Recommendation and context: the missing links for increased life cycle impact in large industries

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LCA COMMUNICATION AND LCA FOR ISO LABELS

Recommendation and context: the missing links for increased life cycle impact in large industries

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Abstract

Purpose This study takes an open and explorative approach to investigating the impact, or lack of impact, of life cycle information on behaviours throughout large production companies. Based on cases where life cycle information has been provided, this paper analyses how life cycle information has been interpreted and acted upon—not only by the life cycle assessment (LCA) practitioner conducting the study but also by employees outside the environmental departments.

Methods To understand the impact of life cycle information on everyday actions in organisations and how this impact can be enhanced, this study takes a grounded approach to following flows of life cycle information from the environmental department through other departments of an organisation. From the flows of information, the research team selected rich descriptions of empirical data that reflect action and inaction. Using interviews and documents, we collected barriers and enablers for acting on life cycle information. Barriers and enablers were interpreted and clustered into categories and arranged into concepts. Next, we reviewed the empirical data using theories from social psychology.

Results and discussion The results show that it is difficult for life cycle information to result in subsequent action outside of environmental departments. The barriers to this action were partly due to the life cycle information per se such as gaps between what life cycle information is available and what life cycle information is needed. Barriers and enablers were also found in relation to the context in which life cycle information was applied and new behaviours were adopted, including timing and software structures, reward systems, trade-offs, and personal beliefs about the profession. The results suggest a new role of the life cycle proponent that includes providing the right life cycle information and understanding and influencing the expected agents' situations.

Conclusions Assisted by theories from social psychology, we found that behaviour can be changed if 'recommendations' and 'contexts' are considered when providing life cycle information. The paper suggests that the impact of life cycle information could increase if normative arguments about environmental visions, strategies, and overarching goals are aligned with enablers that focus on personal goals, such as meeting a deadline, reducing uncertainty, and reaching the threshold for a bonus.

Keywords Action and behaviour · Life cycle assessment (LCA) · Life cycle information · Recommendations and contexts

1 Introduction

In the wake of environmental discourse on such matters as global warming, loss of biodiversity, and scarcity of raw materials, companies are increasingly under pressure to deal with the negative environmental effects associated with their business activities. In this endeavour, many companies recognise the need for a life cycle perspective—a perspective that considers the entire value chain of products and services—when seeking to improve their environmental performance. As primarily a voluntary approach, public policies now also increasingly expect companies to use life cycle thinking and life cycle assessment (LCA) (Sonnemann and Margni 2015). For example, the new EU Directive on Public Procurement makes it possible to include life cycle criteria in tender documents (European Commission 2018) and since 2015, a life cycle perspective has been compulsory in several parts of the updated version of ISO 14001, the international standard for environmental management systems (ISO 2015). In

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addition, current EU work establishes a common LCA methodology as a basis for upcoming EU-wide policies, regulations, and legislation (European Commission 2018). These policies are intended to encourage companies to take a life cycle perspective in their decision-making processes, including the many subsequent actions.

To this end, many companies also already include life cycle thinking in their goals and strategies. Environmental targets like reducing the 'cradle-to-grave' or 'Scope 3' emissions of the company's products and services are all expressions of this ambition (Akzo Nobel 2017; Tetra Pak 2018). Ideally, this focus will result in new forms of decisions or behaviours either within the company or throughout the value chain such as in purchasing, product and concept development, logistics, marketing, and the user phase of products and services. Although recognised as an approach to increasing potential environmental performance (Greenovate!Europe 2012; Pajula et al. 2017) and demonstrating financial benefits (Rex et al. 2015; Marsidi 2016), measures taken to reduce environmental impact along the value chain are still rare compared to measures that address a company's operations (Brunklaus et al. 2013; Arnfalk et al. 2008).

In the quest to make life cycle information a stronger influence on company actions, scholars have looked at the link between life cycle information and decision-making such as the role of methodological choices for the LCA when making decisions or applications (Tillmann 2000) and the need for better presentation and visualisation of LCA results (Sala and Andreasson 2018). Numerous 'decision-support tools' have also been developed to assist companies in taking a life cycle perspective such as tools tailored to specific industry sectors (Ramasamy et al. 2015) and simplified tools and methods tailored to support decision-making among non-LCA experts (Arena et al. 2013). In addition, some argue that the limited use of life cycle information in decision-making is due to the separation of life cycle assessments from economic analyses (Norris 2001). As a result, tools and methods have been developed to fill this gap, for example, by expressing environmental impact in monetary terms (Steen 2015).

The research referred to above suggests that the life cycle information as such needs to be improved and/or better presented to encourage actions based on this information. From a behavioural science perspective, there might also be other barriers to action. However, strange as it may seem, knowing what is the 'right' thing to do does not automatically translate into the right behaviour (Gifford 2011; Gilovich et al. 2002). Although other studies have suggested that behavioural science indeed can be useful in the context of life cycle assessment in relation to measuring and changing consumer behaviour in the use phase (Di Sorrentino et al. 2016), this study takes an open and explorative approach and identifies the barriers and enablers, including behavioural aspects, associated with acting on life cycle information throughout a company. Based on situations where life cycle information is provided to a reasonable state-of-the-art standard, we investigate the impact (or lack of impact) of life cycle assessment on internal actions. To this end, this study analyses how life cycle information is interpret and acted on within the companies, but outside the environmental departments.

This shift from information to situation highlights the managerial aspects required to ensure life cycle information results in action. As such, this paper adds to life cycle management research that focuses on organisational practices within life cycle thinking (Baumann 1998; Heiskanen 2002; Rex 2008; Nilsson-Lindén 2018; Schmidt 2013). Typically, this research is based on rich descriptions of empirical data, which in this study are coupled with theories from social science. Our study adds further empirical insight to this field of life cycle management and reviews these in light of theories from social psychology. Therefore, this study advances research on how companies can act on life cycle information to limit their environmental footprint from a life cycle perspective.

The following section outlines the methodology used to understand the role of life cycle information in everyday actions in organisations. Thereafter, we present the enablers and barriers found for acting on life cycle information in large organisations and follow this with an analysis of the data. Finally, we discuss the results and present our conclusions.

2 Methods

To understand the role of life cycle information in everyday actions in organisations and how this can be enhanced, this study explores how people act in different situations where life cycle information is provided or where decisions are made using life cycle information. The study includes four large production companies operating in international markets in the automotive, chemical, and energy sectors. All these companies have extensive experience with life cycle thinking and operate environmental departments with experts in life cycle assessment (LCA). The analysis addresses the interviewees' understanding of life cycle information, whether it was (or was not) included in various decision-making situations and whether such information influenced subsequent actions.

2.1 Research approach

This study focuses on understanding the barriers and enablers that affect the use or non-use of life cycle information. From this better understanding, we start formulating theories about why and how life cycle information often does not lead to action and how a lack of action can be turned into action. Following the explorative purpose of this study, we applied a problem-driven abductive methodological approach (Dubois and Gadde 2002), iterating theory and empirical

findings, creating opportunities to discover new concepts (Gioia et al. 2013). To get an initial understanding of the phenomenon, we used methods from grounded theory (Glaser and Strauss 1967) in the initial data collection and analysis. Grounded theory is often used in organisational studies with particular interest in case studies of organisational behaviour and features of the organisational world (Martin and Turner 1986). In line with the grounded theory approach, our case studies explored pathways of life cycle information throughout the companies. Open questions about the use or non-use of life cycle information were asked along these pathways. Patterns were then identified across the interviews to gradually create an understanding of the role and impact of life cycle information in everyday actions. The resulting collection of situations was organised into barriers and enablers. These were then reviewed in light of social psychology theory to explain how people evaluate various aspects of a situation and why they choose specific alternatives.

2.2 Selecting the cases

Data were collected from the case studies. The precondition for a case was that life cycle information had been provided to the environmental department as well as at least one other department or group (i.e. target groups) for the purpose of impacting the company's upstream (i.e. providers or feedstock) or downstream (i.e. distribution or user phase) activities. Data were collected during primary interviews with individuals from the company's departments that act on (or are expected to act on) life cycle information. These individuals and their expected actions were articulated either by the companies in their strategic documents or by managers or environmental strategists. Following an initial scan of possible cases in all the companies, we selected four cases from three of the companies. The cases covered purchasing strategy, the development of new product concepts, the introduction of new materials, and the launch of eco-designed products and services.

2.3 Mapping the life cycle information flow

For each case, flows of life cycle information were identified and illustrated in a 'map' showing documents, actions, and software in which life cycle data were stored and used along with corporate functions adding to or using these information flows (Fig. 1). The maps were based on interviews with environmental experts in each company and document studies of the companies' public (environmental) strategies and reports, internal documents and presentations, and technical documentation. The map of each case was validated with the environmental experts at each company and occasionally adjusted. The maps were then used to represent the environmental department's beliefs concerning how and what type of

information reached different parts of their organisation. Based on these maps, interviewees were selected from the information flow between the environmental department and the internal target groups for life cycle information. The aim of the interviews was to understand the ways in which life cycle information had been used in decision-making and actions outside of the environmental departments. Therefore, the 'mapped' reality was combined with different individual's understanding of situations in which life cycle information was intended to be included.

2.4 Data collection

Data collection, including interviews and written documentation, was carried out from November 2016 to October 2017. Each interview included between one and three respondents, lasted between 45 and 90 min, and was audio-recorded and transcribed. In all, 19 interviews were conducted with a total of 27 respondents, including environmental specialists (5), product planners (2), purchasing managers (3), research and development engineers (4), sales and marketing managers (3), sales representatives (5), environmental strategists/managers (4), and corporate communication representatives (1). Interviews were conducted in a semi-structured way with open questions covering the following topics:

- The interviewees' role in the company
- Actions taken with potential life cycle impact
- Existence of data, tools, and administrative systems related to potential life cycle information
- Enablers and barriers to using or acting on life cycle information

2.5 Method of analysis

Data analysis was conducted using a thematic analysis method (Braun and Clarke 2006). This method is used to identify, analyse, and report patterns within data. Interviews were transcribed and read multiple times. From the transcripts, barriers and enablers to knowing and using life cycle information were listed. Reoccurring pattern and rationales across cases were identified. Barriers and enablers were formulated as situations such as 'generic data available, but site-specific data are needed'. Similar situations were further aggregated into categories based on common rationales such as 'customisation of the information'. Categories were further grouped into more general concepts. The identification of categories and concepts was the result of an iterative process in which barriers and enablers were verified and aggregated with representatives from the participating companies, who acted as a review panel. Eventually, the panel identified, evaluated, and discussed the general character of the results. These discussions
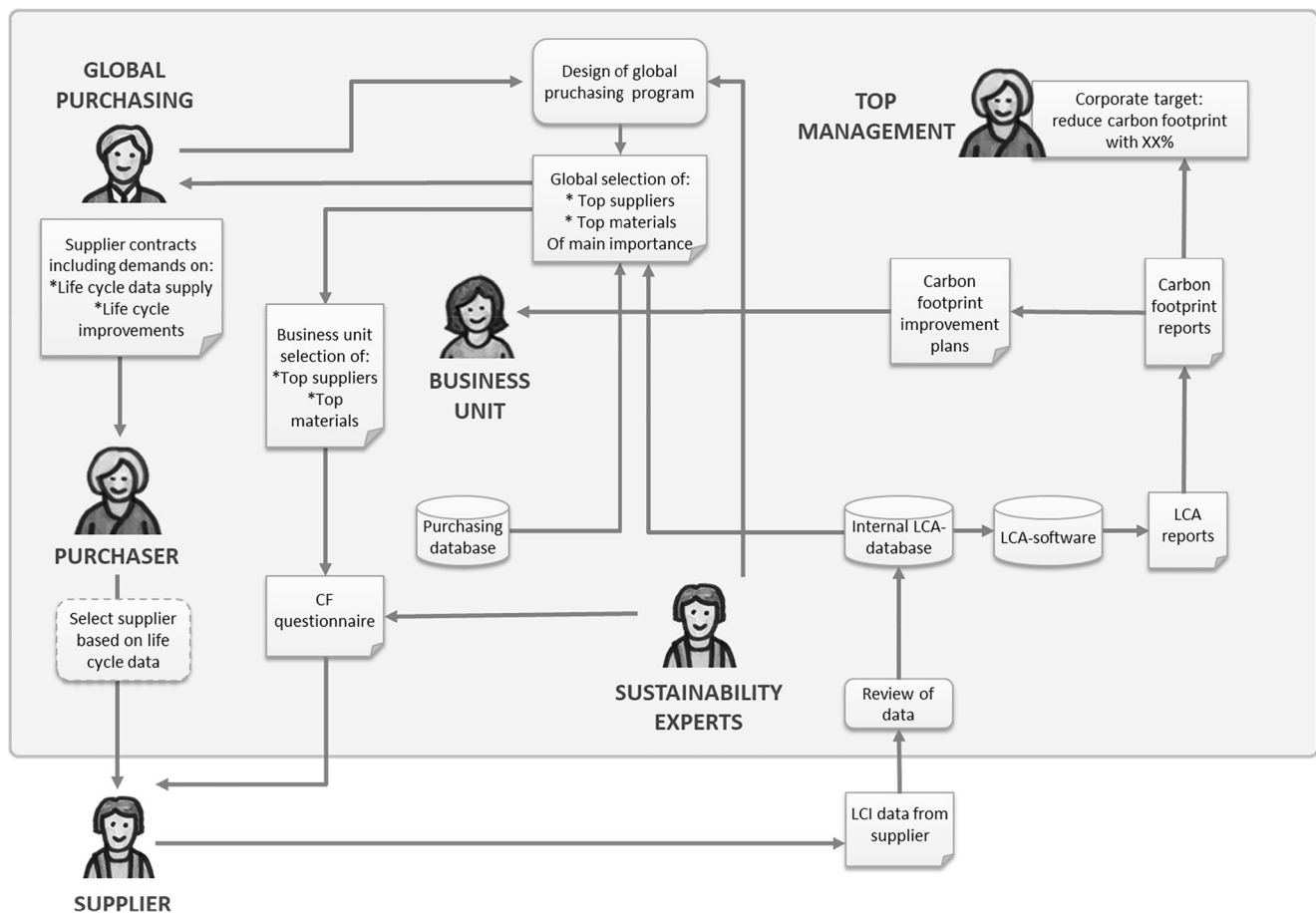
Fig. 1 Example of maps constructed for each case, illustrated as information flow diagram covering actions (rounded squares), documents (squares), and software/databases (cylinders) handling life cycle information for the specific case

provided valuable information and were used to find patterns in the data and to present data in a more aggregated manner.

As a deeper understanding of the use or non-use of life cycle information emerged, observed patterns and conclusions were organised in light of existing theories (cf. Dubois and Gadde 2002). This study aims to understand how life cycle information informs actions taken, including (un)changed behaviour. To this end, we appealed to social psychology theories to further analyse and interpret the empirical findings.

3 Results

We identified several (more or less explicitly expressed) expected actions performed as a result of life cycle information. In each case, barriers and enablers for acting on life cycle information in accordance with these expected actions were collected from the interviews. Table 1 lists examples of such expected actions and actual behaviours throughout the organisation.

The interviews revealed many barriers and enablers for acting on life cycle information. Although specific to each

company and case study, patterns of similar enablers and barriers could be found. Table 2 lists examples of such situations found in the interviews classified into categories of similar patterns. The categories were further grouped into four concepts: information, recommendation, social context, and familiarity. Below are a short description and some quotations that exemplify the barriers and enablers within each concept. The quotations are anonymised via pseudonyms, but the gender, age, and job of the respondents are provided.

3.1 Information

Several barriers and enablers relate to information and its use—e.g. whether the life cycle information given is relevant. Examples were found when retrospective data were available; however, when prospective data were needed or when generic data were available, site-specific data were needed:

> Today [life cycle] information is used retrospectively. […] Not so much for decision – more for information. (Cecilia, 46, marketing manager)

Table 1 Examples of expected actions (as expressed by the environmental experts) and actual behaviour

Role	Expected action	Actual behaviour
Purchaser	Select suppliers based on life cycle information	Expected action sometimes considered but not executed
R&D engineer	Include insights from LCA studies in early product concepts	Actions do not consider specific LCA information but are informed by a general recourse efficiency approach
Product strategist	Replace materials in next product generation	Better alternatives from a life cycle perspective not being prioritised
Driver (end-user)	Drive more fuel efficiently (change end-user behaviour)	Expected action taken; significant increase in fuel efficiency

There were also several situations where life cycle information was provided but where complementary information important for the decision was lacking:

For me, it's not just important how it is right now. I would also like to know the environmental impact from all the elements I work on, and how sensitive these

Table 2 Concepts and categories relevant for understanding (in)action on life cycle information in large organisations, constructed from observed situations acting as barriers and enablers

Concept	Categories	Examples of situations acting as barriers (B) or enablers (E)
Information	Communicate with the right forum	The life cycle information provided is not relevant to the specific decision-making process or specific action of the target group approached. (B)
	Communicate at the right time	Life cycle information is not given within the time frame needed for the recipient to act (e.g. is not available in the preparatory work preceding the formal decision-making process). (B)
	Customisation of the information	Complementary and comparative information needed in relation to life cycle data presented, such as future material availability and prices, are lacking. (B) Retrospective data are presented when prospective data are needed. (B) Upstream data are available, but downstream data are needed. (B) Customised tools for simplified assessments. (E) Generic data available, but site-specific data are needed. (B)
	Link between life cycle information and administrative systems	Existing software does not allow the inclusion of new data (e.g. life cycle data). (B) Data infrastructure/software to collect and store life cycle data are already available for other purposes (e.g. legal). (E)
Recommendation	Visions, goals, and policies	Company visions and goals are based on life cycle thinking. (E) Policies and external subsidies are pushing company actions and market development in the 'right' direction. (E) Expected action/changed practice by the target group not clearly expressed. (B)
	Handling trade-offs and guidance of what action to take	Uncertainty as to how to handle trade-offs between, e.g. economic and ecological goals. (B) Difficulties in evaluating the importance of different types of life cycle impact (e.g. climate impact vs. toxicity). (B) Recommendation of the most preferred action/alternative (from a life cycle perspective) is lacking or not (clearly) presented. (B) Aggregated data providing one-dimensional answers. (E) Multi-dimensional environmental data given. (B)
	Rewarding preferred behaviour	Bonus system includes how the company performs in a life cycle perspective (E) Gamification provides immediate and personalised feedback and rewards for actions in line with life cycle thinking (E)
Social context	Strive for social appropriateness	Personnel want to act in an 'appropriate' way for society at large and the ecological environment. (E) Acting in accordance with personal beliefs about professional and social norms. (E & B) Perceived risk that act in line with life cycle information may jeopardise expected practices and priorities (e.g. not reaching financial goals or sales targets). (B) Norm that 'an experienced driver knows how to drive' (B)
Familiarity	Heuristics	Customers' and own (ad hoc) experiences are perceived as more important than collected data. (B)
	Preference for the known	New (or unknown) material/process. (B) Unknown future price, quality, and availability. (B) Preference to keep existing relations. (B)

elements are. For example, are there materials that we use that are only available from one specific region of the world? I would also like to have price and availability forecasts for all potential new materials. (Gert, 55, research and development engineer)

Another important finding regarding information is the importance of providing information at the right time. For example, one of the interviewees realises during the interview that the representative from the environmental department should participate in their annual 'needs review meeting':

We have a 'needs review meeting' each autumn. This is when we decide the requirements for the coming year. […] The environmental department should actually be part of this and talk about its guidelines. After this meeting, our work is about balancing everything and finding new solutions in the cheapest way. (Stefan, 62, research and development engineer)

In the concept of information, we also include barriers and enablers related to the link between life cycle information and administrative systems. We found situations where data infrastructures used for other purposes (e.g. keeping track of driving time, waste directives, and site data) could enable access to life cycle data, but we also found examples of existing software limiting actions:

Energy is part of the reporting system of the site and has been for many years so the results just 'pop out'. (Elin, 39, Environmental expert)
We want to calculate environmental profiles for prospective solutions, but that is not possible in our existing LCA software. (Johanna, 43, LCA expert)

Internal processes and routines (or lack thereof) could also be a barrier to acting on life cycle information:

What is missing is process. We have data but not processes to use that data. Bits and pieces but not streamlining that processes yet. […] We do need more information. But even if we had the information, we do not have the processes for considering that information. (Charles, 55, Purchasing manager)

3.2 Recommendation

The second concept, recommendation, enables life cycle thinking when it is expressed in company visions, goals, and policies. As expected, all the companies had strategic documents and/or clearly formulated environmental goals that included a life cycle perspective:

Resource efficiency is articulated in all our strategic documents. Right now, the focus is on greenhouse gas emissions, but in a few years the focus could change, for example, to water. (John, 42, sustainability strategist at cooperate communication)

Recommendation could also be expressed and enhanced through rewards of preferred behaviour such as bonus systems:

We have a CEO that embraces sustainability issues. CO2 reduction is also being incorporated into our bonus systems, so we are expected to deliver on these targets. (Theo, 45, environmental strategist)

I had this driver coming up to me, showing me a picture of his new guitar. 'Look,' he said, 'This is what I bought with my fuel-efficient driving bonus'. (Pontus, 40, salesperson)

However, the main targets being articulated—i.e. expected actions in a life cycle perspective for different functions (Table 1)—were often unclear. A reoccurring barrier for action was a lack of guidance as to what action to take from the life cycle information. Barriers also included how to handle trade-offs between financial and ecological goals or what to do when different environmental impacts do not align:

I would like some recommendations or having someone that says 'this is what we propose because […]'. For me, it's really hard to compare earth's metals against carbon dioxide, for example. (Jens, 42, sales and marketing manager)

Similarly, we found that aggregated data providing one-dimensional answers to the environmental impact attracted more interest among decision makers than disaggregated information.

3.3 Social context

The third concept of categories concerned acting correctly in relation to the social context. Examples include individuals trying to act in ways they perceive as appropriate (e.g. in relation to beliefs about their profession):

It is our technical conscience. We think we should do the right thing, and not just from an engineering perspective. We are interested in the whole. But that's quite typical of engineers – you want to improve for humanity. (Stefan, 62, research and development engineer)

On the other hand, perceptions of preferred behaviour also constituted barriers, for example, when actions in line with life cycle information would jeopardise expected practices and priorities. One respondent perceived easy market communication as the superior target: 'What is easy to communicate is what I should defend' (Philip, 47, product planner).

3.4 Familiarity

The last and fourth concept of categories is familiarity. This concept includes heuristics based on previous experiences and preferences. For example, one salesperson noted how his previous experiences were barriers to trusting new information:

> I have been working here for so long that I don't always do as the sales support system suggests. I can give a customer a better alternative, because I know how and where they operate. It's good to have the same customers for a long time. (Lars, 60, salesperson)

Another example illustrates the preference for the known. For example, one research and development engineer noted that the lack of information made it difficult to introduce potentially better materials:

> 'If a new material is suggested, and no one knows if it is available in the future, of if the prices will rise, it is better to stick with the known' (Stefan, 62, research and development engineer).

4 Analysis

The case studies reveal many barriers and enablers for using life cycle information, which were grouped into four areas: information, recommendation, social context, and familiarity. For information, the results support previous research that the link between life cycle information and decision-making is important—i.e. information needs to be relevant. We also found methodological adjustments and tailoring to specific industries or applications as enablers for life cycle information to induce action, especially among the LCA/environmental specialists interviewed. In the same vein, examples of simplified tools and methods geared towards self-supported life cycle investigation (e.g. for product developers) increased use of life cycle information beyond environmental departments. Moreover, several interviewees noted that it was difficult to handle uncertainties associated with evaluating life cycle assessment results and to compare these uncertainties with the financial consequences. All the above confirm previous research that suggests organisations are more likely to act if the right information is delivered in the right format.

4.1 Providing a recommendation

Even when relevant information was provided, interviewees repeatedly expressed a need for additional guidance regarding how to act on the information given, including how to handle trade-offs when aspects such as life cycle information and economic goals do not align. Providing recommendations on how to act in addition to providing life cycle information is in line with what social psychology suggests is needed for behavioural change: the probability of achieving a change in behaviour increases when information (e.g. environmental information) is provided together with a description of the preferred behaviour (i.e. how something should be done) (Schultz 2014). Additionally, when information about what others do is added (provided that 'others' act in line with the desired behaviour), the probability of changing behaviour increases even further (Gifford and Nilsson 2014; Schultz 2014). These results emphasise the importance of providing clear recommendations in the interpretation phase, complimented by a benchmark whenever possible. However, it also points to a need to act beyond the LCA study and to assist in translating the conclusion of the LCA study into a preferred action in the given situation. An LCA practitioner at one of the participating companies summarised the new approach after participating in the project as follows: 'Before, I provided information; now I give recommendations' (Isabelle, 49, LCA practitioner).

4.2 The importance of context

To this end, this study suggests that some of the barriers for acting on life cycle information could be overcome by providing recommendations in addition to information about environmental aspects (Schultz 2014). However, in the case studies, we also found barriers and enablers related to when and to whom information was provided, how recommended action was enhanced, and what practices resulted from familiarity or social context. The results of this study point to a wide range of enablers and barriers linked to the context of the person receiving information, over and above the information itself, such as the time at which information was provided, personal beliefs about the profession, incentive structures, and heuristics. Many examples were found where there was an intention to act on the life cycle information provided, but a shift in behaviour still did not happen. From a behavioural study perspective, this result is not surprising. Human behaviour is complex, and discrepancies between individuals' intentions and actions are not uncommon (Schultz 2014; Gilovich et al. 2002).

There are several cognitive objectives (such as values, beliefs, and norms) that prompt a person's biases towards not acting as expected on life cycle information (Stern et al. 1999; Gilovich et al. 2002; Gifford 2011). Cognitive objectives can be activated or trigged by different contexts due to internal signals (e.g. stress that activates the goal of being on time) or exterior signals (e.g. behaviour of others activates the goal of being on time). Most often fulfilling cognitive objectives is a combination of both internal and external signals. Clearly, behaviour is steered by multiple factors. We found that what was seen as an impassable barrier in one context was seen a minor issue in another context, even within the same target group. For example, there was an inconsistent reaction to how the inclusion of life cycle information would jeopardise a deadline. For some respondents, this concern was a major barrier to action, but as conditions changed (e.g. through gamification enhancing the preferred behaviour), it became less important. How can we then find guidance on what is needed to increase the impact of life cycle information? To find explanations to these situations, we turned to the field of social psychology. Social psychology examines how different personal and contextual factors influence the way people act. Goal framing theory is one framework that aims to understand the plausible motivational strategies applied by individuals in situations where environmental information is provided (Lindenberg and Steg 2007).

4.3 Goal framing theory

The central idea in goal framing theory is that goals (i.e. mental representations of desired future states) govern or 'frame' what people pay attention to and what knowledge and attitudes are activated (Lindenberg and Steg 2007). Hence, goals can act as personal triggers and steer how people evaluate various aspects of a situation and what alternatives are considered. There are two personal goals—the hedonic goal ('to feel better right now') and the gain goal ('to guard and improve one's resources')—and one social goal—the normative goal ('to act appropriately'). The goal that receives cognitive attention governs or 'frames' how the situation is experienced and what alternatives are considered and evaluated, while other goals are pushed into the cognitive background (Lindenberg and Steg 2007). The goal that receives cognitive attention is called the goal frame.

A hedonic goal frame is activated when individuals focus on their feelings. Barriers and benefits are typically short term and characterised by avoiding effort or uncertainty. For example, focusing on gaining immediate efficiency usually results in status quo bias. However, if individuals attend to their personal resources, a gain goal frame is activated. Barriers and benefits relate to a medium- or long-term time horizon. The goals activated normally focus on an improvement in (or preventing a decrease in) one's (often financial) resources. In

an organisational context, this may relate to an individual's focus on doing a good job (according to what is being measured), to get a pay raise, or to reach the threshold for a bonus. The normative goal frame is activated when the focus is on appropriateness and people are especially sensitive to what they think one ought to do in order to maintain social relations (inside and outside the company).

When people want to act appropriately but do not know how or do not know at what cost (e.g. where there is a conflict between financial or ecological benefits), it is likely that personal goals, either gain goal or hedonic goal, will replace the normative goal frame. Consequently, they give up and go with more selfish motives (Lindenberg and Steg 2007). Motivations are rarely homogenous. Individual agency, or the capacity of individuals to act independently, in combination with local contexts within the company, may therefore trigger different goal framings along the same delegation line. This situation may result in discrepancies between the company's ambition to have a life cycle perspective and the decisions and actions taken in the daily work by individuals in the organisation. These discrepancies may explain some of our observations concerning various enablers and barriers for life cycle action.

4.4 Applying goal framing theory on case findings

By reviewing the enablers and barriers found in the cases in relation to the three types of goals in goal framing theory, we find that most barriers and enablers could be sorted into this framework. That is, the existence of company visions and goals with a life cycle perspective is an enabler in a normative goal frame, while lack of guidance on how to handle trade-offs between economic and environmental goals is a barrier related to a gain goal. The availability of complementary data needed for a decision eases the situation in a hedonic goal frame, whereas the need to include new data takes time and poses a barrier to immediate efficiency. Figure 2 provides some examples of barriers and enablers associated with each framing.

A review of the case studies made in relation to goal framing theory supports the notion that barriers of a more practical nature often result in inaction and hedonic goal frames of the situation. For example, difficulties including life cycle information in the existing (IT) software and too short a time frame for including life cycle information in the decision-making process resulted in status quo behaviour. Including new types of information (e.g. life cycle information) may result in a more complex decision-making process, and the lack of guidance or additional information might jeopardise meeting deadlines. To avoid this risk, recipients are not given new types of information.

Many of the barriers identified in our study prompt a personal goal perspective (i.e. hedonic or a gain goal) among the individuals receiving life cycle information. For example, if it
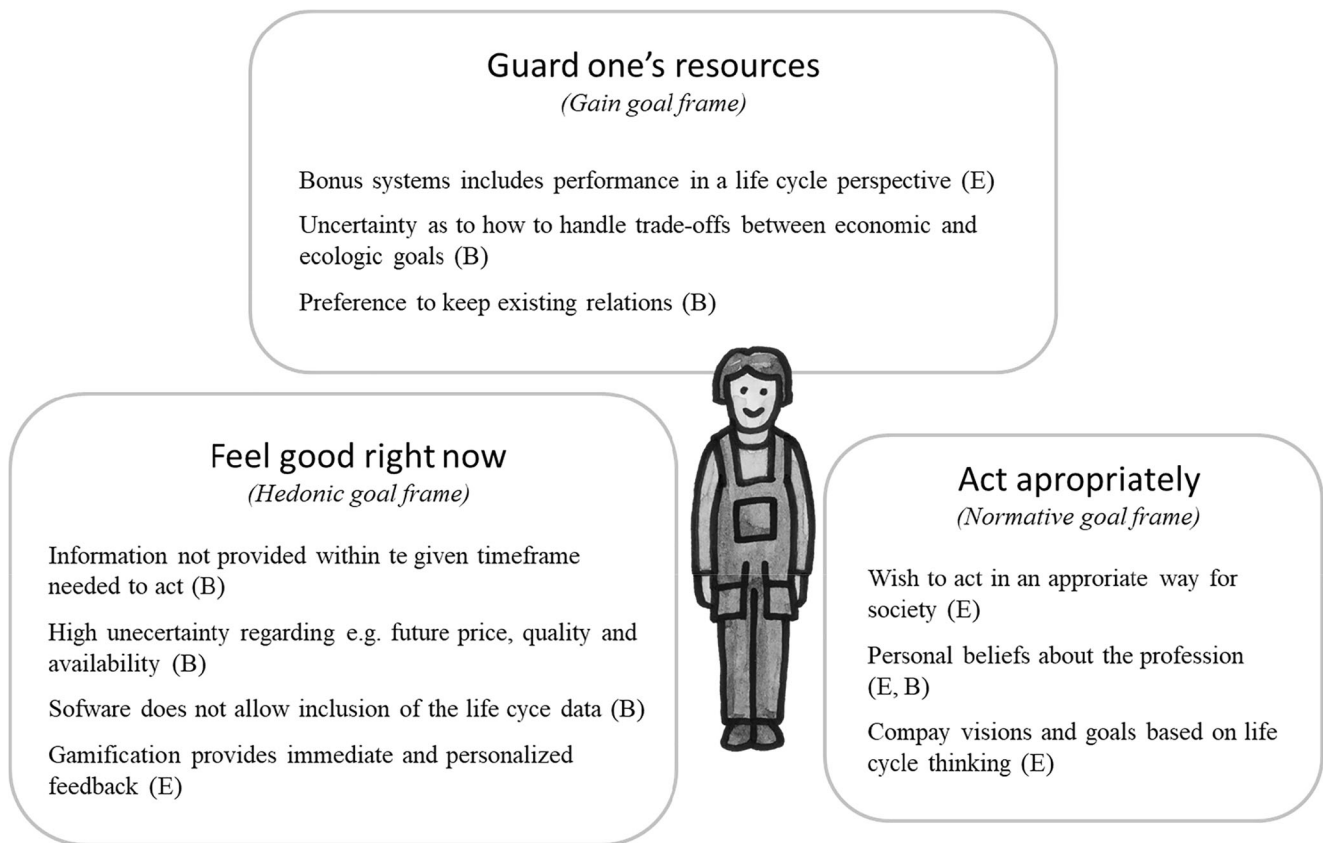
Fig. 2 Examples of barriers and enablers associated with the three types of goals in the goal framing theory

is uncertain which decision to take (e.g. which is the environmentally preferred alternative), hedonic goals tend to frame the decision as it is the safest and simplest strategy to stay with the status quo. Uncertainty regarding the quality of the information also provided prompts, habits, or heuristic biases towards previously used information. Uncertainties regarding the impact on key performance indicators, such as the ability to achieve economic goals, nudge the situation towards a gain goal framing. For example, if recommendations are lacking on how to handle trade-offs between ecological and economic aspects, economics arguments are normally perceived as the strongest factor in the evaluation of success or bonuses.

Notably, many enablers for life cycle thinking found in our case studies were associated with normative goals, such as acting 'appropriately' according to company values or because one puts pride in their profession. Typically, this was expressed by our interviewees as 'the right thing to do' (Stefan, 62, research and development engineer) or 'be in accordance to the company's environmental profile' (Charles, 55, Purchasing manager). These kinds of arguments were prominent as explanations of why life cycle information was perceived as very important to consider at a general level. In the situation of a specific action, however, the decisions at hand were often framed by hedonic or gain goals, resulting in barriers often exceeding enablers.

Following from the above, one hypothesis arising from the study is that organisations have been mostly successful in (or so far mostly focused on) creating logics and enablers related to normative goals. Although normative goals cannot guarantee to frame every situation, enablers related to gain goals and hedonic goals need further exploration. This study suggests that life cycle information will have greater impact on behaviour change if strategic (normative) arguments of life cycle thinking are supplemented with context-adapted enablers that relate to personal goals.

5 Discussion and recommendations

This study investigated perceived barriers for acting on life cycle information. Four concepts were found that characterised actions and inactions with respect to life cycle information: information, recommendation, social context, and familiarity. In addition to aspects relating to the life cycle information per se and how and when the information was provided, the results reveal additional reasons why no actions were taken on received life cycle information. For example, recommendations on how to respond to the received life cycle information were often lacking, especially in conflicts between financial and ecological benefits, contextual factors

such as deadlines and threshold target systems were strong barriers to considering recently received life cycle information, and individual preferences for staying with the familiar were very strong. The enablers for life cycle thinking were mainly, but not exclusively, associated with normative goals. Typically, this was expressed by a desire to act appropriately in relation to the profession or act in line with the company's norms. Barriers, on the other hand, were commonly found in relation to personal goals such as feeling better right now and guarding one's resources.

5.1 Information, recommendation, and context

This study confirms the need for proper life cycle information for a specific decision context. These results, which are in line with what previous behavioural scholars have found, suggest that recommendations on how to act, in addition to providing life cycle information, increase the probability of changing behaviours (Schultz 2014). When information is added about what others do (provided that 'others' act in line with the desired behaviour) and about social factors such as norms align with personal factors such as threshold target systems, it is possible to have a significant impact on behaviour change (Gifford and Nilsson 2014; Lindenberg and Steg 2007; Schultz 2014). In other words, if a company's environmental strategy is not simultaneously supported by normative and personal goals all the way down to the individual employee, there is a risk that when life cycle information is provided, business as usual is the most likely outcome. Consequently, we believe that it is overly optimistic to trust that the link between normative goals, such as strategic documents or internal policy documents, and life cycle information will significantly impact decision-making and behaviours in an organisation. For life cycle information to have a stronger influence on company actions, the following initiatives addressing personal goals and needs seem significant: recommending the preferred alternative, facilitating the desired behaviour, and providing feedback.

The results in this paper point to the importance of not only providing life cycle information that is understood by the target audience but also providing life cycle recommendations on how to act based on the information provided. Moreover, information and recommendations need to be tailored to the context in which the life cycle information is to be applied and a new behaviour is to be adopted. By applying theories from social psychology to understand the impact, or lack of impact, of life cycle information on behaviours throughout large companies, this study adds further empirical and theoretical insights into important aspects when shifting focus from information to situation. By taking this broader perspective on life cycle information, this study could assist companies wanting to act from a life cycle perspective to limit their environmental footprint. By emphasising the shift from information to situation, this study also highlights the managerial aspects of turning life cycle information into action.

5.2 A new role for the LCA practitioner

The shift from providing the right life cycle information to understanding and influencing the expected agents' situation places the life cycle practitioner in a new role. Often, the LCA practitioner in a company (or contracted consultant) compiles and presents life cycle information for further use in the company. Although a well-performed interpretation phase in the LCA that includes clear recommendations is important, further measures are likely to be needed to ensure action. Increasing the impact of life cycle information will probably require deliberate identification and analysis of the target group and adaptation to this group and its contexts. However, compared to LCA studies, this way of acting implies new roles in the organisation: strategically selecting internal target groups for life cycle information; identifying expected changes in actions and routines to reduce environmental impact in a life cycle perspective; familiarisation with the situation and the target group identified; and contributing to shaping situations, alternatives, recommendations, and incentives needed for life cycle action. To this end, such change in mindset from providing information to providing recommendations and context-specific information is not necessarily within the area of interest, expertise, and/or authority of today's LCA practitioners. Therefore, this study highlights the need to look beyond the LCA study as such and highlights a potential shift in the role for the LCA practitioner or the need for a new profession altogether.

5.3 Delimitations and further research

This study aims to get a better understanding of the use or non-use of life cycle information to start formulating theories about why life cycle information has difficulties leading to action and how to change this. The study is restricted by its limited number of cases and interviews, and the suggested hypotheses need to be further tested (e.g. by also including quantitative approaches) to verify the generalizability of our findings. For example, future studies should investigate whether a stronger focus on personal goals would increase the use of life cycle information.

Given that context for life cycle information has an operational impact, it is also relevant to further explore the nature of that context. To this end, concepts and categories identified in the analysis (Table 2) were chosen to illustrate different aspects of this context. They are claimed neither to be comprehensive nor to be fully developed. Future research should further explore and refine the classification of this context.

6 Conclusions

This study has explored how life cycle information is interpreted, evaluated, and used in everyday actions of large industries. Based on situations where life cycle information of a reasonable state-of-the-art standard has been provided, we identified barriers and enablers for acting on life cycle information throughout a company.

The results reveal barriers relating to what data are used (e.g. a gap between what life cycle information is available and what life cycle information is required) and how it is presented (e.g. as aggregated or disaggregated data). However, in addition to aspects relating to life cycle information per se, there were prominent additional reasons why the available information did not produce commensurate action. These additional reasons mainly related to the receivers of the information and the context in which the information was (intended to be) used.

6.1 Recommendation and context as missing links

Assisted by theories from social psychology, we identified recommendations and context as missing links for life cycle information to impact behaviour. Recommendations are needed for the most preferred alternative in a given situation and for identifying who within the internal functions should act differently to include a life cycle perspective and how these people should act. It was further found that clear recommendations need to be coupled with a context where personal goals, such as reaching the threshold for a bonus, meeting a deadline, and reducing uncertainty, align with normative goals, such as environmental visions, strategies, and overarching goals, to increase the likelihood of life cycle information having an operational impact. Life cycle information will likely have a greater impact on behavioural change in contexts where normative arguments are aligned with enablers that focus on personal goals.

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