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Lindén, H., Baumann, H., Rex, E. (2019). LCM development: Focusing on the LC promoters and their organizational problem-solving. *International Journal of Life Cycle Assessment*, 24(2): 297-309. <http://dx.doi.org/10.1007/s11367-018-1523-z>

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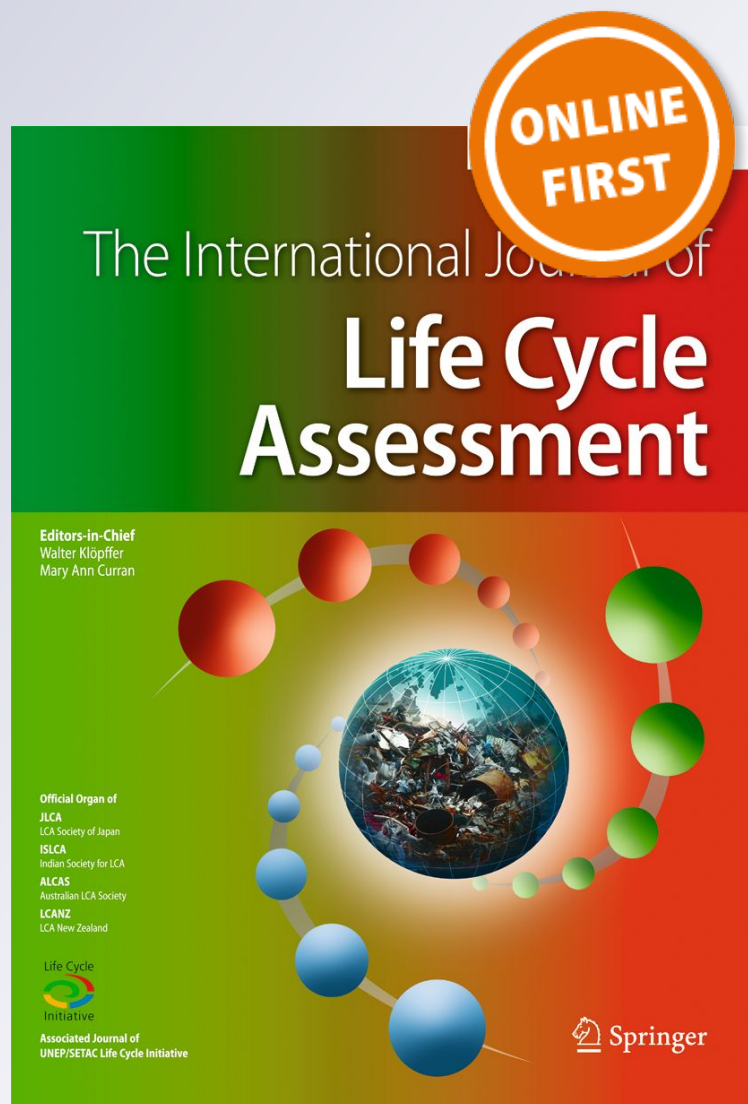
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The International Journal of Life Cycle Assessment

ISSN 0948-3349

Int J Life Cycle Assess

DOI 10.1007/s11367-018-1523-z



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LCM development: focusing on the *LC promoters* and their organizational problem-solving

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Received: 14 February 2018 / Accepted: 19 August 2018
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Abstract

Purpose Life cycle management (LCM) implies a specific sustainability perspective which extends environmental management along the product life cycle, with the aim of decreasing negative environmental impact throughout the product chain. Research has identified that the adoption of LCM in the industry depends upon its situational adaptation to the organizational context. Even so, little is known about the specifics of this adaptation. With this paper, our aim is to add knowledge on LCM adoption and adaptation.

Methods A systematic analysis of empirical material on life cycle (LC) activity in six multinational corporations (MNCs) is conducted, by applying a secondary analysis of qualitative data (Heaton 2008). In order to study instances of LCM adoption and adaptation, we focus on the acts and situations of *LC promoters*. The identified instances are analyzed through the lens of *situated problem-solving* (Kuhn and Jackson 2008).

Results and discussion Sixty-seven instances of LC promotion were identified and analyzed, resulting in the identification of eight categories of problem-situations typically encountered by LC promoters. The identified problem-situations represent different situations when the organizational appropriateness of the LC approach is at stake and to which responses tailored to the organization are put forward by a LC promoter. The results bring to the fore the ubiquity of organizational and creative problem-solving, highlighting the role of LC promoters as change agents for LCM adoption, and depict the development of LCM as an emergent practice, rather than an implementation process.

Conclusions This paper provides a first systematic analysis of LC promoters enacting a variety of responses to organizationally challenging LC situations, thus detailing the adaptation necessary for embedding LCM in the industry. Findings show that the development of LCM to a great extent is about the promotion of a LC approach, and that LC promoters need organizational knowing, in addition to LC knowing, to make the LC approach relevant to management and business.

Keywords Life cycle management (LCM) · Life cycle (LC) promoters · Life cycle thinking (LCT) · Organizational problem-solving · Situational adaptation · Sustainability

Responsible editor: Julia Martínez-Blanco

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s11367-018-1523-z>) contains supplementary material, which is available to authorized users.

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1 Introduction

Research has shown that a product perspective provides a valuable approach for optimizing the reduction of negative environmental impact (see e.g., Hart 1997; Boons 2000; Welford 2003). The framework of life cycle management (LCM) takes such point of departure, as it aims to minimize the negative environmental burden from raw material extraction, to production, manufacturing, and distribution, to end-of-use of the product (Baumann and Tillman 2004; Poikkimäki 2006; Remmen et al. 2007; Balkau and Sonnemann 2010). Yet, the adoption of LCM in the industry has proven to be challenging, as it extends attention beyond company boundaries (Poikkimäki 2006).

In the literature, LCM has been described as a “*management* concept with an underlying life cycle-sustainability-oriented mindset” (Bey 2018, p. 521 [original italics]), and as a “flexible integrated management framework of concepts, techniques and procedures incorporating environmental, economic and social aspects of products, processes and organizations”, rather than a single tool or methodology (Jensen and Remmen 2004, p. 11). Compared to similar supply chain concepts, in LCM, the environmental product life cycle is considered the dominating approach (Seuring 2004). For companies that have embraced the idea of life cycle thinking (LCT) and that would like to pursue a life cycle (LC) approach, the LCM framework provides a toolbox (e.g., life cycle assessment (LCA), design for environment (DfE), life cycle costing (LCC), organizational LCA (O-LCA))—“from which the organization picks its individual set leading to their tailor-made LCM approach” (Bey 2018, p. 521).

Earlier studies of LCM and the use of LCA note that the adoption of a LC approach is influenced by ‘contextual factors’ (Heiskanen 2000), and that LCM does not have a ‘one size fits all’ solution—rather, that it has to be “tailored to the unique context” (Sonneman and Margni 2015, p. 24). However, it is unclear how this tailoring to context takes place. There is thus a gap in the literature concerning the actual tailoring activities recommended to achieve LC adoption.

In order to better understand the processes of adoption and adaptation of LCM, one has to recognize the managerial aspects of LCM (Baumann et al. 2017). This means, for example, taking a practice perspective by focusing on the details of everyday activities (Nicolini 2012), and the shared routines of behavior (Whittington 2006). Often, when focusing only on the structure in organizations, it is easy to forget that the process of organizing happens through people and their talking (Boden 1994). It is thus by studying the everyday activities of LCM—the “practices, reflections, and deliberations in the efforts of creating life cycle-based work in a company” (Nilsson-Lindén et al. 2018, p. 2)—that insights on LCM development is found. Similarly, de Haan and Rotmans (2018) identify that the actor perspective in sustainability transitions is under-researched.

In the empirical material from our previous studies on LCM practice, we have noted that *what* individuals do play a significant role in furthering the use of the LC approach in their respective organizations. We take this observation as a starting point for how we can increase knowledge on LCM tailoring and adoption, and focus thus on the situations and acts by practitioners working with LCM in multinational corporations (MNCs). For the purpose of this paper, we identify a category of LC practitioner (see Baumann 2000; Cooper and Fava 2006) that we here refer to as *LC promoter*. LC promoters are characterized by their efforts to develop the LC approach in their organizations, and their acts in different situations can be analyzed with organizational problem-solving and tailoring. Thus, in this paper, we perform a re-examination

of empirical and qualitative data (Heaton 2008) from our previously reported studies on LCM. This enables a more comprehensive analysis of tailoring of the LC approach for LCM than the individual studies of single MNCs allow. An improved understanding of the tailoring acts by LC promoters provides strategic guidance on adoption and development of LCM in the industry.

2 The role of LC promoters for adoption and adaptation of LCM in MNCs

While traditional corporate environmental management (EM) and LCM hold many similarities, the critical difference between the concepts lies in the extension of consideration, from one company and its traditional boundaries towards the whole product life cycle (Poikkimäki 2006, see also e.g., Remmen et al. 2007; Power 2009; UNEP/SETAC 2012). There are many definitions of LCM (Poikkimäki 2006), but it has been described for example as a product management system (Remmen et al. 2007), a framework or a way of thinking (Poikkimäki 2006), and as providing a social planner’s view (Heiskanen 2002) for guiding practitioners on how to act and think concerning issues related to holistic EM with a product chain perspective. Tools are thus not considered enough on their own, instead, an overall LCM concept is needed to reach a coherent and holistic approach, practiced in the organization (Bey 2018). Such a holistic approach entails a new ‘LCA worldview and a new type of management (Heiskanen 2000). This means that companies aiming to extend EM towards LCM need to *actively* adopt the LC approach, and the management and tools that this requires.

Studies of LC adoption and integration of LCM in company practices have been relatively few and more studies have been called for (Seuring 2004; Vermeulen and Seuring 2009). Existing studies show that LCM development requires more efforts than adoption: LCM has to be adapted and tailored to the specific organizational context (Mortimer 2011; van der Heijden et al. 2012; Sonneman and Margni 2015); Baumann (2000) observed that LC practitioners engaged in LC promotional activities and concluded that identical LC implementation ‘recipes’ will not fit all organizations (Baumann 2000); individuals’ interpretations and contextual factors influence the use of LCA in organizations (Heiskanen 2000; Rex and Baumann 2007). In sum, the significance of practitioners for LCM development is identified in these papers, but their role is not examined in detail.

In the LCT and LCM literature, individuals are often described in terms of LCA practitioners, and as important actors for the uptake of the LC perspective in the industry (e.g., Cooper and Fava 2006; Teixeira and Pax 2011). However, these studies focus on the LCA practitioner’s preferences, awareness, and perceptions about various methodological

LCA options (e.g., system boundary settings, software, LC impact assessment methods, data sources). The LCA practitioner is thus chiefly conceptualized as a person conducting LCA studies, and the need for accessible and cheap data is identified as one of the main obstacles for wider adoption of LCA (Cooper and Fava 2006; Teixeira and Pax 2011; Testa et al. 2016). Cooper and Fava (2006) noted that some LCA practitioners saw a need for *promotion* of LCA in industry, while Testa et al. (2016) concluded that the main difficulty for LCA adoption concerned how LCA results could be transformed into *management* guidelines.

The role of individuals and *change agents* has been addressed with a variety of terms in the environmental literature, for example, *environmental champions* (Post and Altman 1994; Walley and Stubbs 1999; Visser and Crane 2010), *enviropreneurs* (Keogh and Polonsky 1998), *ecopreneurs* (Linnanen 2002; Schaltegger 2002; Schaper 2002; Volery 2002), *green entrepreneurs* (Walley and Taylor 2002; Volery 2002), and *environmental intrapreneurs* (Hostager et al. 1998). The *environmental entrepreneur* is often described as someone who champions an environmentally related idea in an organization (Post and Altman 1994; Walley and Stubbs 1999; Schaltegger 2002) and who has an explicit focus on the identification of environmental *and* business opportunities (i.e., environmental benefits and business profits) and related risks (Hostager et al. 1998; Keogh and Polonsky 1998; Linnanen 2002; Walley and Taylor 2002). However, these types of practitioners are most often described in relation to EM, rather than in relation to the specifics of LCM. In contrast, the *LCA practitioner* is often described as someone conducting LCA, rather than as a practitioner with efforts focused on promoting LCM in industry. The usage of terms such as *entrepreneur* risk leading our thoughts to individuals who go out their way to challenge existing markets or organizational norms, who identify opportunities that will bring financial gains and environmental benefits and do not hesitate to tread untouched lands. Other terms, such as *champion*, are sometimes associated with specific theoretical frameworks (in this case institutional theory). We do not see it adequate to use these terms for these LC practitioners. Instead, we refer to them as *LC promoters*, referring to those practitioners who strive to promote and develop LCM in their organizations. We suggest that by studying the acts and situations of LC promoters, important insights concerning the uptake of the LC perspective into corporate practice can be obtained.

A LC promoter is in this paper viewed as a role that can be taken on by a LC practitioner positioned as a LCA specialist, a sustainability manager, or similar. An individual can shift between different roles, and when it comes to CSR adoption, Osagie et al. (2016) found that CSR managers take on, on different occasions, one of six different roles: coordinator, stimulator, networker, strategist, monitor, and mentor. The

skills and knowledge applied for each role are suggested to vary in importance depending on the enacted role (Osagie et al. 2016). Visser and Crane (2010), on the other hand, suggest four types of sustainability managers; experts, facilitators, catalysts, and analysts, based instead on their motivation and engagement in their sustainability work. They conclude that having a varied group or team of practitioners with different roles in the organization is important. Further, they conclude that a sustainability manager does not have to be considered a champion, or the other way around (Visser and Crane 2010).

The LCM literature, in general, refers to the ‘implementation’ of LCM (e.g., Linnanen et al. 1995; Grayson et al. 2010), where LCM is seen as a planned procedure. Instead, the adaptation of sustainability concepts to specific organizational context has been suggested to be a process of *embedding* in an organization, an emergent change process consisting of small steps, and without clear predictability (van der Heijden et al. 2012, see also Neugebauer et al. 2016). In this process, the ability of LC promoters to adapt their language to different parts of an organization is seen to be important, as well as the acts of relationship-building, networking (Walley and Stubbs 1999; van der Heijden et al. 2012), adaptation to local ways of working (van der Heijden et al. 2012), and to look for opportunities of ‘hijacking’ organizational agendas and turning them into a green agenda (Walley and Stubbs 1999). Social practices in LCM thus hold a prominent role (Schmidt 2013).

To sum up, LCM is more than the application and results of LCA tools. Since LCA results need to be turned into interesting and useful insights for business management, there is a need to study the LC-related activities that go beyond the ‘mere’ conduct of a conventional LCA study (see Baumann and Tillman 2004; Curran 2012). Also, change agents have been found important in the process of adapting sustainability concepts to the local organizational context in company networks and chains (van der Heijden et al. 2012). Drawing on these insights, LCM adoption and adaptation can be better understood by studying the acts of LC promoters in different situations.

3 Methods

The tailoring of LCM to organizational context is in this paper explored by studying the acts and situations of *LC promoters*. As LC promoters engage in many LC-related activities other than those directly associated with performing an LCA study (Baumann 2000; Cooper and Fava 2006), the empirical material on these other LC-related acts and situations provides rich data on the tailoring and development of LCM in industry. Here, a LC promoter is understood as a practitioner who strive to promote and develop a LC approach in his/her respective organization, independent of his/her position in the organization. The acts of LC promoters are viewed as instances of

promotion, during which LC promoters hope to achieve LC uptake and to advance the use of the LC approach in their organizations. In this paper, we refer to the LC approach as a broad concept, in order to cover the many ways in which LCT can be manifested in an organization (though LCM as a management concept, use of LCA as a tool, use of LC-based indicators etc.). Evidence of LC promotion is here sought in empirical field material collected during nearly 20 years of research on LCM in the industry.

The acts of tailoring indicate that LCM adoption is an emergent strategy. This enables us to analyze the promotional instances in the empirical material through the lens of *situated problem-solving* (see Kuhn and Jackson 2008). It is a framework that builds on social practice theory, and identifies how acts of knowledge are part of problem-solving activities. From this follows that *knowing* is considered a more appropriate word than knowledge, as it refers to enactments of knowledge in a process, constructed in ongoing relationships, and thereby constituting a practice (Orlikowski 2002; Nicolini et al. 2003; Diedrich 2004). The *knowledge-accomplishing framework* was developed to provide methodological guidance on knowing and problem-solving in organizations. It builds on the idea that practitioners experience different *determinacy* to the problematic situations they encounter and that this renders different types of responses (Kuhn and Jackson 2008).

Figure 1 shows a modified visualization of the knowledge-accomplishing framework. Kuhn and Jackson (2008) describe problematic situations to be those where the state of affairs is “formed by a stream of past and projected practices in which actors perceive a need to take action to address a threat (current or potential) to ongoing action” (p. 457). When situations appear routine (i.e., high determinacy), actions seem straightforward. Often the actions become those of *information transmission* or *information request*, meaning that it often seems sufficient to convey information between persons

and/or artifacts (i.e., *knowledge deployment*). In other situations, when the determinacy is lower, practitioners might not agree on the actions or cannot anticipate the moves of others, or find it difficult to understand the requirements needed for acting on the situation. Practitioners will in these situations seek either *instruction* or *improvisation*. Instruction refers to when practitioners strive to find others that can help to manage the ambiguity in order to understand the system, while improvisation refers to when practitioner do not know how to act and thus need to improvise. It is situations like these that become ground for *knowledge development* for practitioners (Kuhn and Jackson 2008).

Following this framework, LC promotional activities were viewed as problem-solving responses to situations considered problematic by the LC promoters. Instances of LC promotion were identified in the collected empirical material from six MNCs (Table 1), within five industry sectors; Chemical, Electronics, Pulp and Paper, Automotive and Manufacturing. The empirical material consisted of interviews, observations, and document studies. The studied practitioners worked in various environmentally related positions, such as environmental or sustainability managers, LCA specialists, and LCM project managers. This material was initially collected as part of separate studies of MNCs and their use of the LC approach (Baumann 2000; Rex and Baumann 2004; Rex and Baumann 2006; Rex 2007; Nilsson-Lindén et al. 2018; Rex et al. 2015). This present paper thus presents a secondary analysis building on a re-use of pre-existing qualitative data derived from previous research studies in order to investigate additional research questions (see Heaton 2008).

From this material, we identified acts and situations of LC promoters. The promotional instances were then described, compared, and grouped based on similar features, through an iterative process. From this process, we could identify categories of ‘typical’ problematic situations that LC promoters

Fig. 1 Applied framework for knowledge-related practices in situated problem-solving, based on the framework by Kuhn and Jackson (2008)

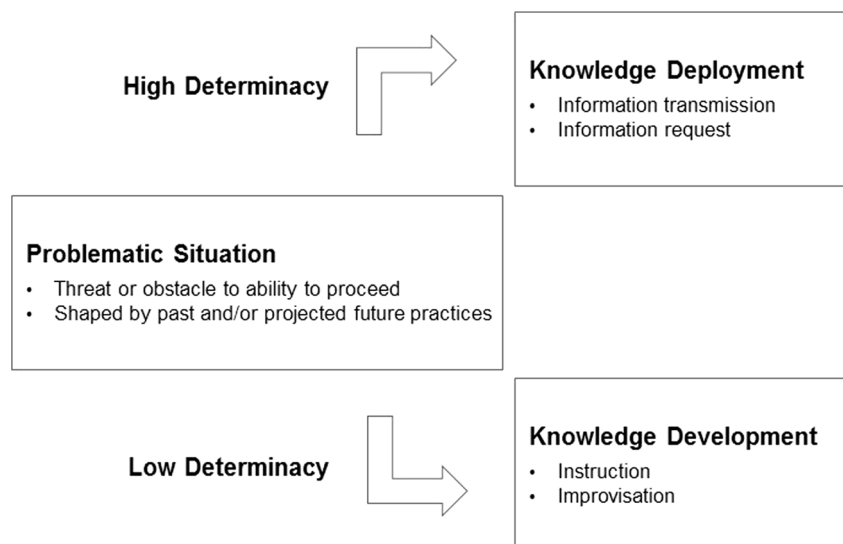


Table 1 Collected empirical material on LCM in industry

MNCs	Time period covered	No of identified problematic situations	Empirical material otherwise reported in
1. Chemical MNC	1996–1997, 2009–2015	29	Baumann (2000), Rex et al. (2015)
2. Electronics MNC	1996–1997	7	Baumann (2000)
3. Pulp and Paper MNC A	Late 1980s to 2005	6	Rex and Baumann (2004), Rex and Baumann (2006)
4. Pulp and Paper MNC B	Late 1980s to 2005	6	Rex and Baumann (2004), Rex and Baumann (2006)
5. Automotive MNC	2001–2007	3	Rex (2007)
6. Manufacturing MNC	2012–2014	16	Nilsson-Lindén et al. (2018)

faced when working with the development of the LC approach in their organizations. Furthermore, the enacted responses to a particular problem-situation constitute a knowledge-based practice that can be characterized.

The number of identified problematic situations shown in Table 1 should not be seen as statistics of the real number of problematic situations or promotional activity, but represent instances possible to identify and analyze from our existing material. We note that some of these identified problem-situations are recurring in our studies, however, we list them only once in the results section. The aim of this paper is not to give a comprehensive overview of the LC work of each included MNC. Instead, the aim of this paper is to provide valid and typical examples of problematic situations that LC promoters can experience, together with examples of problem-solving activities.

4 Promotional acts as instances of problem-situations and problem-solving

In our material, we found that LC practitioners engaged both in the ‘typical’ acts of conducting an LCA study (i.e., goal and scope definition, modeling, data collection, computation, etc.) and promotional acts aiming at the adoption of the LC perspective by other organizational members, with the hope that these would lead to the subsequent development of LCM in their respective company. We note that some LC practitioners engage more frequently in promotional activity than others—the labels LCA specialist and LC promoter should not be understood here as definite professional identities, but as an indication of the different roles LC practitioners can take in the course of their work.

In all, we found 67 distinct promotional instances in our empirical material (see Table 1). Since certain instances were recurring in our material, that is, the same LC promoter enacted the same solution several times within the company; we counted such repeated instances as a single distinct instance.

The 67 promotional instances were analyzed through the lens of Kuhn and Jackson’s (2008) framework (Fig. 1), by which we found that the acts of LC promoters could be grouped as responses to eight types of problem-situations. Each type of problem-situation represents a particular kind of organizational challenge encountered by LC promoters in their efforts for adoption and development of the LC approach in their respective company (see Table 2). Broadly, the problem-situations involve the LC promoter seeking to convince other organizational members about the usefulness and applicability of the LC approach and to obtain a response that ensures their adoption of the proposed LC approach.

Moreover, our empirical material exhibits that LC promoters employed a variety of problem-solving responses in each type of problem-situation (see Table 2; the full tables of instances of problem-solving responses by LC promoters are reported on in the Electronic Supplementary Material, Online Resource 1 (Table A and Table B)). Following Kuhn and Jackson (2008), the many different problem-solving responses to a single type of problem-situation reflect the situatedness of the enactments of LC promoter’s knowing in their problem-solving in the different organizational contexts covered by the empirical material. The difference between the number of documented promotional instances and the number of problem-solving responses is caused by the fact that a few problem-solving responses were observed in more than one organizational context. Next, we outline the practices associated with the situated problem-solving for each problem-situation.

4.1 Problem-solving practices

According to Kuhn and Jackson (2008), enactments of problem-solving to a particular problem constitute a knowledge-based practice. Here, we take the LC promoter’s promotional acts (i.e., problem-solving responses) as a basis for describing the characteristics of their practices and the type of knowing enacted for handling each problem-situation.

Table 2 Types of problem-situations encountered by LC promoters and the number of variations in problem-solving responses identified in the empirical material

Type of problem-situation encountered by the LC promoter	Number of documented promotional instances	Number of identified problem-solving responses
1. Trying to create interest for LCT in the company	5	5
2. Trying to gain a mandate to do LC work in the company	7	5
3. Trying to identify other parties in the company interested in LC efforts	18	8
4. Attempting to create LC efforts that blend in operationally and can be adopted in the organization	11	10
5. Seeking to generate a widespread engagement with LCT throughout the company	11	8
6. Seeking legitimacy for LC efforts	7	5
7. Trying to relate the LC approach to the company business logic	9	7
8. Attempting to extend the LC approach beyond the corporation and engage with product chain actors	4	4
Sum	67	52

4.1.1 Situation 1. LC promoter trying to create interest for LCT in the company

The perceived problem is that there is no or little interest for the LC approach in the company. To create interest in LCT, the LC promoter does not expound on the environmental benefits of LCT and LCA. Instead, we found that LC promoters pointed to an organizational problem experienced in the company and associated its solution with the LC approach. The organizational problems that were referred to by LC promoters in our empirical material varied widely, and ranged from problematic corporate reputation, competitive threat, or developing norms in their business sector. Three examples are as follows:

In a company in the chemical industry, the LC promoter attracted attention to the LC approach by referring to the generally acknowledged poor environmental reputation of chemical companies, claiming that adopting LCT would bring a new and different perspective that would change people's perspective of the company.

In an electronics communications company, the LC promoter attracted attention to the LC approach by referring to the current conventional wisdom on sustainability in the electronics sector: 'there is a broad understanding that 'miniaturization' with electronics is resource-efficient, and with LCA we can prove it'.

The LC promoter referred to market claims made by company competitors, claiming that these could be met by developing new alternatives based on findings from LCA studies.

(For more examples, see column 1 in Table A in Online Resource 1, Electronic Supplementary Material)

The way the LC approach is described as a solution to organizational problems also differed, and was presented, for

example, as a general activity ('let's do LCA') or as specific trouble-shooting activity ('let's identify alternatives via LCA'). This means that the LC promoter needs to craft a plausible argument on how adopting some version of the LC approach help to resolve the organizational problem.

LC promoter's practice for creating interest in LCT involves the identification of an organizational problem that is generally acknowledged within the company. Since each company is different with regards to business models, position on the market, et cetera, LC promoters in different companies are likely to refer to different organizational problems. The practice also involves the presentation of a tailored version of the LC approach that constitutes a plausible solution to the organizational problem. This practice requires a knowing of the perceptions in the company, the judicious selection of one of these that is generally considered as problematic and the ability to propose a tailored solution based in LCT.

4.1.2 Situation 2. LC promoter trying to gain a mandate to do LC work in the company

Since the LC approach is little known and attracts only limited interest, there is no obvious source from where the LC promoter can obtain a mandate for his/her LC activities within the organization and find funds for this work. Here, we found that LC promoters identify other organizational members that show interest in the LC approach, typically, managers with discretionary power over resources sufficient to fund, for example, the starting of an LCA project or employ an LCA specialist. From our material, we found that the identification happened on many occasions through chance meetings, although we also found a few instances where strategically prepared proposals were put forward.

The way in which LC promoters managed to obtain managers support at such meetings happened by absorbing the

manager's frustrations over unmet management goals. In our material, we note that such frustrations concern, for example, unmet customer expectations, dysfunctional working methods, and confusing management choices. Here are two examples of situations in which a LC promoter obtain support for an LCA project:

At a chance meeting by a coffee machine, the LC promoter listens to a manager expressing frustration about choices between product alternatives. The LC promoter promptly took the opportunity to propose an LCA study to resolve the confusion.

Whenever given an opportunity to give a presentation, the LC promoter proposed an LCA project tailored towards the interests of persons in the audience.

Other documented instances cover both failed attempts, and a successful attempt leading up to the hiring of a LCA specialist. While obtaining support is a gamble, we also found instances in which the LC promoter safeguarded some support by requesting smaller investments than actually needed for what he/she had in mind (see column 2 in Table A in Online Resource 1, Electronic Supplementary Material).

The LC promoter's practice for securing a mandate and funds for LC-related work involves a constant preparedness for taking opportunities combined with an ability to quickly propose interesting studies. In addition to thorough knowledge of the possibilities of the LC approach, this requires also a thorough knowing of the organization, the ability to listen and bargaining skills.

4.1.3 Situation 3. LC promoter trying to identify other parties in the company interested in LC efforts

Working alone is perceived as a problem for the LC promoter, not only for the ineffectiveness of being a sole proponent of a particular sustainability perspective, but also for the need for exchange with many actors representing the product chain. From the empirical material, we found that the LC promoter's response included a variety of ways of making contact. On the one hand, the LC promoters organized opportunities through which they could get to know others more closely, before determining whom of these could be good allies. On the other hand, the LC promoters contacted directly persons who were likely to share their interest in LC-related topics, such as the sustainability of products. A typical observation from our material was that the LC promoter 'bypassed' formal hierarchy when making these contacts. Examples of problem-solving responses to working alone are (see also column 3 in Table A in Online Resource 1, Electronic Supplementary Material):

The LC promoter systematically utilized the possibility to create diploma projects for MSc students on LC-

related topics for which there was no internal funding. This permitted the identification of suitable recruits, useful in the furthering of LC efforts.

Instead of asking for permission to build an organization for LC efforts in the company, the LC promoters created informal reference groups to each project and acted as coordinating 'spiders'. With time, the loosely formed groups stabilized with the more dedicated members, and became an effective organization for leading LC operations. The good track record of the informal group led subsequently to it becoming recognized and formalized. In order to achieve the development of green product ranges, the LC promoters started a process in which they engaged directly with teams in the product development function in the company, instead of working through the formal decision-making process in the hierarchical levels of the organization.

Although the empirical material shows many different examples of problem-solving responses, these could be summarized as continued efforts of organizational capacity-building aiming to enable the development of LC efforts within the company. We found LC promoters continuously reflecting on how to augment their LC-related ambitions through a range of means that could help in the building of a supportive network of like-minded within the company. A preference for 'getting things done' often led LC promoters to bypass regular decision-making processes—whenever these were deemed too slow and ineffective, LC efforts were carried out through direct partnerships in the supportive networks. We found that the LC promoters had a multi-faceted practice for recruiting and growing organizational resources helpful in the development of a LC approach in the company. This practice rests on the ability to evaluate the effectiveness of both formal and informal avenues of work, as well as on a certain amount of audacity when choosing the more informal routes.

4.1.4 Situation 4. Attempting to create LC efforts that blend in operationally and can be adopted in the organization

LC promoters recognized that there is a difference between finding a haven for stand-alone projects (i.e., situation 2) and the company having operational structures where LC actions are a matter of course. In our empirical material, this is one of the problem-situations to which we found most examples of problem-solving instances.

The LC promoter's responses included, on the one hand, a LCT-guided targeting of different processes, and on the other, an extensive tailoring of the LC approach to making it blend in attractively with the process at hand. When the LC promoters identified operational processes where they saw an overlap with the LC approach, they emphasized the commonalities between the LC approach and the targeted process. Such

emphasized commonalities differed depending on the targeted context (i.e., the product perspective of the LC approach for product developers, quantitative assessment methodology for KPI, etc.). Furthermore, to encourage adoption of the LC approach, the LC promoters had different ways of preparing tailor-made LC tools in the hope that these could ‘effortlessly’ blend in into the targeted work processes. Here follow three examples of how LC promoters act towards achieving adoption of the LC approach in the companies’ operating processes (for more examples, see column 4 in Table A in Online Resource 1, Electronic Supplementary Material):

Given the product perspective of LCT, LC promoters targeted the routines of the product development process. They developed, presented, and introduced a set of LC tools adapted to the routines within product development. Given the existing use of corporate-wide quantitative targets, LC promoters developed and introduced a corporate-wide carbon reduction target that spanned the entire life cycle, that later got adopted.

At the time of introduction of CO₂ emission trading in the industry, the LC promoter participated in meetings with the company economists in charge of the company’s response to the new trading. Here, the LC promoter introduced the LC approach as ‘environmental accounting’ to the economists. Subsequently, an LC tool focusing only on CO₂ was developed for the economists, who then adopted it.

We noted that the LC promoters, to a great extent, tackled one organizational function after another. Tailoring of the LC approach concerns methodological elements, as well as the language used by LC promoters. We noted that the term “life cycle...” was typically avoided and rephrased to sound more like the ‘local’ terminology, for example, the LC approach is worded as ‘environmental accounting’ or ‘supply chain mapping’. Sometimes, when an opportunity arose, LC promoters engaged in ongoing change processes in the company since these were seen to provide chances for influencing key organizational processes with a LC perspective.

The practice can be summarized as ways of influencing the operational structures of the company so that these embrace a LC perspective. The ability to spread the LC approach by blending in is based on a thorough knowing the possibilities of the LC approach, combined with a broad understanding of the operation of the organization and an ability to assimilate the needs and the language of people working in different parts of the company.

4.1.5 Situation 5. Seeking to generate a widespread engagement with LCT throughout the company

From the material, we note that LC promoters recognize that it is insufficient in the long run to keep working through

networks of like-minded if LCT and LCM are to become regular and influential notions in the organizations. Generating wider engagement for LCT and LCM is thus a challenge faced by LC promoters.

Since LCT represents a systems perspective on products, emphasizing comprehensive environmental considerations and the connectedness of eco-design choices to material sourcing, energy use in manufacturing, recycling possibilities, et cetera, LC promoters see a need for engaging with all functions and levels in the company. The following are three examples of instances where LC promoters tried to generate a widespread engagement with LCT throughout the company:

The LC promoters got involved in the general sustainability training for employees (large-scale communication) as a way to spread LCT in the organization.

The LC promoters proactively developed methods and collected data to show to interested persons what is possible and that the necessary info was ‘already there’, in order to facilitate their adoption of a LC approach.

The LC promoters linked/framed LC actions to ‘new,’ ‘hot’, and trendy topics, for example, ‘the first carbon-neutral factory’, or ‘first hybrid truck’, to increase attention and commitment in the organization.

These problem-solving responses show a wide range of ways in which LC promoters tried to generate more wide-reaching engagement for LCT and LCM, ranging from sustainability training, to coaching, to linking it to popular topics, to inspiring internal media articles, to showing possibilities of LC alternatives. The practice for generating a widespread engagement with LCT throughout a company requires a knowing of social dynamics and communication, combined with the skills of socialites to remember individual members of the organization, their roles, and engage with them at chance meetings (see also column 5 in Table B in Online Resource 1, Electronic Supplementary Material, for more related examples).

4.1.6 Situation 6. Seeking legitimacy for LC efforts

One of the problematic situations identified from the empirical material concerns how LC promoters gain legitimacy for their LC efforts. This implies that LC promoters experience a need to justify their LC work. From the results, we noted that LC promoters responded to this situation by using internal and/or external means to create legitimacy for their own LC work. Some of the problem-solving responses are characterized by LC promoters trying to gain legitimacy by referring to top management support, others by their gathering of witness accounts of the usefulness of an LC approach for the business, as these two examples show:

The LC promoters often referred to having CEO support, with statements such as ‘on the agenda of top management’ et cetera as a way of justifying activities.

The LC promoter continually gathered evidence of the business usefulness (i.e., efficiency, innovation, customer relations) of LCA from LC projects in order to give justification to LC efforts whenever needed.

There are also examples of LC promoters trying to gain legitimacy by engaging third parties:

The LC promoters set up collaboration with a third party in order to gain legitimacy and credibility with the help of an external actor of high standards.

The LC promoters engaged second-tier customers to testify for the benefits of products with better LC performance, as a way of providing credibility to the performance.

The legitimization of LC efforts is a practice for obtaining explicit recognition from parties external to the immediate network of LC supporters, both inside and outside the organization. This practice involves knowing of organizational context, for where to gain explicit recognition and appreciation. It also involves innovative ways of engaging other parties as enablers of legitimacy efforts (see also column 6 in Table B in Online Resource 1, Electronic Supplementary Material, for more related examples).

4.1.7 Situation 7. Trying to relate the LC approach to the company business logic

Even if the LC approach is found across many ‘core activities’ in an organization, we note that LC promoters found that LCT has had small (if any) real influence on the company’s business. The problem of limited influence, in spite of many LC activities, was met with a change in what guides LC promotion. Instead of using the LC perspective as a basis for identifying which operational processes to target (as in problem-situation 4), the LC promoters here used their understanding of the business logic to determine where they should direct their LC promotional activities. From our material, we identified instances where LC promoters try different ways of relating the LC approach to the company’s overall business logic. The following two examples list problem-solving responses focusing specifically on tools:

The LC promoters developed their own weighting system in LCA, based on the company’s own environmental priorities, in order to make it relevant for the specific organization.

The LC promoters tried to relate the LC approach to the organizations business logic by the creation of

combined KPIs with both environmental and economic aspects.

Another type of example shows an instance of LC promotion directed towards product development and sales:

To clarify the business meaning of the company’s climate strategy, LC promoters proposed and presented a group of products with LC-based eco-design in a ‘green’ product portfolio.

From the material, we identified a practice in which LC promoters tried different ways of presenting and making the LC approach relevant to business. Here, the LC promoters use their understanding of the business logic to determine where they should direct their LC promotional activities. Thus, this practice enacts a knowing of existing business logics and how the LC approach could be related to these (for more examples relate to this practice, see column 7 in Table B in Online Resource 1, Electronic Supplementary Material).

4.1.8 Situation 8. Attempting to extend the LC approach beyond the corporation and engage with product chain actors

Working with LCM entails fundamentally a focus on environmental improvements in a product chain perspective. For this to materialize, internal management of the LC approach needs complementing with external management to link with other actors in the product chain. The problem perceived by LC promoters becomes then how to create such externally extended LCM. In our empirical material, we identified situations where LC promoters engaged with other parties, such as practitioners working towards different parts of the company’s product chain or other external actors who together could represent the product chain in greater entirety. When doing so, LC promoters adjusted their interaction (communication and expressed interests) so as to match the interests of the external parties in order to secure their cooperation. Three examples are (see also column 8 in Table B in Online Resource 1, Electronic Supplementary Material):

The LC promoters referred to the sustainability goals of their suppliers or customers, in order to engage them in collaborative LC projects.

The LC promoters engaged a third party organization to act as a ‘broker’ for LC profits, in order to motivate a higher investment for the first tier customer, and to be able to reach environmental and economic benefits at the second tier customer.

The LC promoters pushed purchasing practitioners and suppliers to participate in sustainability assessments of

suppliers, thus mobilizing these practitioners working towards upstream LCM.

From these examples, we identify a problem-solving practice in which the LC promoters adjust their interaction to match the interests of their external parties, and direct their attention towards actors in different parts of the product chain, where the LC promoters see a possibility of LC adoption. This type of practice involves, apart from LC knowledge and knowing, also an understanding of how to communicate with practitioners from different functions. It involves also business intelligence on other product chain actors, as well as a knowing on how to negotiate, in order to promote the LC approach as a viable option. Further, it also implies flexibility on behalf of the LC promoters, as they not only adjust to internal conditions, but also to external parties.

4.2 Knowledge deployment vs. knowledge development

From our analysis, we find that LC promoters enact responses to challenging situations that are both of the character of *knowledge deployment* (i.e., high determinacy responses with *information requests* and *information transmission*) and *knowledge development* (i.e., low determinacy responses with seeking *instruction* and *improvisation*) (see Kuhn and Jackson 2008). However, we predominantly find low determinacy responses in which knowledge is developed. These are mainly of the improvising kind, since the results show the LC promoters constantly dealing with creative problem-solving in order to find possible ways of integrating and adapting the LC approach for their organizations. The uncertain outcome of adoption explains the majority of low determinacy responses in the empirical material. This points to the importance of knowledge development with LC promoters.

The analysis of promotional instances results in a depiction of the LC approach being introduced on numerous occasions through situated problem-solving in organizationally dispersed settings. An argument for LCM employed by an LC promoter might not be the long-term rationale for LCM in the company, but instead what is deemed the most suitable and available option at a given place and point in time. This reflects the situatedness of problem-solving aiming at the adoption of the LC approach in an organization where the environmental focus is limited to corporate environmental management (EM). Through the many low determinacy responses, the LC promoters develop knowledge about actual transitions from EM to LCM. It becomes clear that the LC promoter has an important role for the LC adoption in a company. Furthermore, LCM is seen to emerge through the many instances of situated problem-solving rather than come about through planned implementation. The large number of promotional acts in our empirical material points to the focus on

working towards adoption of LCM rather than of managing LCM.

5 Discussion and conclusions

In this paper, the empirical material on LCM efforts in MNCs has been re-examined (Heaton 2008) with a framework for analyzing situated organizational problem-solving (Kuhn and Jackson 2008). The framework guided us to identify eight problem-situations arising in LC promotion, but we do not claim that this is an exhaustive list of problem categories, rather, it provides typical examples.

The qualitative material used in the secondary analysis is from earlier studies by the same authors as for the present paper, thus avoiding much of the risk of losing the context of the material (see Heaton 2008). As we have used qualitative data from several case studies, this has provided rich empirical material, containing thick ‘problematique’, and thus showing the complexities and contradictions of real life (Flyvbjerg 2006). As we have analyzed data from studies of several MNCs, this enhanced our possibility to generalize. It is therefore likely that the identified problem-situations are present in other MNCs where LC efforts are being developed. This means that problem-situations will likely be similar, while specific responses will vary depending on the organizational contexts and the organizational knowing and experience of LC promoters, assuming their equal LC knowing.

5.1 LC promoters and LC promotion

An important aspect of the term LC promoter lies in the words *life cycle* since these practitioners’ interest is in the broader environmental attention to the entire product life cycle. From what we have seen, LC promoters act within large corporations and their interest in LCM lies in a wish to influence the management towards more sustainable product chains. Often the ideas and problem-solving activities are related to decreased risks and saving cost, as well as creating a business case, but this wish seems more related to that fact that they over time have learned ways in which LCM can attract attention in the organization, rather than an overarching goal to make a profit. This is different to the conventional descriptions of the ‘ecopreneur’ (Hostager et al. 1998; Keogh and Polonsky 1998; Walley and Stubbs 1999; Linnanen 2002; Schaltegger 2002; Schaper 2002; Volery 2002). The term LC promoter reflects this focus on LCM, and the individual actors in the organizations, be it managers, project managers, and specialists, that try to bring about progress of LCM in their organizations through different types of problem-solving activities. The role of the LC promoter thus differs from the conventional LCA practitioner in that the LC promoter collects good evidence of the application of the LC perspective

and promotes it throughout the organization. For the adoption and adaptation of LCM, LC promoters enact a knowing that combines, on the one hand, the LC approach, and on the other, organizational as well as business analysis paired with social communication and negotiation skills. Further, LC promotion is better described as the ‘art of possible’ than the rational application of the LC approach to the main environmental problems of the organization.

A LCA practitioner could take on the role of LC promoter, although it might not always be the case (see e.g., Visser and Crane 2010). As practitioners with different roles bring different sets of skills and motivations (Osagie et al. 2016; Visser and Crane 2010), Visser and Crane (2010) suggested that a varied group of practitioners, in terms of type, is optimal for sustainability managers. We conclude from our study that the role of the LC promoter is highly relevant for the uptake of LCM in MNCs, and that this is a role that is taken on by some LC practitioners. However, in line with the reasoning by Visser and Crane (2010), a diversity in teams is likely to be relevant also for LCM in MNCs. Employing LC promoters specifically might be difficult to deploy, as this is a voluntary role. However, companies could consider allowing possibilities to engage in this type of activities, additional to specified working roles.

Although we identify that LC promoters are important LC practitioners in MNCs, they are not the sole drivers of a LC approach in the industry. Legislation, regulation, and guidelines are examples of additional important aspects. However, we conclude that LC promoters have an important role in adapting the LC approach and making it relevant to the specific organization. The gap between LCA results and the input of these into management guidelines, identified by Testa et al. (2016), is here shown to be filled by LC promoters. The tailoring of the LC approach performed by a LC promoter is critical for the translation of LCA results into guidelines adapted for business management.

5.2 From tailoring to emergent LCM

Suggestions from the literature concerning the development of sustainability management often imply a planned procedure (van der Heijden et al. 2012; Neugebauer et al. 2016). For example, Grayson et al. (2010) proposed a process from gathering ideas, to design, to gathering resources, to launch, to scale up of a project. Similarly, Linnanen et al. (1995) described a process of planning change, through improving personnel ability and improving organizational ability and then establishing the planned changes. However, as Neugebauer et al. (2016) pointed out, there is a risk to see sustainability strategies only as planned, as they rather are on a continuum of planned and emergent.

The material in this paper does not evidence the occurrence of a planned strategy for LCM implementation. Instead, it

shows how situational adaptation leads to an emergent strategy for LCM. The tailoring of the LC approach, undertaken by the LC promoter, is made to adapt it to the organization and with the hope of subsequent adoption. Taken together, the many instances of promotion, in eight categories of organizational problem-solving, tell of an emergent practice. Moreover, the acts of LC promoters involved predominantly knowledge *development*, through innovative and collaborative activities, rather than pertaining to more standard knowledge deployment. This also shows the emergent nature of LCM development.

We have listed the identified types of promotional situations in an order that suggests an approximate process of LC integration into MNCs. However, the individual situations do not arise in order; instead, they are highly intertwined, and the list represents different aspects of LCM adoption and adaptation. Dealing with certain problem categories could be considered early steps for LCM adoption (e.g., trying to create interest for LCM in the company), where others seem to build on more accumulated experience (e.g., integration of a LC approach into the business logic or in LCM collaboration across actors in the product chain). The knowledge, skills, and the knowledge development the LC promoters obtain through situated problem-solving will probably influence the order of the problem categories. The dominance of improvisation over seeking instruction points to the scope for learning in LCM adoption processes.

5.3 A managerial perspective on LCA and LCM uptake in industry

This paper contains a first systematic analysis of LC promoters enacting different responses to challenging LC situations. It has heeded to the calls for more studies of LCM integration in company practices (Seuring 2004; Vermeulen and Seuring 2009). Through our analysis, we bring to the fore the ubiquity of organizational and creative problem-solving done by LC promoters, and the range of their responses to adapt the LC approach to the organization. This highlights the importance of LC promoters for LC integration in MNCs and product chains. Our findings confirm the importance of situational adaptation (e.g., Heiskanen 2000; Mortimer 2011; van der Heijden et al. 2012), and adds to it by showing what situational adaptation actually imply. Our findings also confirm the prominent role of social practices for LCM, suggested by Schmidt (2013), and explicates what is called an interpretative understanding of LCM (Rex and Baumann 2008). In light of this previous research, we find that our results strengthen an understanding of LCM as an emergent practice. Key to this emergent process is the knowledge developed through the numerous, and organizationally dispersed creative problem-solving practices of LC promoters. Through these

practices, LCA results and the LC perspective are tailored to be made relevant to business management.

This paper is also a response to a call for better understanding of the role of ‘change agents’ in an emergent change process consisting of small steps, and without clear predictability (e.g., van der Heijden et al. 2012). Our findings illustrate the actions by *change agents* related to situational adaptation that embeds sustainability and the LC approach, specifically in MNCs. By identifying typical challenging situations for LC promoters and describing the emerging and situated practices, we have tried to move away from what Osagie et al. (2016) referred to as ‘laundry lists’ of important aspects to consider but that are inadequately contextualized in order to be meaningful in practice.

This paper provides an organizational perspective on LCA and LCM uptake in industry and sheds light on the practices for embedding LCM in industry practices. It contributes thereby with strategic guidance on the adoption and adaptation of LCM to different organizational contexts for practitioners. Drawing on organizational problem-solving (Kuhn and Jackson 2008), we note that in addition of LC knowing, LC promoters also need extensive organizational knowing in order to assess and relate LCM to operational processes and business models. In order to support LC practitioners in their efforts to develop LCM, it is our conclusion that it is necessary to help them develop practical knowledge and skills for analyzing and navigating organizational processes and business interests, in addition to LC-related knowledge.

Acknowledgements The authors are grateful to the studied organizations that participated in the studies and made empirical data available for the paper. The authors are also grateful to the funding organization, which made this work possible, but that wishes to remain anonymous.

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