary resources, personnel and know-how to effectively management growing environmental and social concerns relating to their business (Hillary 2004). Many formal and complex management tools, such as the Sustainability Balanced Scorecard or life cycle assessment, find little practical application in SMEs (Johnson 2013). With few exceptions (Perrini & Tencati 2006), relatively few developments and academic attention have focused on SME-specific solutions for sustainability management.

In addition, it remains uncertain which tools will find widespread application in SMEs. For example, an environmental management system (EMS) according to ISO 14001 or the Eco-Management and Audit Scheme (EMAS) are witnessing a period of stagnation to find new German company members. It appears that most companies remain unaware of the potential advantages of environmental and sustainability management. However, recent studies by Schaltegger et al. (2012) showed that the rate of application for sustainability management tools is strongly related with the rate of awareness and that differences between large and small companies may be due to a different level of specific sustainability management knowledge (Hörisch et al. 2013). Johnson (2013) furthermore, showed for SMEs that the higher the awareness of a tool (e.g. an EMS), the more likely that SMEs will adopt it. Therefore, a solution would be to promote awareness-raising programs for such tools in SMEs through governmental initiatives and business network meetings.

More recently, new approaches to sustainability management have emerged in the form of software and web-based applications to support companies of all sizes assess, control, manage and report on their sustainability activities (Marx-Gómex et al. 2013; Süpke et al. 2009). Organizational software and web-tools have been designed to facilitate various management tasks related to sustainability, such as self-assessment and strategy formation on sustainability aspects, sustainability controlling and benchmarking

(e.g. EPM-Kompass; Günter & Kaulich 2005); and sustainability reporting (Isenmann 2004) as well as administration of occupational safety and environmental management (e.g. EcoTra; Maijala and Pohjola, 2006).

However, an all-embracing software or web-tool containing all integrative aspects of sustainability management and covering all management aspects is currently not available (Muuß & Conrad 2012). Even so, few SMEs would likely adopt such a software program mostly due to high implementation and maintenance costs. There also is an apparent inhibition from managers to allow a software application provide specialized knowledge about sustainability aspects without the additional consultation of experts (Steurer et al. 2012).

With very limited exceptions (Álvarez 2013; Günter & Kaulich 2005), research has not yet investigated the adoption of sustainability management software and web-tools in SMEs. Furthermore, a research gap has emerged on the firm-level factors that influence the decision to adopt or reject such software and web-tools. The first part of this paper attempts to fill the knowledge gap on possible application in SMEs by providing initial insights on the main influential factors that might affect the adoption of software and web-tools.

1.2 Sustainability Software for SMEs in German-speaking countries

Sustainability management entails a simultaneous organization of economical, ecological and social aspects regarding business activities in a conscious effort to improve environmental and social performance while remaining competitive and economically viable (Dyllick & Hockerts 2002; Schaltegger & Burritt 2005). In this light, a company should steer its activities in such a way to reduce negative effects and/or achieve positive outcomes for the social and environmental aspects related to business operations, while contributing to the sustainable development of society and the economy (Schaltegger et al. 2003). Visions and strategies of corporate sustainability in turn aim to integrate all these activities into the core business of a company. To support this integration, companies are now provided with a wide set of options, including sustainability management tools and software applications to operationalize sustainability-driven strategies (Schaltegger et al. 2014). A wide range of tools can facilitate managerial tasks with many areas of application, including accounting, research and development, procurement and production, supply chain management as well as cross-functional activities (Windolph et al. 2013).

Similarly to tools, software and web-based applications supporting the implementation of sustainability management can facilitate various management tasks including the assessment, controlling, management and communication (i.e. reporting) of sustainability activities. Commercialized software applications are increasingly emerging, promising to enable the overall coordination and communication

of sustainability-related tasks shared between various functions and employees within the company. While it is understood that software is not a substitute for the human factor – from strategic visions and planning to the manual input and coordination of data – it appears that software can offer many promising advantages once the strategies and responsibilities have been properly assigned. Table 1 below presents an overview of the available web-based tools for SMEs:

Product	Provider	Sustainability Aspects	Application Area
360 Report	360 Report	integrative	reporting
CR Kompass	WeSustain	integrative	assessment, reporting
EcoEnterprise	EcoEnterprise	ecological	controlling, management
EcoWebDesk	EcoIntense	ecological	controlling, management
EPM-Kompass	TU Dresden	ecological	controlling
EffiCheck	PROOFIT	ecological	assessment
Green Software	Avanti	integrative	assessment, management
N-Kompass	NWB	integrative	assessment, management
Quick-Scan	Efficiency Agency	ecological	assessment
Sustainability Manager	TÜV Rheinland	integrative	assessment
Verso Management	Verso	integrative	assessment, reporting

Table 1: An overview of web-based applications for sustainability management

At first glance, it appears that sustainability management software and web-tools are applicable to SMEs. These applications offer a cost-effective approach to introducing sustainability management in the company and allowing managers to deal with sustainability activities in an organized manner. They can be tailored to an enterprise's particular structure and provide user-friendly features, such as a multi-user function allowing multiple persons to work simultaneously on one project as well as offering a manageable step-by-by instructions, so that additional training is not required to input and retrieve the necessary data. While several authors promote the applicability of such software (Günter & Kaulich 2005), there is a lack of empirical evidence on the adoption of such software in SMEs. It remains unclear if firm-level software and web-based tools for sustainability management will be applied by a great number of SMEs. Previous research has yet not investigated which internal and external factors play a role in decision-making to adopt such technologies. Therefore, these practical and scientific uncertainties have lead us to propose the following research question:

Which firm-internal and external factors influence the adoption of software and web-based tools for sustainability management in SMEs?

Instead of examining the current success and failure rates of individual software application and web-tools, this paper investigates various organizational and external factors that might influence adoption rates from a wider perspective. Using the Technology-Organization-Environment framework, it is possible to quantify which particular factors influence the rate of adoption for these new technologies for an enterprise's sustainability management. The next section will explain how the research question was addressed using this framework.

1.3 Technology-Organization-Environment Framework

With the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer 1975) this paper examines various firm-internal and external factors that might influence decision-making for new technologies in SMEs. The TOE framework can be very useful in explaining the adoption and implementation of technologies at the organizational level. In its original form, the TOE framework combines factors in three contexts, including technological factors, internal or organizational factors, and external or environmental factors. This framework is flexible in the sense that it is possible to add a fourth context, individual factors, which was the case in this paper.

The TOE framework has been frequently applied to research on the adoption of new software and web-based solutions in SMEs, particularly with Enterprise Resource Planning (ERP) software (Buonanno et al. 2005; Ramdani et al. 2009; 2013) and e-business solutions (Oliveira & Martins 2011; Zhu et al. 2003). These papers reveal which and how various factors, such as prior IT-knowledge, attitude towards new software, top management support and external IT-support, play a role in firm-wide decision making to adopt such software. For example, Ramdani et al. (2009) illustrate how the adoption of ERP software in SMEs is mostly influenced by top management support since the primary decision-maker in SMEs is typically the owner-manager.

However, no account has been found for the TOE framework in context of environmental or sustainability software. Therefore, this original paper applies an adapted form of the TOE-framework, including internal factors as well, to assess what exactly influences SMEs to adopt sustainability management software. Figure 1 below shows the overall research model as well as the various factors among the four contexts that were taken into consideration for this paper.

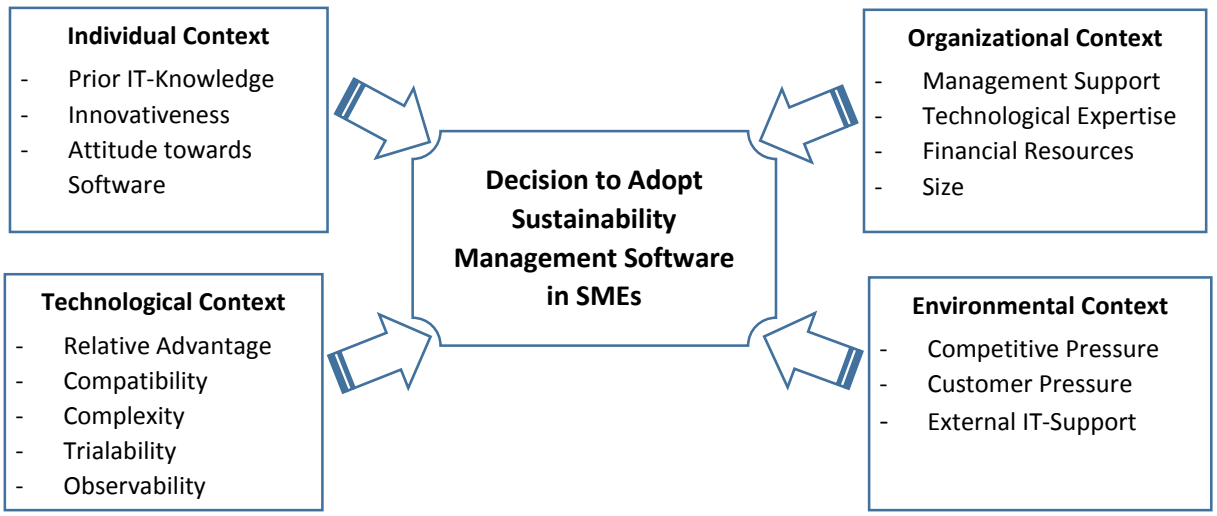

Figure 1: Adaptation of Technology-Organization-Environment (TOE) Framework from Tornatzky and Fleischer [21]

Within the individual context, three factors were selected, including prior IT-knowledge, innovativeness and attitude. Prior IT-knowledge explains an individual's beliefs about level of competency with IT, which in this case is the perceived ability to use the computer and related software applications. Innovativeness refers to the managers' willingness to take risks and try something new through experimentation. Attitude refers to a managers' positive or negative feelings about a new technology (Fishbein & Ajzen 1975). In this context, attitudes towards sustainability management software and web-tools are being assessed.

From the technological context, five factors were provided, including relative advantage, compatibility, complexity, trialability and observability. Relative advantage refers to the degree in which a manager perceives the software or web-tool to be superior to the previous method of operation. This factor is considered a key factor in improving the rate of new technology adoption to the extent that the innovation is perceived as advantageous (Hashem & Tan 2007). However, it might not be as relevant in the case of sustainability management software and web-tools as most SMEs have not previously have had a formal approach to sustainability up till now (Graafland et al. 2003). Compatibility explains the degree in which software is perceived to be well-matched with existing organizational structure and software usage. Complexity is the perceived extent to which a new technology is difficult to understand and use. This would be reflected as a negative value in comparison to rate of adoption. Trialability and observability focus on the degree in which software can be experimented on a limited basis and can be visible to others.

In the organizational context, four factors were included in the model – top management support, technological expertise, financial resources and firm size. For starters, support from top management can highly affect if such software will be implemented (Hashem & Tann 2007; Ramdani et al. 2013). Furthermore, the availability of in-house software support (technological expertise) and ample financial

resources may play a role in decision-making. Company size, measured by full-time employees, has been revealed as a major determinant for the rate of new technology adoption (Hashem & Tann 2007).

From the environmental context, three factors were selected, including competitive pressure, customer pressure and external IT-support. Competitive pressure measures the perceived intensity level of competition and resulting pressure to adopt new technologies to remain competitive. Customer pressure is the perceived feeling of demands from customers to adopt software. In the case of SMEs, this may occur through large companies demanding their suppliers to adopt a certain software. Finally, external IT-support examines the perceived availability of external support from software companies and from state-funded programs. The next section will explain how these factors are brought together in a quantitative analysis and provide the results.

1.4 Methods and Results

In order to address this paper's research question, an online survey was conducted with top managers in German small, medium and large-sized enterprises from February to June 2014. In order to gain a suitable representation of German SMEs in all industry sectors, enterprises have been selected and classified according to two main criteria. First, companies were evenly distributed into five groups in accordance with the European definition of SMEs (EU 2005). Table 2 below reveals the distribution of the sample according to numbers of full-time employees.

Company Size (Full-time employees)	**Number of contacted companies**	**Number of companies that completed the survey**
10 – 49	250	34
50 – 99	250	29
100 – 249	250	31
250 – 499	250	26
500 +	250	25
Totals	**1250**	**145**

Table 2: Distribution of sampled companies (according to employees)

Second, companies were selected according to various industry sectors. In total, enterprises from 10 main industries were included in the survey, including manufacturing, energy utilities, construction, wholesaler and retailers, transportation, gastronomy, and various service sectors. The number of companies selected from each industry was based on percentages of enterprises in each sector (German Statistics Office, 2013).

A total of 1,250 enterprises were sent an e-mail invitation to the online survey. However, 96 of these invitations were sent back as "not deliverable". In total, the survey produced 145 usable questionnaires

from the 1,154 e-mails delivered. The response rate is 12.6%, which is comparable with other surveys with similar focus of sustainability management in SMEs (Johnson 2013).

The online survey consisted of questions with mostly closed-form responses using a 7-point Likert scale. The dependent variable is the adoption of sustainability management software with the question, "Does your company currently use or plan to adopt sustainability management software within the next two years?" Questions on the relevant factors were organized according to the four contexts - individual, technological, organizational and environmental. For each individual factor within each context (e.g. "top management support" in the organizational context), three to eight questions were provided, and these questions were later averaged to represent the factor in the analysis stage.

An initial evaluation of the results examined the descriptive statistics of the data including mean values (Avg.) and standard deviations (S.D.) of studied factors of the TOE framework. These factors were investigated based on the answer to the lead question on adoption, that is either "decision to adopt" or "decision to reject". Adopters (decision to adopt) are managers who currently use sustainability management software and/or who intend to adopt such software within the next two years. Non-adopters (decision to reject) are managers who neither use nor plan to adopt such software. As expected, the group "decision to reject" was much greater (110 enterprises) than the group "decision to adopt" (35 enterprises). Table 3 below shows the descriptive statistics of mean values and standard deviations from the various influential factors between the two groups of respondents.

Factors	Adopters		Non-Adopters		Difference
Individual Factors	*Avg.*	*S.D.*	*Avg.*	*S.D.*	*Avg.*
Prior IT-Knowledge	4.43	1.06	4.55	1.39	- 0,12
Innovativeness	6.01	0.85	5.85	0.91	0.16
Attitude	4.80	1.41	2.93	1.35	1.87
Technological Factors					
Relative Advantage	4.59	1.23	3.91	1.27	0.68
Compatibility	4.47	1.29	3.67	1.24	0.80
Complexity	4.18	1.42	3.86	1.21	0.32
Trialability	4.02	1.61	2.33	1.48	1.69
Observability	4.90	1.61	2.02	1.52	2.88
Organizational Factors					
Top Management Support	4.36	1.44	2.92	1.51	1.44
Financial Resources	4.93	1.67	4.31	1.79	0.62
Technological Expertise	5.47	1.20	4.54	1.65	0.93
Environmental Factors					
Competitive Pressure	3.87	1.52	2.80	1.37	1.07
Customer Pressure	3.23	1.51	2.95	1.56	0.28
External IT-Support	3.65	1.29	2.76	1.18	0.89

Table 3: Averages and Differences between Factors in the Decision-Making of Software Adoption

From Table 3 we observe significant differences between both groups, adopters and non-adopters, with the factors personal attitude, trialability, observability, top management support and competitive pressures. From these preliminary results, we can deduce that managers' perceived awareness of commercialized software for sustainability management is a major determinant for adoption, where they can also test it on a limited basis (trialability) and see others using it (observability). Furthermore, the overall positive attitude towards software combined with added support from top management also positively influence the chances that such software will be used.

Other factors had also similar results, including top management support, technological expertise, competitive pressure and external IT-support. Even though the differences of two factors in the environmental context (i.e. competitive pressure and external IT-support) are substantial, the overall averages are moderate and even below average even for adopters. This means that external factors play a marginal role in the decision to adopt sustainability management software. Only one factor, namely prior IT-knowledge, was stronger for non-adopters than adopters; however, the difference is so small

that it is difficult to argue that commercialized software for sustainability management might be able to increase such IT-knowledge.

In a second step, a multi-logit regression analysis was conducted on those variables that had the greatest difference in mean values between the two groups (adopters and non-adopters). These selected variables include attitude, trialability, top management support, competitive pressure and external IT-support. Company size according to employee amounts was also included as a control variable. After a preliminary reliability screening, the variable 'observability' was removed because it too strongly predicts adoption, which makes all the other factors insignificant. In addition, the problem of multicollineartiy arose for the factor observability in the regression model, as the variance inflation factor (VIF) was above 4. While observability is clearly the strongest variable predicting adoption, other factors also play a role in the adoption of sustainability management software. From another point of view, it could be argued that the other variables first influence observability and then the latter strongly influences adoption. Table 4 below shows the results of the regression analysis.

Independent variables	**B**	**Wald**	**Sig.**	**Exp(B)**
Constant	-7.801	24.07	0.000	0.00
Attitude	0.496	2.87	*0.090**	1.64
Top Management Support	0.421	3.56	*0.059**	1.52
Trialability	0.590	5.72	*0.017***	1.80
Competitive Pressure	-0.171	0.39	0.534	0.84
External IT-Support	0.000	0.000	0.999	1.00
Company Size	0.697	6.71	*0.010****	2.01

Notes: * = p < 0.10; ** = p < 0.05; *** p < 0.01; N = 112

Table 4: Logistic regression model for the adoption of sustainability management software

The results of the regression analysis is statistically significant. This regression implies that a considerable portion of variation in the decision to adopt sustainability management software can be explained by the independent and control variables included in the model. According to the standard regression coefficient (B), four variables have significant degrees of influence, including company size, trialability, attitude and top management support.

The most significant variable is company size (0.697), followed by trialability (0.590), personal attitude (0.496; only significant at the 0.10 level), and top management support (0.421; only significant at the 0.10 level). While other studies confirm that size plays a significant role [2, 16], these presented individual (attitude) and internal factors (trialability and top management support) are key determinants for the decision to adopt sustainability management software. Competitive pressure and external IT-

support were both not significant, confirming the descriptive analysis that environmental factors do not influence managers' decision making on sustainability management software.

1.5 Discussion

Besides the strong influence of company size, the results show that the decision to adopt sustainability management software mainly depends on the observability – the awareness that sustainability management software exists – and trialability – SME managers have been able to try it out. Furthermore, SMEs managers will likely adopt sustainability management software if they have an overall positive attitude towards the software. It is also important that top management supports the decision to adopt it. Future research could further investigate these influential factors in qualitative interviews to better understand why companies should to adopt or reject such software.

While these results provide new insights on influential factors for the adoption of sustainability management software, several concerns remain. On one hand, it remains uncertain if companies with existing environmental and sustainability management systems have less of a need for commercialized software, as they have probably some IT-solution already, for example self-made Excel spreadsheets and Word documents. On the other hand, companies that are not interested in sustainability management in the first place will not perceive any benefit for related software.

While this study provides good insights for SMEs with more than 10 employees, the results did not include an important sub-category of SMEs – micro-sized enterprises. From the overview of the available sustainability management software and a conceptual framework based on the business model canvas by Osterwalder et al. (2010), we now present a novel concept for an online tool for micro-enterprises to assess and report on sustainability impacts of their business.

Part 2: Web-based Sustainability Management Tool for Micro-Enterprises

2.1 Background

With few exceptions (Zorpas 2010), previous research has not proposed company-level tools for sustainability management in micro-enterprises and particularly start-ups. While some research does exist on sustainable business models and plans (Boons & Lüdeke-Freund 2013), these models are more focused on sustainable innovations versus the core business itself. Such business models are difficult for most start-ups to implement because they mainly revolve around new business units than the core message of a new company. These business models also do not provide tools for a comprehensive sustainability evaluation and reporting system (Perrini & Tencati 2006).

Furthermore, IT-solutions have not considered the early stages of business creation from the actual start-up of a company to its further development as a micro-enterprise. In fact, it appears that literature has

overlooked certain category of businesses in the sustainability management context. According to the European Commission this category includes micro-enterprises with less than 10 employees and no more than 2 million Euro annual revenue.

However, mounting evidence suggests that start-ups and micro-enterprises should be considered in light of sustainable development for several reasons. First, sustainability is relevant for all companies in every industry of every economy (Schaltegger & Burritt 2005). Secondly, sustainability will never be achieved if the smallest companies do not get involved (Hillary 2000). Not only do micro-enterprises constitute a majority of all registered businesses, e.g. 2.8 million enterprises (ca. 80%) in Germany fall into the micro-enterprise range, they also feed many products and services into the larger companies as suppliers and service-vendors. Thirdly, while it could be argued that individual micro-enterprises transmit a puny, insignificant burden on the environment, it is their collective impact and spill-over into larger enterprises that raises major concerns.

Fourthly, besides the direct burdens placed on society and the environment, indirect effects can be attributed to the exemplary roles that entrepreneurs and owner-managers of small businesses hold in economies and societies that desperately look for heroes to right the wrongs of environmental degradation and intra-generational injustices through sustainability-driven goals and measures. When considering the good examples set by social entrepreneurs, such as Muhammad Yunus, and ecopreneurs, such as Klaus Hipp, new business founders need not just inspirational stories, but effective operational means and devices to steer their business endeavors into future-oriented sustainability enterprises (Schaltegger & Wagner 2011).

Last but not least, start-ups generally do not remain small but rather are growth-oriented (Gregory et al. 2005; Lewis et al. 1983; Yim 2008). As the size of the enterprise increases, so too does the relevance and motivations for sustainability management (Udayasankar 2008). In addition to well-known management problems of fast-growing enterprises (Jarillo 1989; Miller 2001), small business managers must be informed about the increasing environmental and social demands that rise with increasing size. For example, in the future it is plausible that medium-sized enterprises starting with 100 employees will be mandated by corporate law to state their environmental and social impacts through annual sustainability reports (Kolk 2004; van Wensen et al. 2010). Those owner-managers that have addressed with sustainability issues from the beginning might achieve a competitive advantage over those that decide to wait it out. The challenges of sustainability management in start-ups and fast growing companies should be integrated so to avoid a lengthy, costly period of playing catch-up.

Thus, the questions are raised: why should a start-up or micro-sized enterprise wait to reach a certain size in order to measure, manage and report on its sustainability activities? How could such a sustainability management program be conceptualized? What benefits would it bring the enterprise? Lastly, how might IT-solutions provide simple yet effective means to accomplishing these goals?

The aim of this paper is, therefore, not only to close the theoretical gap on appropriate sustainability measures for start-ups and micro-enterprises, but also to propose a conceptual framework for an IT-supported application that allows a company to easily assess and report its sustainability activities. This conceptual model will hopefully set the foundation for further practical developments. Based on previous research on sustainability management tools in SMEs (Johnson 2013) and private households, this conceptual paper proposes the contents and step-wise process of an IT-support tool for both start-ups and micro-enterprises. This tool, as we call the "Sustainability Quick-Check" (SQC) model, will be explained in the next section.

2.2 IT-supported Sustainability Quick Check Tool

Many of the existing processes for the preparation of sustainability assessments and reports are complex and contain a variety of indicators and metrics. In turn, this provides no clear path or structure for intuitive handling. One possible reason may be attribute to the fact that software applications were intended to be sold with additional consulting services. The aim of this paper is to develop a manageable and straightforward tool with a clear structure and based on understandable steps for a start-up and micro-enterprise.

The development of the SQC model is broken down into three complementary and sequential stages. In the first stage, a systematic analysis of the existing sustainability management tools and software and tools were examined. Based on Johnson (2013), it is established that not all management tools are applicable even in small and medium-sized enterprises (SMEs) with 10 or more employees. The most applicable tools for small businesses are those that correspond with well-established management practices, such as a quality management system, training and education on sustainability management, risk analysis, supply chain management and even an environmental management system.

In the second stage of analysis, several SME-adequate software and web-based applications, such as Avanti GreenSoftware (www.avanti-greensoftware.com/de/), CR-Kompass (www.crkompass.de/), N-Kompass (www.n-kompass.de/) and 360 Report (www.360report.org/de/) were closely examined. These software not only offer user-friendly, cost effective ways to analyze and report on sustainability management in SMEs, combined they provide a good overview of what criteria and indicators should be considered for sustainability management in small businesses. While these various applications offer great insights applicable topics and indicators for SMEs, it is still uncertain if these software packages and web-applications will be adopted by very small enterprises and start-up companies.

In the third stage, a grid was developed that allows a structured overview of sustainability topics and corresponding indicators for start-ups and micro-enterprises. The idea behind this structure was to combine the results from both the first and second stage of analysis with the ideas from business model canvas (Muuß & Conrad 2012). Suitable sustainability key performance indicators and metrics were

classified into various SQC-categories, such as production, supply chain management, sales and marketing and administration and supporting business functions (including strategy and human resources), and further broken down into key activities, key resources and key partners from both environmental and social perspectives. Table 1 below depicts example of possible categories, fields and aspects for the SQC model.

Basic Structure of the *Sustainability Quick Check (SQC)*		**Sustainability**	
		Ecological Aspects	**Social Aspects**
***SQC*-Category**	**Assessment field**	**Example Criteria**	
Production of Product / Service	Key Activities 	Energy and Water consumption in production (G4-EN3/ EN8)	Adherence to working hours and und guarantee of workplace safety (G4-LA5 und LA6)
	Key Resources 	Use of non-toxic and recycling materials and packaging (G4-EN1 und EN28)	Use of fair trade materials, incl. free from forced and child labor
	Key Partners 	Selection of regional, sustainable production partners, i.a. avoidance of long transport routes (G4-EN17 und EC9)	Support of the disadvantaged, e.g. collaboration with disabled persons
Supply Chain Management, incl. Logistics and Procurement	Key Activities	Shortening transport routes	Supply chain code of conduct and enforcement (audits); Supplier Training
	Key Resources	Environmentally conscious procurement (guidelines) for sustainable and environmentally safe materials (G4-EN2)	Purchasing requirements for fair products
	Key Partners	Selection of regional, environmentally friendly partners	Supplier selection and negotiations for fair and safe working practices

Market incl. Sales and Marketing	Key Activities	Market analysis and promotion of environmentally friendly products and services	Fair Marketing; Ensure transparency of social standards in own production and supply chain
	Key Resources	FSC- or PEFC-certified printed ads; paperless-advertising	Partnerships with NGOs (e.g. Cause-Related Marketing)
	Key Partners	Selection of environmentally conscious buyers and distribution points	Socially conscious buyers
Firm Structure, Administration and Human Resources	Key Activities	Training and support on the ecological performance of employees	Pay attention to equality in the workplace; Guidelines for recruitment (G4-LA1)
	Key Resources	Energy efficient Administration building (G4-EN3)	Employees with fair wages (G4-EC5)
	Key Partners	Employee participation in environmental activities	Employee participation in firm-internal decisions as well as firm-external community engagement projects

Figure 2 – Concept "Sustainability Quick-Check Tool"

The SQC model is based on some of the components of the aforementioned software, the value chain according to Porter (1985) and the business model canvas by Osterwalder et al. (2010). The value chain is the presentation and analysis of the primary (e.g. logistics, production or operations, sales and marketing) and secondary activities (e.g. administration, human resources, research and development) that support the primary activities, and together they bring value to a company's products and services. Similarly, this value chain has been used to assess environmental and social sustainability aspects along all these business activities (Schaltegger et al. 2003). Therefore, the value chain served as the basis for our selection of the four SQC categories, including production, supply chain, market and internal firm structure. Primary activities can be located in the first, second and their categories. For example, inbound and outbound logistics are combined with supply chain management and procurement into one category. The supporting activities provide an indirect but still supporting role in the production of products and/or services, and these are mostly located in the fourth category.

The business model canvas is a method of visualization of business models (Osterwalder et al. 2010). Business models describe the basic principles by which organizations create value, with the distinctions

made between three aspects: the product-market combination, the configuration of value chains and main revenue mechanisms. For the SQC, the configuration of value chains is considered to be particularly important, since this the area where sustainability-related decision are made. Also, this part of the business model fits well with Porter's (1985) value chain. A brief description of the product-market combination should precede the initial analysis, but it is actually not a part of the SQC since it is tailored for all kinds of startups and micro-enterprises. The environmental and social aspects of companies are already a part the business model, and they will be described separately in the product-market combination.

The business model canvas depicts a total of nine areas of a business model. The fields deemed particularly relevant for the SQC are the key activities, key resources and key partners. Key activities are those actions that are particularly important for a particular area of a business (in this case for each category, such as production of products and services). Key resources can be both physical and intellectual, human or financial resources. In addition, a sustainability management tool that carries information about desired sustainable processes, such as guidelines for environmentally conscious procurement and supply chains, can also be considered a key resource. Key partners consider essential partnerships into order to fulfill the key activities. Examples of partners are buyer-supplier relationships, and also strategic alliances with competitors and additional support organizations. This area ensure that sustainability issues are at the heart of cooperation, but partners must also be audited and consulted for conformity to an enterprises' sustainability goals.

These aspects should be monitored within each of the SQC categories to ensure that sustainability-related targets are met, and that he enterprise has the proper resources and partnerships to fulfill these actions. The analyzed sustainability reports can then account on the three pillars of sustainability: economic, environmental and social aspects. Since the development and description of business models and the development of business plans – economic criteria are already involved with every environmental and social aspect of the SQC. Therefore, the economic aspects are not given an own column in the model.

By associating environmental and social areas of action in the SQC categories, each key area can be seen as an individual aspect that provides the basis for an overall combinative effort for sustainability in a start-up or micro-enterprise. These aspects are also related to core indicators found in the GRI reporting scheme. These indicators can thus be assessed within the framework of a software application as bullet points to cover or as questions that must be answered within a project to establish sustainability criteria within a very small business. These core indicators selected were mostly confirmed through an overview of the new G4-criteria (GRI 2014).

2.3 Conclusions and Outlook

Overall, this paper was able to gain greater insights on the factors that influence the adoption of sustainability software in SMEs. It opens the discussion and offers new find pathways to consider in the adoption by highlighting the main factors that might encourage further adoption in SMEs. From a practical standpoint, it should help software developers understand their target market and position the product more effectively toward the end-user. In this way, the results can make a considerable contribution for future research to build from as well as support the further development of software in SMEs.

The results of this paper also provide both academic and practical implications. From an academic standpoint, the paper provides numerous points of departure for further interdisciplinary research. In the context of startup-related research, for instance, the IT-supported tool can be used as a basis for sustainability-centered business plans. From a practical perspective, this conceptual tool can encourage consultants of startups and software developers to include sustainability criteria in the creation of new software and further services. Based on this conceptual framework, mini-sustainability quick-checks and reports can be created as complementary parts of business plans and marketing-related activities.

References

Àlvarez, I. 2013. "Branchenorientierte und IT-gestützte Energieeffizienz und Benchmarking in KMU-Netzwerken," In *IT-gestütztes Ressourcen-und Energiemanagement*, ed. Jorge Marx Gómez, Corinna Lang and Volker Wohgemuth, 21-33, Berlin Heidelberg: Springer.

Arena, M.; Azzone, G. 2012. "A process-based operational framework for sustainability reporting in SMEs," *Journal of Small Business and Enterprise Development*. Vol. 19, No. 4, 669-686.

Boons, F. and Lüdeke-Freund, F. 2013. "Business models for sustainable innovation: State-of-the-art and steps towards a research agenda," *Journal of Cleaner Production*, Vol. 45, 9-19.

Borga, F.; Citterio; A.; Noci, G. and Pizzurno, E. 2008. "Sustainability report in small enterprises: Case studies in Italian furniture companies," *Business Strategy and the Environment*, Vol. 18, No. 3, 162-176.

Buonanno, G., Faverio, P., Pigni, F., Ravarini, A., Sciuto, D., and Tagliavini, M. 2005. "Factors affecting ERP system adoption: A comparative analysis between SMEs and large companies," J*ournal of Enterprise Information Management*, Vol 18, No. 4, 384-426.

Dyllick, T., and Hockerts, K. 2002. "Beyond the business case for corporate sustainability," *Business Strategy and the Environment*, Vol 11, No. 2, 130-141.

European Commission. 2005. *The New SME Definition: User Guide and Model Declarations.* Available at: http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_ user_guide_en.pdf. (Accessed on 02.04.2012).

Figge, F., Hahn, T., Schaltegger, S., and Wagner, M. 2002. "The sustainability balanced scorecard: Linking sustainability management to business strategy," *Business Strategy and the Environment*, Vol. 11, No. 5, 269-284.

Fishbein, M., and Ajzen, I. 1975. *Belief, attitude, intention and behavior: An introduction to theory and research.* Reading, MA: Addison-Wesley Publishing.

German Federal Statistical Office. 2013. *Statistical Yearbook*. Wiesbaden.

Graafland, J.; van de Ven, B. and Stoffele, N. 2003. "Strategies and Instruments for Organising CSR by Small and Large Businesses in the Netherlands," *Journal of Business Ethics*, Vol. 47, 45-60.

Gregory, B. T., Rutherford, M. W., Oswald, S., and Gardiner, L. 2005. "An empirical investigation of the growth cycle theory of small firm financing," *Journal of Small Business Management*, Vol. 43, No. 4, 382-392.

GRI, Global Reporting Initiative. 2014. Sustainability Reporting Guidelines, Reporting Principles and Standard Disclosures. https://www.globalreporting.org/reporting/g4/Pages/default.aspx. (Accessed on 19.06.2014).

Günther, E. and Kaulich, S. 2005. "The EPM-KOMPAS: An instrument to control the environmental performance in small and medium-sized enterprises," *Business Strategy and the Environment*, Vol. 14, No. 6, 361-371.

Hashem, G. and Tan, J. 2007 "The adoption of ISO 9000 standards with the Egyptian context: A diffusion of innovation approach," *Total Quality Management*, Vol. 18, No. 6, 631-652.

Hillary, R. 2000. Small and Medium-Sized Enterprises and the Environment. Sheffield, England: Greenleaf Publishing.

Hillary, R. 2004. 'Environmental Management Systems and the Smaller Enterprise,' *Journal of Cleaner Production*, Vol. 12, 561-569.

Hörisch, J.; Johnson, M. P. and Schaltegger, S. 2014. "Implementation of Sustainability Management and Company Size: A Knowledge-Based View," *Business Strategy and the Environment*, Early View.

Isenmann, R. 2004. "Internet-based sustainability reporting," *International Journal of Environment and Sustainable Development*, Vol. 3, No. 2, 145-167.

Jarillo, J. C. 1989. "Entrepreneurship and growth: The strategic use of external resources," *Journal of Business Venturing*, Vol. 4, No. 2, 133-147.

Johnson, M. P. 2013. “Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools,” *Corporate Social Responsibility and Environmental Management*, Early View.

Kolk, A. 2004. “A decade of sustainability reporting: developments and significance,” International *Journal of Environment and Sustainable Development*, Vol. 3, No. 1, 51-64.

KPMG. 2014. KPMG-Handbuch zur Nachhaltigkeitsberichterstattung. Available at: http://www.kpmg.de/docs/Nachhaltigkeit_06-2012__sec.pdf. (Accessed on 19.06.2014).

Lewis, Virginia L., and Neil C. Churchill, 1983. “The five stages of small business growth,” *Harvard Business Review*, Vol. 61, No. 3, 30-50.

Marx Gómez, J. M.; Lang, C. and Wohlgemuth, V. 2013. *IT-gestütztes Ressourcen-und Energiemanagement. Konferenzband zu den 5. BUIS-Tagen*. Berlin: Springer Verlag.

Miller, William L. 2001. “Innovation for business growth,” *Research-Technology Management*, Vol. 44, No. 5, 26-41.

Muuß, K. and Conrad, C. 2012. *Nachhaltigkeit managen. Softwaresysteme für das Nachhaltigkeitsmanagement*, Bremen: Brands and Values.

Oliveira, T. and Martins, M. F. 2011. “Literature review of information technology adoption models at firm level,” *The Electronic Journal Information Systems Evaluation*, Vol. 14, No. 1, pp. 110-121.

Osterwalder, A., & Pigneur, Y. 2010. *Business Model Generation: A Handbook For Visionaries, Game Changers, and Challenger*. Hoboken, NJ: Wiley.

Perrini, F. and Tencati, A. 2006. “Sustainability and stakeholder management: the need for new corporate performance evaluation and reporting systems,” *Business Strategy and the Environment*, Vol. 15, No. 5, 296-308.

Porter, M. E. 1985. *Competitive advantage: Creating and sustaining superior performance*. New York: The Free Press.

Powell, J. C. 1996. “A lifecycle assessment and economic valuation of recycling,” *Journal of Environmental Planning and Management*, Vol. 39, No. 1, 97-112.

Ramdani, B, Kawalek, P., and Lorenzo, O. 2009. “Predicting SMEs’ adoption of enterprise systems,” *Journal of Enterprise Information Management*, Vol. 22, No. 1, 10-24.

Ramdani, B., Chevers, D., and Williams, D. A. 2013. “SMEs' adoption of enterprise applications: A technology-organisation-environment model,” *Journal of Small Business and Enterprise Development*, Vol. 20, No. 4, pp. 735-753.

Schaltegger, S. and Wagner, M. 2011. “Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions,” *Business Strategy and the Environment*, Vol. 20, No. 4, 222-237.

Schaltegger, S., and Burritt, R. "Corporate sustainability," 2005. In: *The international yearbook of environmental and resource economics 2005/2006: A Survey of current issues*, ed. Henk Folmer and Tom Tietenberg, 185-222, Northhampton, MA: Edward Elgar Publishing.

Schaltegger, S., Kleiber, O., and Müller, J. 2003. "Die Werkzeuge des Nachhaltigkeitsmanagements: Konzepte und Instrumente zur Umsetzung unternehmerischer Nachhaltigkeit". In *Handbuch Nachhaltige Entwicklung*, Ed. Gudrum Linne and Michael Schwarz, 331-342, Wiesbaden: VS Verlag.

Schaltegger, S.; Windolph, S.E. and Herzig, C. 2012. "Applying the known. A longitudinal analysis of the knowledge and application of sustainability management tools in large German companies," *Society and Economy*, Vol. 34, No. 4, 549–579.

Steurer R, Martinuzzi A, Margula S. 2012. "Public policies on CSR in Europe: Themes, instruments, and regional differences," *Corporate Social Responsibility and Environmental Management*, Vol. 19, No. 4, 206-227.

Süpke, D., Marx Gómez, J., and Isenmann, R. 2009. "Web 2.0 sustainability reporting: Approach to refining communication on sustainability," In *Environmental Informatics and Industrial Environmental Protection (EnviroInfo)*, 235-243.

Tornatzky, L.G. and Fleischer, M. 1975. *The Processes of Technological Innovation*. Lexington, MA: Lexington Books.

Udayasankar K. 2008. "Corporate social responsibility and firm size," *Journal of Business Ethics*, Vol. 83, No. 2, 167-175.

Utopies. 2012). Sustainability Reporting at Crossroads: Reporting Trends Survey 2012. Available at: http://www.utopies.com/IMG/pdf/Utopies_ReportingTrendsSurvey_2012.pdf. (Accessed on 19.06.2014).

Van Wensen, K., Broer, W., Klein, J. and Knopf, J. 2010. "The State of P lay in Sustainability Reporting in the European Union", 2010. Brussels: European Commission.

Windolph, S. E., Harms, D., and Schaltegger, S. 2013. "Motivations for Corporate Sustainability Management: Contrasting Survey Results and Implementation," *Corporate Social Responsibility and Environmental Management*, Early View.

Yim, H. R. 2008. "Quality shock vs. market shock: Lessons from recently established rapidly growing US startups," *Journal of Business Venturing*, Vol. 23, No. 2, 141-164.

Zhu, K., Kraemer, K., and Xu, S. 2003. "Electronic business adoption by European firms: A cross-country assessment of the facilitators and inhibitors," *European Journal of Information Systems*, Vol. 12, No. 4, 251-268.

Zorpas A. 2010. "Environmental management systems as sustainable tools in the way of life for SMEs and VSMEs," *Bioresource Technology*, Vol. 101, 1544-1557.