

LIFE CYCLE MANAGEMENT IN PRODUCT DEVELOPMENT: A COMPARATIVE ANALYSIS OF INDUSTRY PRACTICES

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ABSTRACT

The integration of Life Cycle Thinking (LCT) and Life Cycle Management (LCM) into business operations poses great challenges, as it requires a wider range of environmental responsibility often extending beyond a company's immediate control. Simultaneously, it offers many opportunities such as the reduction of a product's or industry's environmental impacts, an increase in process efficiency or the interconnectedness within the organization itself or across a supply chain.

Product development has been an area where application of LCM has been discussed most, since most product impacts are determined in the innovation and design phases. This comparative analysis explores the various approaches and challenges two companies are currently facing in their attempts to integrate LCT into their core product development processes.

INTRODUCTION

Inspired by Jensen and Remmen's (2006) life cycle management (LCM) diagram, this comparative analysis explores the various approaches and challenges two companies are currently facing in their attempts to integrate life cycle thinking (LCT) into their core product development processes (PDP) – those being Grundfos Holding A/S (manufacturer of pumps) and Siemens Wind Power (manufacturer of wind turbines).

Both companies reflect themselves as industry leaders within product innovation and technology. It can be expected that in the future, sustainability must be an encompassed element in this definition of "leader" in order to maintain and/or strengthen both company positions. It has been previously shown that sustainable products via the application of LCM have positively contributed to a company's competitive advantage and improved its platform for innovation. This has been realized by exemplary companies such as Interface, Philips and Unilever.

The levels of LCM integration will be explored below in order to see if companies from different industries have common challenges and opportunities that can be utilized for mutual collaboration on advancing LCM.

APPROACHES TO LIFE CYCLE MANAGEMENT

Grundfos

Initiating LCT with a focus on energy efficiency

LCT was originally applied in a Grundfos context through the development and participation in an early version of Life Cycle Analysis (LCA) in the mid 90's (UMIP – Udvikling af miljøvenlige Industriprodukter) and was initiated by the Danish Environmental Agency (Hausschild, 1996). The results of this assessment indicated that over 90% of the environmental impacts were generated through the use phase of the assessed products rather than the material selection, manufacturing, logistics or end-of-life phases. This laid part in initiating Grundfos' journey towards a focus on lowering energy consumption of their products. After 20 years of innovation, Grundfos succeeded in leading both industry standards as well as lobbying externally for the importance of energy efficiency in pumps and motors, while actively contributing towards the Eco-Design Directive EuP (energy using product) (Grundfos Holding A/S, 2013). Despite the successful integration, development and deployment of an energy efficiency focus, LCT had not been applied in a systematic fashion. A study undertaken by Holgaard, Remmen and Jørgensen (2007) confirmed that Grundfos had several initiatives that were connected to LCM, yet the concept had been applied in a fragmented manner, with a limited focus on product development.

Expansion of LCM – towards a more systematic integration

It wasn't until 2012 that Grundfos expanded their focus to encompass a more holistic LCM approach, emphasizing integration into their PDP; more specifically, integration by means of their corporate sustainability strategy (Grundfos Holding, 2012) and specific strategies relating to product development. With a broader focus, several life cycle based projects have been launched which are inter-disciplinary and run in parallel to ensure consequent and systematic work with all aspects of sustainability.

Crucial to the future expansion of LCM, Grundfos must adjust its existing core business processes and tools accordingly. Creating and implementing support tools which enable the product development organization to work with a life cycle based product approach will also lend to the organization giving equal consideration to the triple bottom line (TBL) when developing new products. Despite the TBL being a core aspect of Grundfos' sustainability strategy, there is still a misunderstanding that sustainability equates only to environmental aspects rather than on economic and social interests as well. Therefore communication across the company, from top management level to production employees must clarify and align all dimensions of the TBL. All tools and processes, including those that are currently under development and those yet to be developed, must underline the connection between economic, environmental and social aspects. With roughly 80.000 different products, the approach and tools must allow flexibility and adjustment possibilities according to the product characteristics; a "one-size fits all" approach risks compromising the sustainable improvement possibilities of Grundfos' products.

Siemens Wind Power

Looking back at an evolving product standard

As early as 1993 Siemens AG began mapping its minimum requirements, regarding environmentally compatible product and system design with an Environmental Protection (EP) Standard. Valid company-wide, it promotes a holistic and integrated approach spanning

the entire product life cycle, from product planning to end-of-life management. It is also continually adapted so company units can continue to satisfy international regulatory requirements, strengthen environmental communication with customers, and broaden environmental awareness among employees (Siemens AG, 2012).

As one of the youngest Divisions of Siemens AG, Wind Power’s primary focus has been on its expansion in a growing industry. Internal resource and operating efficiency programs have thus been primarily emphasized for the technology projects (manufacturing life cycle phase). Goals for waste reduction, energy consumption and air emissions were continuously set and reevaluated, while product related environmental management remained less formalized, despite many product improvement projects existing.

Moving forward towards an integrated product management approach

The Wind Power Division is however, working to strengthen its environmental position in the PDP. In 2011 the company initiated a research project involving Design for Environment (DfE) integration in the PDP. One business segment has since implemented DfE requirements and product managers have been trained on the process in addition to various environmental concepts. Furthermore, findings from two investigations resulted in product development and technology departments initiating formal projects for material efficiency and waste reduction.

Wind Power has also begun implementing a program launched under the Global EHS Program of Siemens AG entitled “Product Eco Excellence”. One of the key focus areas in this program is about intensifying the production and use of LCAs. The LCA results will be summarized in environmental product declarations (EPDs) to strengthen external communication with customers. Additionally, the results will be used to catalyze discussions with product and technology developers regarding further product improvements.

In a longer perspective, Wind Power must expand on its DfE process to strengthen its LCM approach by further integrating it into all engineering functions, company-wide. It must also incorporate other environmental requirements along the supply chain (e.g. purchasing, projects, service, etc.) while aligning with its business partners (e.g. suppliers). The LCA results should be used internally to communicate LCT and create a common understanding that relates each departmental function to product impacts and associated improvement potentials. Linking the other departmental functions to the PDP and expanding the focus to other responsible functions is critical for integrating LCM into the full PDP spectrum.

The table below summarizes the various decision levels and policies, systems, concepts, tools and data, which are utilized by each company. The difference in approaches indicates that LCM offers a flexible approach for integration.

Table 1: Comparison of LCM approaches (based on Jensen & Remmen, 2006)

APPROACHES TO LCM	GRUNDFOS	SIEMENS WIND POWER
Policies / Strategies	– Energy efficiency → product sustainability	– Corporate environmental product standard
Systems / Processes	– TBL formally integrated (under development)	– DfE formally integrated (under development)
Concepts / Programs	– Sustainable product solutions	– Product eco excellence
Tools / Techniques	– Currently under development	– Waste reviews

Data / Information / Models	– UMIP	– LCAs and EPDs
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CHALLENGES AND OPPORTUNITIES INTEGRATING LCM

The table below illustrates the various challenges and opportunities each company currently faces. Common challenges are apparent, despite the fact that both companies operate in different industries, encompass different dimensions in scope (TBL vs. environmental), exhibit different levels of LCM integration and ambition.

Table 2: Comparison of challenges and opportunities

	GRUNDFOS	SIEMENS WIND POWER
CHALLENGES	<ul style="list-style-type: none"> – Trade-off issues relating to impacts vs. concreteness in engineering – Managing complexity and interconnectivity of departmental functions in the PDP – Clear communication of business potential 	<ul style="list-style-type: none"> – Formalized DfE process incorporating more departmental functions – Balanced approach with environment as additional core element of product development – Multi-criteria decision making support
	COMMON <ul style="list-style-type: none"> – Company-wide mutual understanding of LCT/LCM – Moving from initial support to independent practice and tool application – Evolution from impact assessment to systematic management and reduction of impacts – Appropriate resource allocation and management commitment needed 	
OPPORTUNITIES	<ul style="list-style-type: none"> – Unrealized potential connected to resource efficiency – Creation of a sharper competitive edge in the market – LCM has proved to be highly beneficial in the case of energy efficiency – Front runner in a relatively conservative market 	<ul style="list-style-type: none"> – Flexibility allows various ambition levels across departmental functions – A multi-dimensional concept of sustainability motivates cross functional collaboration – Ability to positively influence the industry through application
	COMMON <ul style="list-style-type: none"> – Large number of methods/tools and case examples for inspiration – Product LCT can act as facilitator between sustainability dimensions – Significant innovation potential if existing knowledge is connected to sustainability – New business model opportunities through circular thinking 	

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