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*Publication date:*  
2007

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

*Citation for published version (APA):*  
Holgaard, J. E., Remmen, A., & Jørgensen, T. H. (2007). LCM - intentional strategy or a patchwork of practices? Aalborg: Aalborg Universitet.

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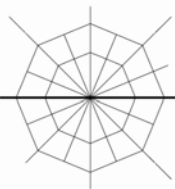
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**Working Paper 20 2007**

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Arne Remmen  
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**Technology, Environment and Society**

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# Colophon

LCM - intentional strategy or a patchwork of practices?

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Series: Working Paper 20

Layout: Annia Aarup Jensen

Published 2007

ISSN 1603-9890

Technology, Environment and Society

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<http://www.plan.aau.dk/tms/publikationer/workingpaper.php>

# Abstract

The scope of this paper is to discuss the relation between the understanding of Life Cycle Management, LCM at the conceptual level and the practical use of LCM at the company level. The company Grundfos has not chosen an LCM vocabulary in their strategic approach. However, if the environmental practise of Grundfos is reviewed on the basis of a conceptual LCM framework, it could be argued that the company is practising LCM in several areas. In this paper, we investigate the practices within the different departments at Grundfos A/S. Rather than being based on a conceptual LCM model, these practices have “grown” from below on the basis of different ideas, projects with different aims, etc.

LCM-related systems, activities and tools are prioritised in the company, and general management frameworks, such as Business Excellence, are applied and could be related to LCM. However, with reference to the theory of communities of practice, the culture of the different departments has implications on the actual practices. A closer interaction between the departments is needed, if the activities are to be considered an integrated LCM strategy - intentionally or emerged from practice.



# LCM – intentional strategy or a patchwork of practices?

In the following, a short overview of the conceptual and methodological framework is given for the investigation of LCM practices at Grundfos. The various practices are described within the different departments at Grundfos A/S. At a conceptual level, these practices are related to LCM. On this basis, it will be discussed to what extent LCM should be integrated as an intentional strategy at Grundfos A/S in order to create a closer link and interconnection between the different practices.

## Investigating LCM practices at Grundfos

In this section, the framework for investigating LCM-related practices is introduced. First, the conceptual framework for LCM is presented, and LCM is addressed in an organisational perspective and seen as interrelated communities of practices. Secondly, the case study approach applied is introduced in order to investigate environmental and social practices at Grundfos.

### *The conceptual framework of LCM*

Life Cycle Management is a relatively new business strategy. Recent definitions characterize LCM as a management strategy that seeks to promote an integrated approach towards life cycle thinking across departments and business areas. The LCM working group within UNEP describes LCM in the following way (Jensen and Remmen, 2005):

*LCM is not a single tool or methodology. It is a flexible integrated framework of concepts, techniques and procedures. LCM inherently takes a life cycle approach in considering environmental, economic, technological and social aspects of products and organizations. LCM, as any other management pattern, is applied on a voluntary basis and can be adapted to the specific needs and characteristics of individual organizations.*

This definition emphasizes all three pillars of sustainability, and that LCM represents a management framework, introducing life cycle thinking as well as social and environmental responsibility in several business areas. Apart from environmental, economic and social aspects of sustainability, the definition also includes technology. This emphasizes the importance of technological innovations and that innovations must also be based on life cycle thinking. Other definitions exist and some researchers and companies have presented product-oriented environmental management systems (POEMS) or life cycle assessment (LCA) as synonyms to LCM.

A key factor that distinguishes LCM from environmental management systems (EMS) is the life cycle perspective as well as the inclusion of economic and social aspects.

Product-oriented environmental management systems are also based on LCT, but only focus on the environmental dimension. Therefore, POEMS represent an “entry gate” to LCM, but is not LCM in full scale. While EMS is closely related to the environmental department, the aim of LCM is to create a comprehensive management strategy which embraces a wide range of activities. POEMS also involve several departments, such as product development, purchasing and marketing in the pursuit of cleaner products. As LCM embraces social and economic aspects as well, the interdisciplinary approach becomes even more pivotal. The implementation of LCM involves two types of challenges (Remmen and Thrane, 2005):

- An intra-organisational: how to engage all departments in the organisation in product-oriented initiatives
- An inter-organisational: how to engage the different stakeholders especially in the product chain in product life cycle improvements

MANAGEMENT LEVEL	Social dimension	Environmental dimension	Economical dimension
Objective	Sustainability		
Concept	----- Life ----- Cycle ----- Thinking -----		
Strategies	----- Life ----- Cycle ----- Management-----		
	Corporate social responsibility	Pollution Prevention	Product and supply chain management
Systems	OHSAS	EMS, POEMS	TQM, EFQM, IPD
Tools	Work place assessment	Cleaner Production LCA, EcoDesign	EMA, LCC.

**Explanations:** OHSAS = Standard for occupational H&S, EMS = Environmental Management System  
 POEMS = Product Oriented Environmental Management System TQM = Total Quality Management  
 EFQM = European Foundation for Quality Management IPD = Integrated Product Development LCA =  
 Life Cycle Assessment, EMA = Environmental Management Accounting LCC = Life Cycle Cost  
 Analysis.

Figure 1: Different management levels and examples of strategies, systems and tools related to sustainability (Remmen & Thrane, 2005).

In order to develop cleaner products and move towards sustainable development, social and environmental procedures and tools must be integrated in the daily work of the different departments. As shown in figure 1, several strategies, systems and tools are involved from the strategic level to the operational level. Many entry gates to LCM exist in a company, and LCM can be addressed at different levels of ambition. No matter the ambition level, the LCM philosophy stresses the integration of different strategies, systems and tools. Together with the need for an interdisciplinary approach, this integration presents major organisational challenges to the company. Figure 2 exemplifies how different departments in companies apply numerous procedures and tools that are related to LCM.

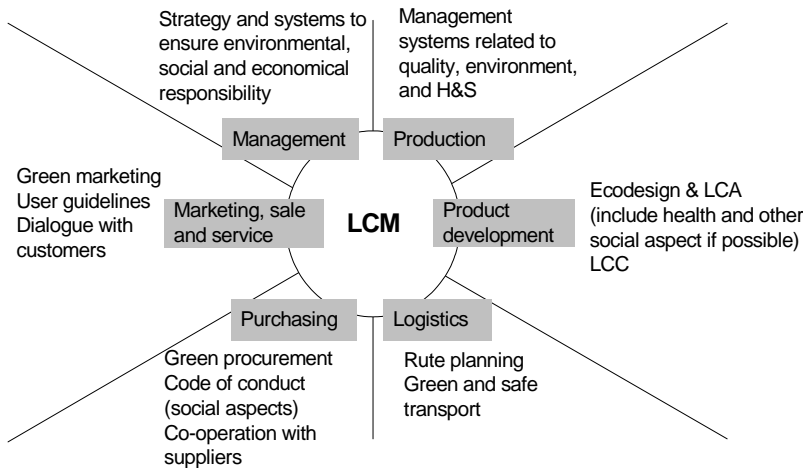


Figure 2: Approaches and tools as part of LCM, in various departments, (inspired by Schmidt et al., 2000)

### *LCM as interrelated communities of practice*

The environmental practises of various departments can be studied from the perspective of what Etienne Wenger calls communities of practice, (see Wenger 1998). Within communities of practice, the social relations are tuned, meaning structures are shared and negotiated, and a social identity is formed through the mutual engagement in a shared enterprise. There is a mutual way of talking about the shared historical and social resources, frameworks and perspectives which can sustain common engagement in action; in other words, shared practices exist.

Communities of practice are integral parts of our daily lives and are informal and pervasive to the extent that they are rarely brought into explicit focus. Communities of practice involve a complex process that combines doing, talking, thinking, feeling and belonging. Over time and as boundary forms, discontinuities will occur between those who are participating and those who are not; but at the same time, ways of maintaining connections with the rest of the world are developed. An important notion in that respect is brokers.

Brokers are able to make new connections across communities of practice, enable coordination and even create new possibilities of meaning. The connection of communities involves processes of translation, coordination and alignment between perspectives. In this paper, we argue that more brokers between the different departments are needed in order to assure the interdisciplinary and integrative approach stressed by the concept of LCM presented in this sub-section.

### *Grundfos as case company*

With more than 12,500 employees and a turnover of more than 13,000 million DKK, the Grundfos Group is a large company, at least in a Danish context. Grundfos is represented by companies in all parts of the world and has distributors in a large number of countries. Circular pumps, submersible pumps and centrifugal pumps are the three major product groups of the company, which annually produces more than 10 million pumps (Grundfos, 2006a).



The case of Grundfos was chosen as an extreme case in order to obtain information about a company, who has a long tradition of integrating environmental protection and social responsibility in its processes and products. In 1991, Grundfos signed the environmental charter issued by the International Chamber of Commerce, to demonstrate its intention of fully integrating environmental management into all business areas. Since then, Grundfos has intensified its environmental activities. From 1996 to 1999, their sites in Denmark and in various other countries were certified according to ISO 14001, and some were also EMAS-registered. During the 90s, the environmental impacts of production have been systematically reduced. Focus has been on reducing: energy use, emissions, water consumption, waste water, use of materials, as well as pollution from materials, chemicals, accidents, risks, and noise. In 2004, Grundfos obtained the European energy label for circular pumps; a labelling initiated by Grundfos, other European producers of pumps and the EU.

In 2002, Grundfos introduced a corporate policy on social responsibility and joined UN's Global Compact with 10 principles of social and environmental responsibility. Several companies have emphasised the social dimension and are certified according to OHSAS 18001 for occupational health and safety management. Furthermore, Grundfos was the first company to be certified according to the Social Index, which was developed and launched in 2000 by the Danish Ministry of Social Affairs in order to measure the social responsibility of a company. (Grundfos, 2005b).

The case study has been made as a longitudinal study over several years. In 2000-2003, qualitative interviews were made with the environmental manager (Andersen 2000, 2001 & 2002), the head of the communication division (Mortensen, 2002), and three persons responsible for environment in the electronic production unit (Hansen, 2000), purchase to the electronic unit (Matthiesen, 2001) and product development (Thorup, 2001). From 2003 to 2006, several visits to Grundfos have been used for following up on the company's environmental and social activities, most recent in 2006 (Andersen, 2006), (Nystrup, 2006). Furthermore, written material describing the company's environmental performance was used and, in addition, occasional information has been provided by telephone or mail.

In the previous section, LCM was defined as based on life cycle thinking considering environmental, economic, technological and social aspects of products and business activities. However, it must be noted that the case study of Grundfos has been limited to addressing the environmental and social activities. Furthermore, the company has not yet applied LCM as an intentional strategy. The case will exemplify how LCM can work at the practical level as a number of loosely coupled activities handled within and across different communities of practice. On this basis, the idea of applying LCM as an intentional strategy at Grundfos is discussed.

## **Practices towards sustainability**

Grundfos is working with the two main challenges of LCM: the intra-organisational challenge of engaging all departments in product-oriented initiatives and the inter-organisational challenge of engaging the different stakeholders, especially in the product chain. Both challenges are dealt with in various departments at Grundfos.

Before these activities are discussed, the overall strategy of sustainability is presented.

In 2006, Grundfos published the first sustainability report stating that “the goal is sustainability in all we do”. Here, the primary stakeholders are appointed to be the owners, society (including suppliers and authorities), customers, and employees. Focussing on each of the stakeholders, Grundfos addresses their activities regarding, for instance, prosperity, investments, health and safety, environmental impacts, and reputation. (Grundfos, 2006c).

#### *Coordination of environmental and social issues*

The Department of Central Service is responsible for co-ordinating the environmental activities, managing cross-organisational projects and maintaining the expertise regarding environment as well as health and safety. For example, Grundfos has initiated several cross-organisational projects to enter into a closer collaboration with suppliers and to coordinate their environmental improvements and exchange experiences on environmental management.

Furthermore, Central Service determines the overall focus areas in environmental and occupational health and safety management of production, but the specific production sites define the approach and goal setting related to these areas (Andersen, 2000). Grundfos has integrated the management systems for environment and health and safety into one common system. When Grundfos applies the term “environment”, it refers to the external environment as well as health and safety. Another activity is to follow the regulative demands on electronics in the EU. Grundfos is subject to the RoHS directive on reduction of hazardous substances and to the EuP directive on eco-design requirements for Energy-using Products (EuP), which will be implemented in national law by August 2007 (European Union, 2005).

Central Service develops tools for gathering experiences, ideas and data, and provides internal consultant services on environment, health and safety. One example of a tool applied to handle issues of health and safety is the classification of every workplace by three colours: red (requires immediate attention), yellow (attention might be needed), green (everything is all right). In 2006, 85 % of the workplaces at Grundfos A/S were green, 10% yellow and 5% red (Grundfos A/S, 2006b).

At the sites around the world, Grundfos involves in the local community by supporting local initiatives, for instance through donations to a more stable water supply.

Grundfos has estimated the life cycle costs of different solutions to the same pumping task. This method is developed in close collaboration between Hydraulic Institute, Europump and the US Department of Energy's Office of Industrial Technologies (Grundfos, 2005a). Indexed figures to calculate the economic impact of resource savings have also been prepared. A turnover ratio, which is a relative index used for calculating the financial impact of resource savings, has been applied. As an example, in 2004, Grundfos would have incurred an additional expense of DKK 13.090.000 for electricity, if the consumption to turnover ratio had remained the same as in 1999 (Grundfos, 2005a:28).

### *Environmental and social practices in the different departments*

At the different production units, the specific goals for improvements of the environment and occupational health and safety are formulated. Each unit is responsible for following up on these goals and implementing solutions in order to secure continuous improvements. Central Service has prepared a spreadsheet for calculating key figures of the production units, so the production units can follow the progress towards their own goals and compare their environmental performance with the performance of other production units. For instance, in 2000, the Grundfos Group had its highest number of accidents per one million working hours and for this reason, accidents were appointed the main focus area (Grundfos, 2005a). From 2000 to 2005, the number of accidents was reduced from 30 to 18 per one million working hours and absence caused by accidents from 2.8 to 1.9 per one thousand working hours. To improve the health of the employees, Grundfos established a Centre for Health and Wellbeing in 2004, which runs health campaigns, conducts quit smoking courses, etc. (Grundfos, 2005a).

Grundfos has a tradition of social engagement in the local community. Since 1969, Grundfos has had a number of protected workplaces for people with disabilities caused by physical, psychological or social circumstances. The objective is that these employees make up 3% of the total work force in Grundfos, Denmark. Grundfos also has a programme for integration of refugees and immigrants and other exposed groups.

At each production site, an environmental coordinator is appointed, but the management philosophy builds on a high degree of employee participation. Employees' ideas to improve the company's environmental performance are valued and feedback is given by use of IT. The ideas and feedback are collected in a database (Andersen, 2002). As a consequence, the motivation for contributing to the environmental activities has increased among the employees. Grundfos determines specific goals for the number of suggestions per employee, and the accumulated number of suggestions for environmental and health and safety improvements at Grundfos A/S was 2.606 in 2001 and 12.236 in 2006 (Grundfos, 2006b). Furthermore, the visualization of the employees' ideas serves as a signal of the fact that their proposals are taken seriously and the ideas are implemented if feasible.

In *product development*, two different tools have been applied. First, overall principles of eco-design have been prepared for the product developers. These principles are supported by workshops and guidance from an environmental responsible, who is familiar with daily routines and actual development projects. The guidelines on Eco-design developed in the EDIP project (Environmental Design of Industrial Products) have formed the basis for eco-design at Grundfos. However, it is stressed that the company is cautious when specifying the guidelines further, as the extent to which they correlate with other product parameters differs from one project to another (Thorup, 2001).

Secondly, the importance of the different life cycle stages was estimated based on life cycle assessment. The environmental impacts of a pump are related to the following life cycle stages (Grundfos, 2005a):

- 6.4% for production
- 1.6 % for transportation
- 87.9% for use
- 4.1% for disposal

Therefore, the two main issues in regard to eco-design focus on reducing the energy consumption during use and optimising the possibility of recycling at the end-of-life stage.

Energy efficiency is continuously improved by technological innovations, like optimisation of the hydraulic design, loss reduction in the motor and use of permanent magnet technology in the motor (Grundfos, 2005a). Grundfos has initiated a European energy-labelling scheme of circulator pumps used in heating systems, which was launched in 2004. The labelling scheme consists of classes A to G, where A stands for the most efficient pump. The A category pumps do only work when necessary and only with the required power. The energy label has made it easier for consumers to choose an energy-efficient pump. The situation in most European homes is category D circulating pumps (Grundfos, 2005a).

The recycle percentage of a typical Grundfos pump is between 90% and 98%, and besides, 2-8% can be incinerated (Grundfos, 2006b). Furthermore, the environmental policy states that the Service Department shall receive, repair or inform of disposal channels of worn-out products (Grundfos, 2006b). In 2004 and 2005, the objective was that 80% of new products should, as a minimum, demonstrate a 5% reduction in electricity consumption compared to the previous model (2% if the previous model is less than five years old). In 2004, this goal was reached in the cases of 3 out of 4 products; and the model which failed to achieve the goal is being phased out. Another goal is a reduction of material consumption in new products. In 2004, this goal was reached in the case of two out of four products. One of the products had increased material consumption as a trade-off to increase the quality and lower the price. In the other case, the increased amount of material was a trade-off to increase energy efficiency (Grundfos, 2005a).

In 2000, distribution was one of the projects taken up by the Department of Central Service. The project focused on developing key figures, which could be used for measuring the environmental impact and performance of the related transportation of goods. The project was carried out in close collaboration with the transport supplier, Schenker BTL (Andersen, 2000). Since 2001, Grundfos has gathered environmental data on selected transportation routes, which are used for defining objectives of ongoing improvements. By gathering data on the regular routes, environmental ratios have been made, and objectives have been defined for the load ratio expressing the degree of utilisation of the space (Grundfos, 2005a).

The key tools for purchasers are self-evaluation schemes and auditing. In 2000, a system was established to evaluate the suppliers in regard to environmental and health and safety issues. Emphasis is put on whether the supplier has a certified environmental management system, and if this is not the case, the purchasers are interested in knowing why and whether it is planned to implement this system. However, Grundfos has few possibilities of making demands on their suppliers, if there is lack of products on the market. This has been the case of some electronic components (Matthiesen, 2001).

The Sales and Marketing Department has recently begun to see environmental performance as a customer-driven activity. The three basic tools for sales and marketing are the European energy label scheme, environmental product declarations, and environmental marketing of products based on the goals of energy efficiency and reduction of materials. The environmental product declarations are mainly prepared at the request of the Swedish market due to national regulation.

## Management approach to life cycle thinking

In this section, we discuss the organisational and strategic framework for handling the environmental and social initiatives of Grundfos in an LCM perspective. The strengths and weaknesses of an intentional LCM strategy are addressed as an alternative to a patchwork of practices covering a range of LCM activities.

### *The organisational framework in an LCM perspective*

LCM has not been applied as an overall strategy at Grundfos. However, by taking the business excellence model as a point of departure, and by emphasizing sustainable development in its company values, Grundfos has implemented activities related to LCM. These activities have followed four tracks:

- Environmental and health and safety management of production. Related activities have been handled at the specific production sites and coordinated by the Department of Central Service.
- Environmental product chain management. Up-stream activities have been handled by purchasers guided by the Department of Central Service. Down-stream, the Department of Research and Development has played a central role in initiating energy labelling.
- Life cycle assessment and eco-design. These activities have mainly been handled by the Department of Research and Development.
- Corporate social responsibility. Activities are anchored in a cross-organisational task force and in the health and safety unit at Central Service.

The strength of this strategy has been the ownership of activities close to the departments affected by the initiatives and changes. This means that the systems, tools and goals can be prepared in accordance with local traditions and routines. However, this strategy also makes the coordination of different tracks more complicated, as the communities of practices have been closely related to the different departments, and their engagement in a specific activity is related to the product, e.g. sale, product development, purchase etc.

In this patchwork approach to LCM, the different communities of practice may, in fact, be considered as well functioning without substantial interrelations.

The Department of Central Service has served as the coordinator of environmental and health and safety management of production, whereas its role in relation to product-oriented activities has been of a more consultative character.

However, in recent years, Grundfos has made some organisational adjustments in order to increase the co-ordination of product-oriented activities. In 2005, the intra-organisational link between the product-oriented work and the environmental management of production was strengthened. Today, the employee responsible for product-related environmental initiatives spends part time at the Department of Product Development and part time at Central Service, where environmental management is co-ordinated (Andersen, 2006). This co-ordination is important, as trade-offs in some cases are present between environmental considerations in production and design principles in product development. Besides, the same employee has earlier worked with corporate social responsibility.

In other words, the two communities of practices are interrelated by an intentional use of a broker, who mediates between the different engagements and practices. However, in an LCM perspective, this strategy should be much more prevalent, including linkages between all communities of practices, e.g. those related to the Departments of Logistics, Purchase and Sale. More brokers are needed in order to assemble the patchwork of LCM activities and establish an interdisciplinary and integrative LCM approach. Furthermore, a sustainability report can be seen as a boundary object that can be part of creating a mutual understanding and a common reference point between different communities of practices.

## Combining Business excellence with LCM

One way of making the systems and tools applied in the patchwork of LCM-related activities more intertwined is to gather them under one umbrella – and LCM might be an appropriate overall concept. LCM is closely related to Grundfos’ business excellence model and the concept of sustainability, as illustrated in figure 3.

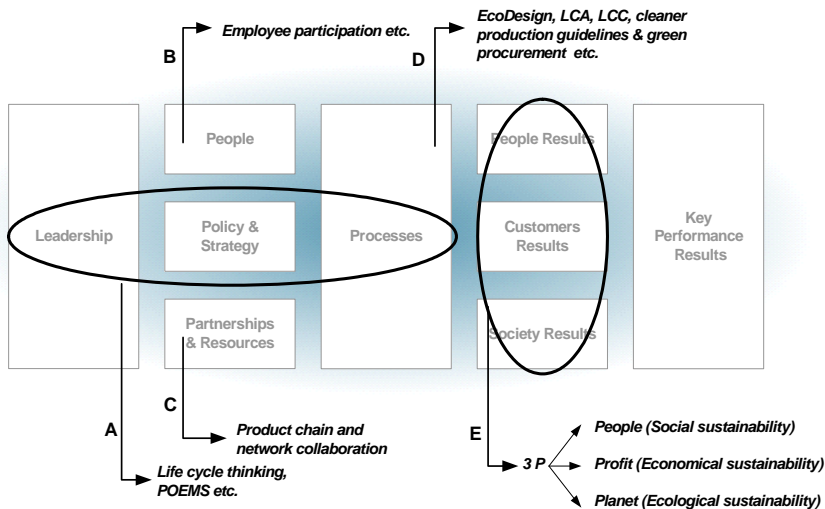


Figure 3: LCM strategies, systems and tools applied to EFQM (Remmen & Thrane, 2005).

Regarding the enablers (left side), a company can choose to integrate life cycle thinking and/or POEMS in its leadership, policy and strategy and at the process level (see A). Employee participation is essential also to LCM and corresponds to the “people” element of enablers (B). Product chain and network collaboration is presented here with the terms “partnerships and resources” (C), and tools such as eco-design, LCA, etc. can be adapted at the process level (D). On the result side, the triple bottom line seems to be in accordance with performance indicators suggested in EFQM, but obviously it should be ensured that the focus on environmental and social impacts gets sufficient attention and that performance indicators are developed for these areas (E) (Remmen & Thrane, 2005).

LCM in this perspective becomes an integrated way of doing business. Today, sustainability is a key value at Grundfos, and, as we have shown in this paper, several activities support this company value. However, the more explicit the company values are linked to the overall business strategies; the more the need for linkages, brokers, boundary objects, etc. between the different LCM activities becomes obvious.

In the fall of 2006, Grundfos has reorganised in order to establish a team covering the whole Grundfos group, which specifically is assigned to handle strategic considerations related to sustainability. This can become a turning point to insure that the patchwork of practices, which has grown out of the different communities of practices, to a higher extent, is coordinated and interrelated.

# Final remarks

Based on a case study of the Danish company Grundfos, we have shown considerable differences between the understanding of LCM at the conceptual level and the practise of LCM at company level. At the conceptual level, LCM can be viewed as a deconstruction of the concept of sustainability, which leads to different strategies, systems and activities. However, in companies, LCM-related activities often grow out of the engagement of specific communities of practices, which might be just as or even more interrelated with actors outside the company. LCM, so to speak, enters through the 'back door'.

At Grundfos A/S, the LCM practices are, to a large extent, not based on a conceptual LCM model. They have grown from below on the basis of different ideas and projects with different aims. The cultures in the different departments have far-reaching implications on the actual practices in the company. Closer interactions and a common framework between the departments are needed, if the activities are to be considered as part of an integrated LCM strategy.

The future challenge of Grundfos and other companies is to secure that the philosophy of an interdisciplinary and integrated product-oriented approach to sustainability is driven and coordinated intentionally at the strategic level. This must take place without closing the door to incentives, which grow out of different communities of practice, where brokers and engaged individuals are redefining what LCM is all about.



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