THESIS FOR THE DEGREE OF LICENTIATE OF PHILOSOPHY

A knowledge management perspective on environmental life cycle management

A manufacturing company example

HANNA NILSSON-LINDÉN

Division of Environmental Systems Analysis
Department of Energy and Environment

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2014

A knowledge management perspective on environmental life cycle management
A manufacturing company example

Cover picture by Shutterstock, designed by Rashevskyi Viacheslav:

[The cover picture of a globe consisting of linked chains, in this Licentiate thesis, represents the challenge of sustainably manage the huge amount of products that floods our world today. These products are linked together in product chains, often having a global reach.]

A KNOWLEDGE MANAGEMENT PERSPECTIVE ON ENVIRONMENTAL LIFE CYCLE MANAGEMENT

A manufacturing company example

Hanna Nilsson-Lindén, Environmental Systems Analysis, Energy and Environment,
Chalmers University of Technology, Sweden

ABSTRACT

The overall aim of this thesis is to broaden the understanding of environmental life cycle management (LCM). This aim has a two dimensional approach; one empirical and one theoretical. *Paper I* focuses on LCM in the existing literature and LCM in practice, and *paper II* explores the inclusion of knowledge management into LCM. This thesis' essay applies theoretical insights from *paper II* on the empirical field material from *paper I*, and provides a knowledge management perspective on LCM in practice.

The idea of LCM is to stretch environmental consideration from a corporate perspective to a product chain perspective. Proposed critical success factors to LCM, for example, the importance of communication, interaction, collaboration and integration, revolve to a large extent around the idea that LCM efforts need to be integrated in organizations' business operations and functions. However, detailed empirical studies on how LCM is managed in practice are scarce. A study of LCM in practice at a multinational company has been conducted, pointing to the difficulties of integration and identifying several integration paths: by targeting structural aspects such as inclusion of sustainability aspects in tools and processes; using networks and social interaction to create commitment and integration; or finding ways to work around certain organizational levels to more easily work with LCM internally in the organization.

Critical success factors to LCM integration highlighted in the literature are also much discussed in the knowledge management field, from where additional insights have been sought, to further understand and develop LCM. Which implicit assumptions LCM practitioners have of knowledge thus leads to differences in how LCM integration is managed. Knowledge management can be said to have two leading perspectives; the

objectified knowledge and the *situated knowing* perspectives. The study identified that solutions to LCM integration were sought mainly in an objectified knowledge perspective, yet, there is potential of utilizing insights also from a situated knowing perspective.

LIST OF INCLUDED PAPERS

Paper I

Nilsson-Linden, Hanna; Baumann, Henrikke; Rosén, Magnus & Diedrich, Andreas (2014). Organizing life cycle management in practice: challenges of a multinational manufacturing corporation.

Invited, and submitted to, the LCM2013 conference Special Issue in the *International Journal of Life Cycle Assessment.*

Paper II

Nilsson-Linden, Hanna; Baumann, Henrikke; Diedrich, Andreas & Rosén, Magnus (2014). The inclusion of knowledge management in life cycle management: a way forward?

Submitted to *Business Strategy and the Environment.*

OTHER PUBLICATIONS BY THE AUTHOR

Nilsson-Lindén, Hanna & Baumann, Henrikke (2013). Organizing sustainable product chains of a multinational corporation: life cycle management in practice, *Short paper in the Proceedings of the 6th International Conference on Life Cycle Management*, Gothenburg, Sweden, August 26-28, 2013.

Nilsson-Lindén, Hanna; Baumann, Henrikke & Diedrich, Andreas (2013). The role of knowledge and capabilities in a sustainable product chain context - a literature review, *Paper in Proceedings of, and presentation at, the 8th EISAM colloquium on Organizational Change & Development*, Ghent, Belgium, September 12-13, 2013.

Gullbring, AnnSofie; Nilsson, Hanna & Baumann, Henrikke (2010). Environmental management in a diaper product chain. *Proceedings of the 10th EURAM conference*, Rome, Italy, May 19-22, 2010.

ACKNOWLEDGEMENTS

OPENING

The curtains are raised

~

Sustainability practitioner nr 1: ― *How do we create real engagement in the whole organization? People really need to feel that sustainability is their 'baby'.*

Sustainability practitioner nr 2: ― *We have to include it into balanced scorecards; we have to make sure all managers see it!*

Sustainability practitioner nr 1: ― *Yes, we have to create common goals, it generates commitment. We could use a bonus system...*

Sustainability practitioner nr 2: ― *It really is a challenge to find a way to create pull and not only push. We have to communicate, to motivate, to inform and to educate.*

Sustainability practitioner nr 3: ― *But there is no true demand ... Maybe because managers don't ask for it?*

Sustainability practitioner nr 2: ― *We have to include it into the bonus systems. Top management is already 'on board', now it's time to engage the rest of the organization.*

~

The above dialogue is based on an actual conversation between sustainability practitioners working at the Company. The dialogue exemplifies the reality that these practitioners are facing, and the challenges they struggle with in their everyday working situation.

x

TABLE OF CONTENTS

1. INTRODUCTION

The idea of environmental life cycle management (LCM) is to stretch environmental consideration from a corporate perspective to a product chain perspective (Hunkeler et al. 2003; Baumann & Tillman 2004; Poikkimäki 2006; Sonnemann & de Leeuw 2006; Remmen et al. 2007; Power 2009). LCM research proposes vague factors considered critical to successfully achieve LCM. The research has much of a focus on tools, and is often prescriptive in nature. Proposed critical success factors to LCM revolves to a large extent around the idea that LCM efforts need to be integrated internally in the organizations that are part of the product chain. That is, LCM efforts should not be limited to specific functions but rather be a part of everyday practice and of all functions in the organization. It is also increasingly common for multinational corporations to highlight LCM or sustainability as part of their core values (some examples[1] being ABB, Ericsson, SKF and Volvo Group), or in other ways state that sustainability permeates their organizations. Integration of LCM internally in organizations is thus the focus of both academia and industry, but how to achieve this in practice is less clear and largely unstudied. The question is thus how research and practice can address the complexity of LCM faced in everyday business management.

1.1 RESEARCH AIMS

Since studies of LCM in practice are scarce, I wanted to empirically explore the actual challenges that sustainability practitioners experience in their everyday work. The overall aim is thus to broaden the understanding of LCM, and it seeks to do so in two ways: first through an empirical exploration of the practice of LCM, and secondly, through a theoretical investigation on how the LCM field could benefit from other research fields. I depict the challenges that exist in the LCM field, and point to possible solutions to these challenges, by gaining insights from the knowledge management field. To complement the extensive aim of broadening the understanding of LCM, three specific aims have been formulated, and processed in the two appended papers and in this thesis essay respectively:

---

[1] Based on annual (or sustainability) reports from 2013.

1) To contrast the vague and general factors proposed as critical to LCM in existing literature, with detailed accounts on LCM in practice in a multinational manufacturing company recognized for its' work with LCM (Paper I).

2) To explore the inclusion of knowledge management into LCM, as a potential way forward in the further development of LCM (Paper II).

3) To investigate how different knowledge perspectives influence LCM at a multinational manufacturing company (thesis essay).

Paper I and *paper II* thus focus on LCM in existing literature and in practice, and the potential benefits of linking LCM with knowledge management, respectively. The thesis' essay applies the theoretical insights from *paper II* to the empirical field material from *paper I*.

1.2 OUTLINE

In chapter 1, the study is introduced, along with the research aims. In chapter 2, I describe how the research process evolved during the work towards the Licentiate thesis. This is followed by a discussion on knowledge perspectives, networks and communities of practice, and its' relevance to LCM in practice, in chapter 3. Chapter 4 includes my reflections on methodological approaches, and on potential future research directions. The closing chapter 5 of the thesis essay entails some of my personal reflections on the research process.

2. THE RESEARCH PROCESS

The previous chapter provided an overview of the direction of my research, while in this chapter I will provide a description of the methodological paths part of my research process.

2.1 PAPER I

In line with the overall aim of broadening the understanding of LCM, I felt it necessary to begin with a review of the LCM literature. The review provided me with an overview and an understanding of the LCM field. It demonstrated that existing LCM research proposed many prescriptions of what LCM is, including what tools, methods and approaches to use. Several factors considered critical to successfully conduct LCM were also proposed. But these were vague and general and did not provide any clear understanding on how LCM actually can be managed in a company. As such, the literature fails to address the complexity of organizing LCM in practice.

Owing to the mainly normative character of the LCM literature, complementary insights were sought also in the related field of life cycle thinking, which draws on the social sciences and provides some studies on the practice of life cycle assessment and LCM. Insight was also sought in the field of sustainable supply chain management[2] (SSCM). This stream of literature is based on a supply chain focus and has originated from the business management field, while LCM has originated from environmental sciences, and where the product chain is instead the basis of consideration (Seuring 2004; Vermeulen & Seuring 2009). In SSCM emphasis is thus rather on a one company perspective with focus on suppliers, while in LCM focus can be on a one company perspective and also take a holistic chain perspective, concentrating mainly on the products and their life cycle. These three research streams all focus on 'sustainable product chains,' although with slightly different emphases. This provided me with a more complete understanding of life cycle-related

---

[2] Green supply chain management (GSCM) and environmental supply chain management (ESCM) are concepts also used, often synonymously. Although SSCM often include not only environmental, but also social, factors.

research, both with regards to the outcomes, but also with regards to the methodological approaches that have been utilized in the related research fields.

The LCM literature many times renders a feeling of a utopian descriptions ─ that LCM should include holistic management in the whole product chain (Linnanen et al. 1995; Fava 1997; Hunkeler et al. 2003; Baumann & Tillman 2004; Poikkimäki 2006; Sonnemann & de Leeuw 2006; Remmen et al. 2007; Power 2009), and that all actors and all functions should be included (Linnanen et al. 1995; Fava 1997; Hunkeler et al. 2003; Remmen et al. 2007). At the same time, many LCM examples provided in literature only cover parts of companies' product chains, and lack descriptions of how sustainability practitioners manage LCM internally in their organizations and externally in product chains. Due to this, I wanted to explore how LCM is enacted in practice in organizations and to contrast the vague and general factors proposed as critical to LCM in existing literature, by providing detailed accounts on LCM. My interest was thus on the way in which practitioners organize LCM and the challenges related to it. The opportunity presented itself to me to study a multinational manufacturing company recognized for its work with LCM. The studied organization, here referred to as the Company, has received several awards for its sustainability work, and is thus considered a frontrunner with regards to sustainability related goals and activities. As any multinational corporation it has numerous suppliers and customers across the globe, and should in principle with the help of its LCM-related initiatives have great potential to reduce the total environmental burden of its activities. The Company has stated ambitions to integrate LCM into internal core business processes, and to reduce environmental impact within its own operations and in operations upstream and downstream in its product chains. This made the Company a well-suited corporation for a study of LCM in practice.

To capture the complexity of organizing LCM, a practice-oriented approach was used (Nicolini et al. 2003). Having such an approach enabled the description of ongoing activities of LCM in practice, what Annemarie Mol (2003) called a praxiography, or what Barbara Czarniawska (1997) referred to as a 'window study' ─ when "a researcher opens an arbitrary time window and describes all that can be seen through it" (p. 65). When I opened my 'window' in a specific time and place, and started my empirical data collection,

4

I considered it important to begin with an overview of the LCM-related initiatives rather than directly diving deep into specific functions or initiatives. I began conducting interviews with practitioners working with various LCM-related initiatives, hereafter referred to as *sustainability practitioners*. Thirteen semi-structured interviews of about one and a half hours each were conducted. An interview guide was prepared, and the questions were formulated so that the interviewees had the possibility to provide answers with rich descriptions. I asked about their working roles; where in the organization they were situated; how the Company's work had progressed and developed over time; internal and external collaborations concerning life cycle and/or environmental issues; factors considered important when working with sustainability, and; perceived impact on the organization with regards to sustainability. These questions formed the basic interview guide, which also allowed for follow up questions based on the interviewees' responses.

From these interviews new potential interviewees were identified by use of snowball sampling (Bryman & Bell 2007). The process resulted in a mainly managerial focus in my research, since the practitioners in the study are managers, project managers or similar, rather than practitioners on an operational level. The main part of the interviewees thus had a strategic position working with sustainability in the Company, while some worked only part time on sustainability-related issues. The qualitative study has been undertaken over two years. Observations took place at the Company's strategic sustainability department, and consisted in continuous part-time observations about one day a week. It gave me a possibility to take part of some of the everyday discussions regarding LCM. Document studies have been used to complement my understanding of the company and its LCM initiatives. Three workshops have also been conducted, one with the environmental research group and two with the strategic sustainability department, giving me the opportunity to have my empirical insights validated by my respondents. It has been questioned whether validation of results via respondents can be accurately performed, but the method is also recognized for its possibility to generate further empirical material (Bloor 1978; 1983, in Silverman 2011). I believe it was valuable to conduct these workshops, since it was a possibility for me to validate my empirical findings, but foremost because they provided me with a possibility to present my findings to representatives of the studied organization, and receive further reflections and interpretations from sustainability

practitioners at the Company. As described, multiple qualitative methods have been applied in the study — a validation method often referred to as triangulation. But David Silverman (2011) argued that findings from several methods will not indicate a more 'true' picture of social reality, but rather different aspects of the same object. Czarniawska (1999) also raised a note of caution regarding the concept on validation in qualitative research, stating that the notion of validity regards the correspondence between the text and the world, but that words cannot be compared to worlds, it can only be compared to other words. Hence, most validation practices consist in comparing texts against other texts. For me, using multiple methods has mainly been an approach to complement my understanding of interview results, and to create a more rich description and understanding of LCM in practice.

Regarding the reliability of my results, I find it unlikely to expect the exact same empirical material from a repeated study. I believe instead that interviews are socially constructed and that interviews are a construct between the interviewer and the interviewee (Silverman 2011). Czarniawska (2004) noted that competing versions of reality always exists, but that the importance lie in the attempt to represent the reality, the field of theory and practice, as faithfully as possible in one's texts. I have tried to do just that, to be transparent with regards to how I have conducted my research, and tried to represent the reality, as it has unfolded (as I have interpreted it), as accurately as possible. Though, the process of organizing and fitting the empirical material in a suitable narrative has proven quite challenging. There have been many 'stories' in the material with inter-linkages in-between them. This is also something that critics of 'case studies' sometimes see as a drawback. But Bent Flyvbjerg (2006) argued that this was one of the five misunderstandings of case study research. Complex narratives do not need to be a 'problem', instead "good narratives typically approach the complexities and contradictions of real life" (p. 237), and can unfold 'thick' problematique. To provide a narrative with rich descriptions I have included citations from the empirical material in *paper I*, instead of only rewriting the material, something that has been noted as important (Seale 1999, in Silverman 2011). Still, such an approach can be criticized for being 'anecdotal' in character, (Mehan 1979, in Silverman 2011) as only part of the empirical material can be part of academic articles. Silverman (2011) proposed that to overcome such criticism and to still claim validity, one can use the

constant comparative method – constantly comparing data and categories within one or several cases. This notion derives from Barney Glaser and Anselm Strauss (1967), as part of their development of grounded theory. Kathy Charmaz (2006) described grounded theory as methods that "consists of systematic, yet flexible guidelines for collecting and analyzing qualitative data to construct theories 'grounded' in the data themselves" (p. 2). My research has been influenced by an abductive approach, where the researcher lets herself be guided by both theory and empirical field material interchangeably, thereby creating an emerging theory (Czarniawska forthcoming). This has meant that theoretical and empirical input has been intertwined in the research process and made it possible for me to gain insights from the literature reviews, to the study of practice, and the other way around. The interview material has been continuously coded throughout the process of empirical data collection, which has meant that categories changed and developed as the study progressed — new categories emerged and others proved less useful. By coding the material I have been able to structure the material and the analysis, and to identify common or divergent patterns. Hence, I have applied several characteristics of grounded theory in my research; the categories I have developed have been grounded in the empirical material, but have emerged in parallel with the literature review. I have thus not adhered fully to grounded theory methods, as I, for example, have not applied the use of memo notes in a comprehensive manner. But Charmaz (2006) highlighted the methods for grounded theory as flexible guidelines, and as a complementary approach to other qualitative research methods, rather than opposite to other methods.

2.2 PAPER II

Paper I demonstrated the importance and the challenge of, for example, integration, collaboration and networking in LCM practice. These were also factors considered essential in the LCM literature, although it provided only vague prescriptions. With these insights, I wanted to explore whether LCM research and practice could gain from studying other fields. Similar factors were also commonly discussed in the knowledge management field, and I therefore saw the possibility of promising insights to be sought within knowledge management, and applied with LCM. As I had already studied LCM in practice and the

LCM-related literature, beginning this exploration of knowledge management and the link to environmental aspects, I continued to review that part of the LCM literature that in some way related to knowledge management[3]. I found that there had been some implicit links between the research fields, but the literature review and the concepts used were quite sprawling. Sometimes concepts such as *environmental knowledge management* (Wernick 2002; Huang & Shih 2009) were used, or phrases such as *knowledge sharing in green supply* (Cheng et al. 2008) or combinations of *capabilities* and, for example, *green*, *environmental management*, *sustainable business*, *SSCM* etc. (e.g., van Kleef & Roome 2007; Benitez-Amado et al. 2010; Gold et al. 2010; Hofmann et al. 2012). Generally, focus in this literature turned out to be on capabilities and necessary resources. Sometimes factors such as interaction and networking were discussed, although not as extensively as capabilities, resources, and similar aspects. The review demonstrated that an explicit link between LCM and different perspectives on knowledge had not been made. In parallel, I studied literature on knowledge management. It became clear that there are several perspectives, in which knowledge is viewed differently. Two leading perspectives are here referred to as *objectified knowledge* and *situated knowing* perspectives. Which of the two perspectives of knowledge that is prevailing among practitioners will therefore affect how LCM is implemented and managed. Thus, in *paper II* the inclusion of knowledge management and these different perspectives on knowledge into LCM is explored, as a way of broadening the understanding of LCM, and as a potential way forward in the further development of LCM. The paper generates a clear picture of how different perspectives on knowledge influence LCM. I also identify the possibilities of making use of a situated knowing perspective, for example, the use of communities of practice is suggested as a way of sharing knowledge and collaborating for LCM.

The literature study in *paper II* is structured both *thematically* and *chronologically* (Czarniawska forthcoming). The basis of it is thematic since I have chosen to describe the literature of what I (and others) describe as different existing perspectives on knowledge. But these perspectives build on each other; one is a criticism of the other ─ texts are not created in isolation, they are a response to already existing texts and ideas (Czarniawska 2004). Therefore one can say that this review is also chronologically structured, since

---

[3] I also reviewed environmental management literature that included knowledge management aspects.

situated knowing developed as a criticism towards objectified knowledge. Chris Hart (1999) highlighted that making connections between ideas, theories and experience is a key aspect of good scholarship, and that this is done by "applying a method or methodology from one area to another" (p. 8) and providing new ways of looking at issues. The point of this study was just that, to apply different perspectives on a studied field; to use different perspectives present in the knowledge management field on the field of LCM.

2.3 THE LICENTIATE THESIS

Paper I thus includes literature on LCM and the related fields of life cycle thinking and SSCM, and LCM in practice at a manufacturing company recognized for its work with LCM. *Paper II* is instead a theoretical paper combining the fields of LCM and knowledge management. In this thesis essay I combine the insights gained from the two papers and study how different knowledge perspectives influence LCM at a multinational manufacturing company. Hence, the thesis essay focuses mainly on knowledge management and LCM in practice, although also building on the existing LCM-related literature. Figure 1 displays how the included papers and the thesis essay relate to the fields of LCM and knowledge management, and to literature and field material.
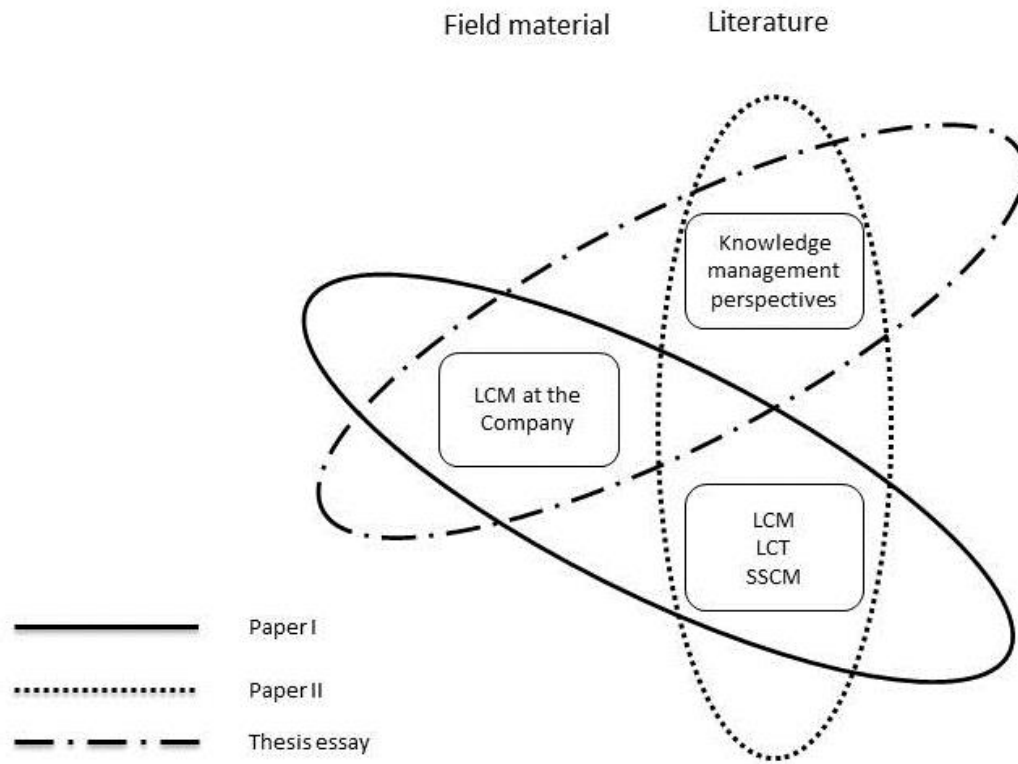
Figure 1 Visualization of the different research fields in focus in this Licentiate thesis and how the two papers and the thesis essay relate to these fields.

3. A KNOWLEDGE MANAGEMENT PERSPECTIVE ON LCM IN PRACTICE

Factors considered essential in LCM, such as collaboration, knowledge sharing and integration, are also discussed in the knowledge management field. Since the LCM literature does not address these issues in any detailed manner, but rather provide vague prescriptions, I saw the potential for promising insights being sought within the knowledge management field, and possibilities of including these into the LCM field. Managing life cycles implies that practitioners have to consider and manage a lot of knowledge, for example, regarding a variety of multifaceted environmental issues, on how to learn and how to communicate this knowledge, and how to collaborate on these issues – both internally in organizations and externally in-between actors. Which implicit assumptions sustainability practitioners have of knowledge leads to differences of how LCM integration is managed. That is, the way LCM is translated in practice includes assumptions about knowledge management and knowledge sharing, which has consequences for its implementation. One can say that there are two leading perspectives within knowledge management, which will here be referred to as the *objectified knowledge* and the *situated knowing* perspectives, and proponents of each perspective have different underlying assumptions. Depending on which perspective one has of knowledge management, it will make a difference for how LCM is conducted. A theoretical exploration on the inclusion of knowledge management into LCM is discussed in *paper II,* but will here be further developed by adding empirical data from *paper I* to this analysis.

3.1 KNOWLEDGE PERSPECTIVES

Having an objectified knowledge perspective implies that one views knowledge as something that can be separated from people by codification (Nonaka 1991). For proponents of this view, a central knowledge management activity is to turn *tacit* knowledge[4] into *explicit* knowledge, and to share it with others (Nonaka 1991; Zack 1999). Knowledge is thus considered valuable primarily if accessible (Davenport & Prusak 2000). The knowledge management process is stated to include the creation of knowledge, capture

---

[4] Knowledge that is considered difficult to articulate in an explicit form (Hislop 2005/2009).

and storage of knowledge, refinement, distribution, use, and monitoring and feedback on the knowledge management process (Davenport & Völpel 2001). The distribution, or transfer of knowledge, is sometimes referred to as the *conduit model of knowledge sharing* (Hislop 2005/2009, p. 26). The idea is to transfer explicit knowledge from 'the transmitter' to 'the receiver' without any important information being lost in the process (see Boland & Tenkasi 1995, for strengths and weaknesses of the conduit model of knowledge sharing). From an objectified knowledge point of view, management of knowledge thus comes down to finding 'the right tools for the job' (Clarke & Fujimura 1992). Best practices from one place are then considered possible to be transferred to another place, if only the appropriate tools are present.

Critics of the objectified knowledge perspective argue instead that knowledge is not something that can be easily transferred from one place to another, since what is 'best' in one context might be out of place in another (Diedrich 2004). Within the situated knowing perspective, knowledge is instead viewed as a process,[5] constructed in ongoing relationships, and therefore inseparable from practice (Orlikowski 2002; Nicolini et al. 2003; Diedrich 2004). Wanda Orlikowski (2002) stated that knowledge and learning need to be considered in its specific context and be adapted to local circumstances. Proponents of situated knowing thus view the sharing of knowledge as something that could not be transferred out of contexts, but instead that the sharing of knowledge requires involved parties to have an understanding of each other's prior knowledge base and tacit assumptions (Boland & Tenkasi 1995). John Brown and Paul Duguid (1991) proposed a distinction between *canonical practices* ― work practices described, for example, in manuals ― and *noncanonical practices* ― the actual practices performed by employees. They pointed out that it is the actual practices that ensure success, or failure, of an organization, and that concentrating only on canonical practices "can blind an organization's core to the actual, and usually valuable practices of its members" (p. 41). With a *situated knowing* perspective focus turns to noncanonical practices, rather than mainly on tools, and views knowledge as situated in action.

---

[5] Hence the divide between situated *knowing,* and objectified *knowledge* (see Orlikowski 2002).

3.2 LCM IN PRACTICE

The study of LCM in practice in *paper I* demonstrated that the Company had several initiatives focusing in some way on sustainability, and that they together covered most of a generic product chain. That is, the LCM-related initiatives targeted different parts of a conceptual products' life cycle, from raw material extraction to the products' end-of-life phase, and these initiatives jointly covered most of such a generic product chain. Several of the initiatives had developed during recent years, or had recently been updated to better include sustainability. These initiatives were developed by sustainability practitioners at strategic levels, but the idea was that they would later on 'run on their own,' or at least not be continuously managed by specific sustainability departments. The study showed that sustainability practitioners had a continuous focus on the importance of integration, and there were often talk about the need for 'ownership,' and about the need for staff to take responsibility for including sustainability aspects in their work. This integration emphasis implied that sustainability practitioners were still in a phase where they had to make sure that initiatives were developed, implemented, and utilized. One of the challenges identified related to integration was to make sure that a sustainability focus was not only present at certain organizational levels. The general idea was that it was not top management that needed convincing or support, but rather that attention needed to be directed towards the middle management levels. Since middle managers must balance many demands and aspects, there was a perception among sustainability practitioners that middle managers sometimes had difficulties to prioritize also sustainability in their everyday work. Solutions for this challenge were often sought and discussed in terms of targets and measureable tools, such as incorporating sustainability aspects into key performance indicators (KPIs) and balanced scorecards. Sustainability practitioners believed that there was a lack of KPIs that included sustainability and that sustainability therefore was not prioritized. This lack of sustainability in KPIs could then also create a mismatch between the developed sustainability concepts, and the structures and targets in place to ensure commitment to these concepts. There was also a perception that there were colliding goals and KPIs, which therefore could create mistrust among the staff. A provided example of this was with regards to sales, for example, if sales staff would be measured only on purchase price, then long-term thinking and concern for environmental aspects would not be rewarded. Many

13

sustainability practitioners therefore thought that there needed to be efforts directed towards updating existing KPIs and balanced scorecards. The general attitude seemed to be 'what gets measured gets done.' The integration emphasis was also a reoccurring topic when it came to business processes, for example, when implementing the new energy management system into the existing environmental management system and in line with the company's Lean concept. Other ways utilized to highlight sustainability was to have sustainability related information on the Company's internal and external webpages, incorporated in the annual reports, in relevant product sheets and in educational programs.

There were also other paths for integration identified in the study. In some cases sustainability practitioners had tried to find ways of working around certain organizational levels, as had been done in the work with the sustainability portfolio. The basis for this was said to be the need for linking top management ambitions, with the operational levels of the organization, this way avoiding some of the middle management levels, and creating more direct communication. It was a way of circumventing the ordinary processes, creating a more direct connection between those working with the solutions and those deciding on its fate. It was said that an important aspect in doing so was to still manage it in a legitimate way, not making anyone feel overrun.

There were also several LCM-related networks active in the organization, focusing on, for example, environment, health and safety (EHS), energy management or sustainability. Sustainability practitioners pointed out that these networks provided them with possibilities of gaining knowledge and also sharing knowledge with others. They also pointed out that it was important for staff to have a possibility to network with others regarding these issues in order to engage in sustainability. Networks were thus utilized and stressed as important by sustainability practitioners. But, while there was talk of tools and targets as specific areas important to further develop, networks were discussed in terms of their usefulness and it was not directly stated as a need to allocate more resources into it. This was thus a third integration path identified in the study, and one that I considered could be further developed and utilized. Some sustainability practitioners experienced that they had large networks, while others did not share this feeling. There was also a perception that it could be quite difficult to know who to contact, especially for new staff. And some expressed a

feeling of not knowing what was going on in other LCM-related initiatives. Key individuals seemed to have more of an overview, being involved in several initiatives, but an easily accessible overview of LCM activity at the Company was lacking. Although the idea of LCM is to have a holistic environmental approach, the study demonstrated that there was a lack of a comprehensive overview of LCM-related initiatives and the involved sustainability practitioners. This implies that contrary to the holistic ideal, LCM in practice could easily lead to a fragmented comprehension and overview of ongoing activities, even in an organization with explicit LCM aspirations.

3.3 NETWORKS & COMMUNITIES OF PRACTICE

Based on my empirical findings, one of the conclusions in *paper I* is a suggestion to further explore networking possibilities as a path towards integration and collaboration for LCM, and as a way of creating an comprehensive overview of LCM initiatives and involved sustainability practitioners. In *paper II,* I demonstrated the potential of a situated knowing perspective, and that such an approach could provide valuable insights on how to further understand and develop LCM. Proponents of this view stress the fact that knowledge is not separable from practice and therefore knowledge sharing needs other routes than, for example, 'best practices'. Based on a situated knowing perspective, communities of practice is seen as a potential way of furthering LCM development in organizations, and is in *paper II* suggested as an approach to facilitate knowledge sharing and collaboration for LCM.

As described earlier, there are different perspectives on knowledge, which affect how LCM is conducted. Looking at LCM in practice from a knowledge management point of view, indicate that the primary perspective on knowledge in the Company is an objectified one, focusing foremost on measurable tools and processes ― *canonical practices*. As has been shown, the Company has also made use of networks in the organization. But networks are, according to Brown and Duguid (1991), also part of canonical activities due to its top-down approach, while communities of practice are of a *noncanonical* nature due to its bottom-up approach. Brown and Duguid (1991) explained that the difference between networks and communities of practice are that networks are created by managers for specific projects,

where members are chosen due to their ability to contribute to the team's goals. Communities of practice is instead characterized by an emergent approach, and Wenger and Snyder (2000) described them as informal groups that organize themselves, set their own agendas and establish their own leadership and membership.

Knowledge sharing and collaboration, from a situated knowing point of view, stem from the idea that knowledge is embedded in practice and impossible to separate from collective actions. Brown and Duguid (1991) therefore argued that to concentrate mainly on canonical practices can draw attention away from the actual practices of the employed staff. Noncanonical practices were instead considered to be what really ensures success, or failure, of an organization. Hence, there is a risk associated with too much tool focus, and of losing focus on the actual usefulness of these tools for practitioners (Brown & Duguid 1991). There is also a risk that people might not always be willing to share the knowledge that they have built up. In such cases tools for knowledge sharing would be useless, or at least not used efficiently. The necessity of social interaction could thus be underestimated, and experiences and practice (how things *are* done) be downgraded, while the 'best practices' view (how things *should* be done) would be benefited.

Both appended papers suggest further focus on networking possibilities for sustainability practitioners, but *paper II* also demonstrates the importance of understanding noncanonical practices. Therefore another route for knowledge sharing and integration, than via networks, could be to put more effort and support into possibilities for sustainability practitioners to engage in communities of practice. Etienne Wenger and William Snyder (2000) suggested that communities of practice could complement the more common team and networks approach. The idea of communities of practice is groups of people who come together around a common topic and where the social interaction in the group facilitates knowledge sharing. Departments, teams etc. can sometimes turn into separate knowledge islands, and communities of practice is thus one way of bridging such islands (Scarso & Bolisani 2008). A community of practice could, for example, consist of practitioners that otherwise collaborate in teams, and thus feel a need to also collaborate and share experiences and knowledge with colleagues in similar working roles. Alessia d'Amato and Nigel Roome (2009) pointed to the importance of interaction between managers, teams, and

networks in the organization, due to the difficulty of individual actors to handle the change for sustainability on their own. Networks have thus been suggested to form platforms for exchanging ideas and information between sustainability practitioners in the organization, and create an arena for discussing sustainability issues (van Kleef & Roome 2007). Communities of practice should provide similar possibilities, although through another type of organization.

3.4 IMPLICATIONS FOR PRACTITIONERS

As shown in *paper I,* a network approach is already present at the Company, and several LCM-related networks are active in the organization. But these could be further utilized within the Company to facilitate knowledge sharing and collaboration with regards to LCM. But as networks have a top-down approach, they could be complemented with the use of communities of practice. The advantage of communities of practice is its bottom-up approach which allows for an enhanced focus on actual practice, contrary to the top-down approach of more formal organizational forms such as networks. Existing networks could thus be complemented with a specific LCM community, with the intention of discussing overall LCM issues and initiatives, instead of only discussing specific initiatives or activities. Wenger and Snyder (2000) argued that communities of practice cannot be managed top-down, but proposed that it is possible to 'cultivate' such communities, for example, by identifying potential communities of practice that could enhance company strategic capabilities and bringing the right people together. They also stressed that if an organization would like to employ a community of practice approach, managers should provide sufficient structures for communities of practice to develop and thrive, for example, by facilitating communication in-between members, and making sure that the communities receive the resources and support that they need. Wenger and Snyder (2000) also considered it necessary to assess the value of these communities by nontraditional methods, such as interviews, since they are not measurable by the usual quantitative methods. Organizations willing to utilize such a community of practice approach could, for example, provide sustainability practitioners with specific time and resources each month to meet and communicate in the LCM community. The members could then together decide on how to operate, what activities would facilitate collaboration and knowledge sharing for LCM, and

provide an arena for discussing LCM. Wenger and Snyder (2000) concluded that a defined identity, and commonly shared goals, is what ensures commitment, engagement, and value for members' part of such communities. This implies that members of the LCM community would be the ones who feel that they can gain and/or can contribute in the discussions on LCM.

An LCM community would be a possibility for sustainability practitioners to specifically discuss LCM initiatives, how these initiatives are connected, and how collaboration could be further enhanced in-between members and departments. Apart from creating an arena for LCM discussions and overview, such a community could also be a way of visualizing sustainability practitioners in the organization. Such visualization could facilitate for sustainability practitioners within the organization to locate each other and thereby facilitate collaboration and knowledge sharing. By visualizing members of an LCM community it could potentially also open up for other staff, that does not specifically work with sustainability or LCM but who have aspirations to do so in their local organizations, to identify people to contact. A community approach to LCM, compared to a network approach, would thus indicate that the members would have more influence on the community and the agenda, rather than be managed top-down by managers.

In workshop discussions with sustainability practitioners at the Company it was discussed that a situated knowing approach could be further developed in the organization, for example, by focusing more on networking possibilities or other forms of social interaction and learning-by-doing activities. Developing networks or communities, was considered opportunities for development, to create possibilities for occasionally meeting face-to-face, and thereby creating new opportunities for knowledge sharing. Having the possibility to share thoughts and ideas with other practitioners, in open discussions, and having time and possibilities to reflect upon activities was viewed as important. Dedicated time and resources for reflection and contemplating on LCM activities was also considered important, but it was also commented that there would be a difficulty of having legitimacy for such activities, especially dedicated time for reflection. Appointed time for reflection was considered a possibility for people to contemplate, for example, how they could make use of sustainability aspects in their everyday activities, or what they actually learnt from

workshops they participated in etc. From the workshop discussions several possible ways in which the Company could utilize insights from the situated knowing perspective in the strive for LCM integration were identified by the practitioners, for example;

- to put more efforts into understanding the everyday practice of departments/functions to develop tools and processes that incorporate more of the complexity of everyday work with sustainability, and are therefore more effective;

- to have more possibilities for social interaction, reflection and knowledge sharing via networks, communities of practice, personal meetings, Webinars with more open agendas etc., and;

- to continue to use, and further develop, workshops and similar activities in educations and other forums for knowledge sharing.

3.5 CONCLUSIONS

As mentioned in the introduction of this thesis essay, integration of LCM internally in organizations, and in product chains, are the focus of both academia and industry. In *Paper I* some of the present challenges related to LCM integration are identified, and in *paper II* the potential benefits of linking LCM with knowledge management are explored. Taking a knowledge management perspective on LCM has provided me with a valuable approach to understanding how different knowledge perspectives influence LCM in practice and its integration. Using insights from knowledge management can provide LCM researchers and sustainability practitioners with a possibility to view this integration in a broadened perspective; it can also provide potential ways of furthering the development of LCM, for example, by utilizing a more situated perspective on knowledge, and by the use of communities of practice.

The discussion in this thesis essay has shown that different knowledge perspectives influence LCM in practice. With an objectified knowledge perspective focus turns to canonical practices, the practices that *should* be conducted. With a situated knowing perspective, focus instead turns to *actual* practice and noncanonical practices. Both

appended papers suggest that to further integrate LCM in organizations, sustainability practitioners need more possibilities for interaction and knowledge sharing. In *paper I,* I suggested the further use of networks, and potentially an LCM network. The study in *paper II* though, demonstrated the importance of a situated knowing perspective. This thesis essay has shown that using networks implies a formal and top-down management approach, relating more to the objectified perspective on knowledge, while from a situated knowing point of view, communities of practice is a more successful approach to use. The conclusion from this thesis essay is that complementing existing networks with the use of communities of practice is a potentially successful approach to utilize in LCM.

4. RESEARCH DIRECTIONS

The overall aim of this Licentiate thesis has been to broaden the understanding of LCM. As it is an extensive aim, it was complemented with three specific aims, processed in the two appended papers and in this thesis essay respectively. Although, I do not claim to have all answers as regards LCM, I do believe that my research contributes with a broaden understanding of LCM. It addresses the complexity of organizing LCM in practice. It also provides a new way of understanding LCM, via a knowledge management 'lens'. It also provides potential paths for future development of LCM.

As is common for qualitative research, I have had a single case study approach (Silverman 2011), or what I prefer to refer to as a praxiography (Mol 2003). As mentioned, Flyvbjerg (2006) posted five common misunderstandings of case study research. One of them is the misconception that context-independent knowledge is more valuable than context-dependent knowledge. Instead, he argued that the advantage of qualitative research is the insights it provides on local practices. Flyvbjerg (2006) also considered it a misunderstanding that it would not be possible to generalize from single cases. He instead considered such an approach valuable in identifying what Karl Popper (1959) referred to as 'black swans' among the rest of the white swans,[6] due to its in-depth approach. In my research I have intentionally studied one organization, which has explicit LCM ambitions, and that has been recognized for its LCM work. This way I had the opportunity to study LCM practice in further detail, than is common for existing LCM research. It has thus generated detailed insight on LCM and its integration, which as of now has been scarce. Maybe it cannot be compared to identifying a black swan among the white, but LCM literature has mainly consisted of normative and vague descriptions, and my research contributes by describing one of those 'swans' that makes up the LCM practice, at least in a manufacturing context. I cannot claim that my findings from the field are surely applicable in other contexts, but I have contributed with a broadened perspective on the challenges of LCM implementation. I have also opened up for a possible new approach to understanding

---

[6] Popper (1959) exemplified his thoughts on 'falsification' using the example of swans: if all swans were thought to be white, it would only take the observation of one black swan, to falsify the perception that all swans are white.

LCM via knowledge management perspectives, and highlighted a situated knowing perspective as a possible further route to explore in LCM.

In my research I have had a practice-oriented approach, trying to study the field and the activities present. As of now my research has had mainly a managerial focus, I have thus studied practice in the sense of studying strategic initiatives present in the organization, and studied how sustainability practitioners and managers organize LCM in the everyday context, and the challenges these practitioners encounter when trying to integrate LCM into the organizations' business operations and functions. My research has demonstrated the importance of a situated knowing approach when understanding and developing LCM. Such focus on social aspects is highlighted by Sanna Poikkimäki (2006), who commented that emphasis only on technology and quantitative data "may not reveal the full importance of interaction and co-operation, or related learning and knowledge creation processes" (p. 126). Instead, she saw a need for more interpretative and qualitative perspectives on LCM. Hence, focus only on tools and structure will not explain why things happen as they do, or how life cycle related actions and people interact with each other and with the overall business practices (Rex 2008). Formalized structures in organizations, comprising of tools and the like, create a systematic approach to LCM, but social practices involves the important creation of meaning among practitioners, and affect whether sustainability initiatives will be prioritized in the everyday work, or not (Schmidt 2013). A need for more attention to practice and practitioners in in sustainability has been highlighted (e.g., Rosén 2011; Löfgren 2012), but as of now, LCM literature has been dominated by general critical success factors and focus on tools.

4.1 POSSIBLE FUTURE STUDIES

My continued research direction can take one of several paths. Based on my studies there are several possible paths to further explore. Studies could, for example, be done with regards to networks; potentially studying one or several of the existing LCM-related networks and its' members, to understand the practice of those networks. Such an approach would provide valuable insights on the use of these networks, and on the potential of organizing a specific LCM network, or utilizing a community of practice approach to LCM.

Another possible research direction would be to conduct a prolonged study of practice, for example, at a sales department or a purchasing department, as these is examples of departments important in communication with external actors. These are also departments identified in *paper I* as potential areas where further integration efforts are needed. Such a study would provide rich data on the everyday activities, and on how these activities relate to existing LCM-related initiatives. It would thus be a possibility to study how these initiatives are managed at local departments, and in what way environmental issues permeate these departments. A thorough understanding of how environmental aspects affect local departments implies that such insights can be used to facilitate a more efficient development and use of sustainability related initiatives and tools.

A third direction of research could be to study specific line organizations, in that way tracing LCM-related initiatives and activities from its development to its actual usage; to follow the initiatives from top management level, throughout the line organization and middle management, to the operational level. Studying such practice would provide an understanding of how these initiatives disseminate through organizations and deeper insights on what obstacles that emerge along the way. A forth direction for further research could be to extend the research focus from a single company perspective to the whole product chain – possibly studying one or several product chains to examine how various LCM-related initiatives in an organization affect the products. Such a study would provide valuable insights on how inclusive these initiatives are, how well they are implemented, and how comprehensively these initiatives cover the entire product chain of these products. It would thus also be a step towards further collaboration with external actors, and integration of LCM in product chains.

These are some suggestions if research directions that has emerged from my studies. As of now my research has had mainly a managerial focus. Further studies, as the before mentioned examples, could elaborate on the practice-oriented approach and include also operational levels, as a complement to the managerial perspective. Or, it could take a turn towards studying LCM in-between actors and organizations in product chains, or further study the possibility of an LCM-specific network or community of practice.

5. CLOSING

In my research I have gone back and forth from the 'desk', to the field, in a continuous process. Data has thus been collected from the literature reviews and from the empirical material in parallel, and influences from both have developed my focus. It has thus been an emergent process. Conducting research on LCM has meant that I have moved in-between several research fields and also tried to bridge fields. It has certainly not been entirely easy, but it has been a great learning experience. It has made me contemplate the various ways of conducting research and writing papers, and it has forced me to position myself within research methodology, and research approaches. LCM is the field that I have studied, and which is the basis of my research. This being said, my social science background has dominated my approach, rather than a technical one, which position me within what I in *paper II* refer to as the life cycle thinking field. My research brought me to other fields, specifically to the knowledge management field, which has been used as a lens through which LCM can be further understood and developed. The LCM field, with its development focus and emphasis on improvement has influenced me, and I have had a solution-oriented approach, trying to understand, and potentially develop LCM, by gaining insights from other fields.

But I have also wandered into the empirical field. Czarniawska (2007) described how fieldwork consists of a curiosity of the people who construct their world differently than researchers do. I opened my 'window' in time and space, and tried to describe all that could be seen through it, being curious as of how sustainability practitioners organize and manage LCM. Entering the field of practice has been both inspiring and challenging. Inspiring because I have had the possibility to study LCM in its making, and I have been able to speak with, and listen to, the sustainability practitioners that work with these issues on a daily basis. The study provided me with an understanding and overview of the LCM practice present at the Company. But it has also been challenging at times, especially with regards to rules of participation. Rosalie Wax (1971/1985) described how the first part of field work — the initiation phase — is when "the fieldworker finds, is offered, and accepts the lines of communication and the social vantage points through and from which he will make his observations and will be permitted to participate" (p. 16). The level of access to

the field of practice in this case has been high, and I have had no difficulty of conducting the interviews that I have wished for. I was, for example, granted a temporary access card to the Company's premises, and had a desk available at the strategic sustainability department. Although, access has not been approved for all media, gaining access, for example to the Intranet, was less successful and denied on the basis of me not being an employee. The challenging part of this was not the denial of access, but rather the process of understanding the playing field, and the actors involved. Wax (1971/1985) referred to this as a 'social limbo' for the field researcher, when he or she is trying to figure out how to act and behave in the culture at hand. Someone who is not a standard member but instead "a person who, though he always is and remains an outsider or non-native, may function in the society in a manner that is useful and agreeable to his hosts" (p. 50). She described further that people usually do not mind the researcher trying to fit into the culture as "long as the fieldworker makes is clear that he knows he is only playing a part and that his newly acquired skills do not entitle him to any privileges which they are not willing to offer him" (p. 49). As my results began to accumulate, it was time for me to step out of the field, and back to the desk, writing my papers, and creating a narrative of the stories from the field. This Licentiate thesis is a product of that process.

The curtains fall

~

The white board is scribbled with notes on the latest activity, the upcoming anniversary of the sustainability portfolio. Texts and examples of best practice are prepared. The sales of the products have increased, although there is still a long way to go. Still there is time until the targets should be met, and so time will tell if they will be reached, excelled, or not reached at all.

~

REFERENCES

Baumann, Henrikke & Tillman, Anne-Marie (2004). *The hitch hiker's guide to LCA: an orientation in life cycle assessment methodology and application.* Lund: Studentlitteratur.

Benitez-Amado, Jose; Perez-Arostegui, Maria Nieves & Tamayo-Torres, Javier (2010). Information technology-enabled innovativeness and green capabilities. *Journal of Computer Information Systems, 51*(2), pp. 87-96.

Boland, Richard J. & Tenkasi, Ramkrishnan V. (1995). Perspective making and perspective taking in communities of knowing. *Organization Science, 4*(6), pp. 350-372.

Brown, John Seely & Duguid, Paul (1991). Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), pp. 40-57.

Bryman, Alan & Bell, Emma (2007). *Business Research Methods* (2nd ed.). Oxford : Oxford University Press.

Charmaz, Kathy (2006). *Constructing grounded theory: a practical guide through qualitative analysis.* Thousand Oaks, CA: SAGE.

Cheng, Jao-Hng; Yeh, Chung-Hsing & Tu, Chia-Wen (2008). Trust and knowledge sharing in green supply chains. *Supply Chain Management: An International Journal, 13*(4), pp. 283 – 295.

Clarke, Adele E. & Fujimura, Joan H. (Eds.) (1992). *The Right Tools for the Job.* Princeton: Princeton University Press.

Czarniawska, Barbara (1997). *Narrating the organization: dramas of institutional identity*. Chicago: University of Chicago Press.

Czarniawska, Barbara (1999). *Writing management. Organization theory as literary genre.* Oxford: Oxford University Press.

Czarniawska, Barbara (2004). *Narratives in social science research.* London: SAGE.

Czarniawska, Barbara (2007). *Shadowing and other techniques for doing fieldwork in modern societies*. Malmö: Liber.

Czarniawska, Barbara (forthcoming). *Social science research: from field to desk.* London: SAGE Publications Ltd.

d'Amato, Alessia & Roome, Nigel (2009). Toward an integrated model of leadership for corporate responsibility and sustainable development: a process model of corporate responsibility beyond management innovation. *Corporate Governance, 9*(4), pp. 421-434.

Davenport, Thomas H. & Prusak, Laurence (2000). *Working knowledge: How organizations manage what they know*. Boston, Massachusetts: Harvard Business School Press.

Davenport, Thomas H. & Völpel, Sven C. (2001). The rise of knowledge towards attention management. *Journal of Knowledge management, 5*(3), pp. 212-221.

Diedrich, Andreas (2004). *Engineering knowledge: how engineers and managers practice knowledge management*. PhD dissertation. Gothenburg: BAS Publishing.

Fava, James (1997). LCA: concept, methodology, or strategy? *Journal of Industrial Ecology, 1*(2), pp. 8-10.

Flyvbjerg, Bent (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), pp. 219–245.

Glaser, Barney & Strauss, Anselm (1967). *The discovery of grounded theory: strategies for qualitative research.* London: Weidenfeld and Nicolson.

Gold, Stefan; Seuring, Stefan & Beske, Philip (2010). Sustainable supply chain management and inter-organizational resources: a literature review. *Corporate Social Responsibility and Environmental Management, 17*(4), pp. 230–245.

Hart, Chris. (1999). *Doing a literature review. Releasing the social science research imagination.* London: SAGE.

Hislop, Donald (2005/2009). *Knowledge management in organizations: a critical introduction.* New York: Oxford University Press.

Hofmann, Kay H.; Theyel, Gregory & Wood, Craig H. (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), pp. 530–545.

Huang, Po-Shin & Shih, Li-Hsing (2009). Effective environmental management through environmental knowledge management. *International Journal of Environmental Science and Technology, 6*(1), pp. 35-50.

Hunkeler, David; Saur, Konrad; Rebitzer, Gerald; Finkbeiner, Matthias; Schmidth, Wulf-Peter; Jensen, Allan A.; Stranddorf, Heidi & Christiansen, Kim (2003). *Life cycle management.* SETAC Press.

Linnanen, Lassi; Bostrom, Taina & Miettinen, Pauli (1995). Life cycle management: integrated approach towards corporate environmental issues. *Business Strategy and the Environment, 4*(3), pp. 117-127.

Löfgren, Birger (2012). *The green engineer as an enabler of life-cycle management in manufacturing: models and practices.* PhD dissertation. Chalmers University of Technology.

Mol, Annemarie. (2003). *The body multiple: ontology in medical practice.* Durham, NC: Duke University Press.

Nicolini, Davide; Gherardi, Silvia & Yanow, Dvora (Eds.) (2003). *Knowing in organizations: a practice-based approach.* Armonk, New York, London, England: M.E. Sharp, Inc.

Nonaka, Ikujiro (1991). The knowledge creating company. *Harvard Business Review, 69*(6), pp. 96-104.

Orlikowski, Wanda J. (2002). Knowing in practice: enacting a collective capability in distributed organizing. *Organization Science, 13*(3), pp. 249-273.

Poikkimäki, Sanna (2006). *Look closer to see further – exploring environmental life cycle management, LCM.* PhD dissertation. University of Jyväskylä.

Popper, Karl (1959). *The Logic of Scientific Discovery.* Oxford, England: Basic Books.

Power, Winifred (Ed.) (2009). *Life cycle management: how business uses it to decrease footprint, create opportunities and make value chains more sustainable.* United Nations Environment Programme & Society of Environmental Toxicology and Chemistry Europe.

Remmen, Arne; Jensen, Allan A. & Frydendal, Jeppe (2007). *Life cycle management: a business guide to sustainability.* Nairobi, Kenya: UNEP/SETAC.

Rex, Emma (2008). Marketing for life cycle thinking. PhD dissertation. Chalmers University of Technology.

Rosén, Magnus (2011). *The practice of strategy formation – opening the green box.* PhD dissertation. School of Economics and Commercial Law, Gothenburg University. Department of Business Administration.

Scarso, Eric & Bolisani, Ettore (2008). Communities of practice as structures for managing knowledge in networked corporations. *Journal of Manufacturing Technology Management, 19*(3), pp. 374-390.

Seuring, Stefan (2004). Industrial ecology, life cycles, supply chains: differences and interrelations. *Business Strategy and the Environment, 13*(5), pp. 306–319.

Silverman, David (2011). *Interpreting qualitative data: a guide to the principles of qualitative research* (4th ed.). London: SAGE Publications Ltd.

Schmidt, Kirsten (2013). Social practices – a new focus in LCM. In *LCM2013: The sixth International Conference on Life Cycle Management,* Gothenburg.

Sonnemann, Guido & de Leeuw, Bas (2006). Life cycle management in developing countries: State of the art and outlook. *International Journal of Life Cycle Assessment, 11*(1), pp. 123-126.

van Kleef, J.A.G. & Roome, Nigel (2007). Developing capabilities and competence for sustainable business management as innovation: a research agenda. *Journal of Cleaner Production, 15*(1), pp. 38-51.

Vermeulen, Walter J. V. & Seuring, Stefan (2009), Sustainability through the market – the impacts of sustainable supply chain management: introduction. *Sustainable development, 17*(5), p. 269–273.

Wax, Rosalie (1971/1985). *Doing field work: warnings and advice.* Chicago: Midway Reprint.

Wenger, Etienne C. & Snyder, William M. (2000). Communities of practice: the organizational frontier. *Harvard Business Review, 78*(1), pp. 139-145.

Wernick, Iddo (2002). Environmental Knowledge Management. *Journal of Industrial Ecology, 6*(2), pp. 7–9.

Zack, Michael, H. (Ed.) (1999). *Knowledge and strategy.* Boston: Butterworth Heinemann.