

# Life Cycle Management: A Bridge to More Sustainable Products

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## ABSTRACT

Product Life Cycle Thinking is about widening views and expands the traditional focus on manufacturing processes to incorporate various aspects associated with a product over its entire life cycle and value chain. The main aim of Product Life Cycle Thinking is to reduce resource consumptions and emissions to the environment, as well as improve the socio-economic performance, in all stages of a product's life. Life Cycle Management (LCM) is a systematic way to incorporate Product Life Cycle Thinking into normal business practice, and herewith providing the societies with more sustainable goods and services. Life Cycle Management can facilitate the link between the economic, social and environmental dimensions within a company. LCM is explicitly aimed to modify and improve the performance of product systems and supports the business assimilation of, for example, Integrated Product Policies, Ecolabeling, Design for Environment, Green Procurement, and various communication efforts in the value chain. The Life Cycle Management concept was originally developed by OECD and Environment Canada and further developed by a SETAC LCM Working Group and lately the UNEP-SETAC Life Cycle Initiative LCM Programme.

**Keywords:** Life Cycle Management, LCM, Life Cycle Thinking, sustainable products.

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## Introduction: Sustainability and the Triple Bottom Line

Sustainable development is now almost an everyday term, defined broadly as development meeting current needs of society while ensuring that future generations' needs are met. Sustainable Development should ideally improve the quality of life for every individual on earth without expending the earth's resources beyond its capacity. The journey towards sustainable development requires that businesses and individuals take action, i.e., changing consumption and production behaviors, setting policies and changing practices, and finding innovative ways to be profitable and at the same time improving the environmental performance and the quality of life.

Three dimensions characterize sustainability: an economic, a social, and an environmental. In the business community sustainability has been coined "the triple bottom line" that to industry have to expand the traditional business or economic aspect to include environmental and social dimensions, to create a more "sustainable" business [1]. That is illustrated in Figure 1 from reference [2]:

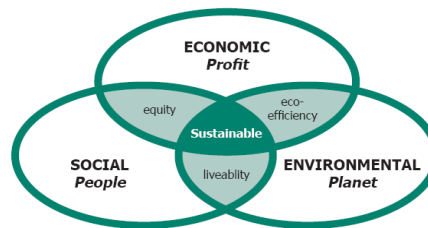


Figure 1: The three dimensions of sustainability.

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## Introduction to Life Cycle Thinking

Product life cycle thinking is about widening views by expanding the traditional focus on manufacturing processes to incorporate various aspects associated with a product over its entire life cycle (Figure 2):

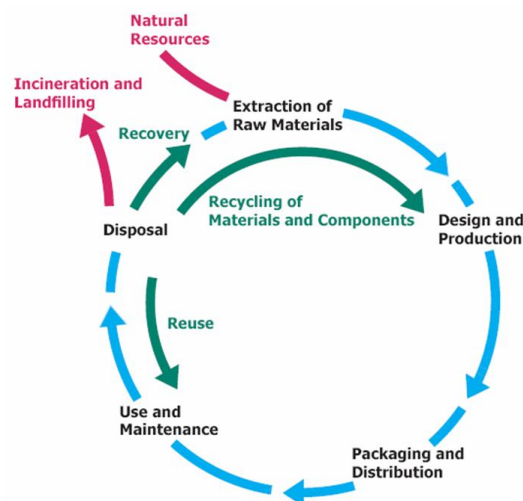


Figure 2: The product life cycle.

During lifetime every product will cast a shadow somewhere in the life cycle, thus product life cycle thinking is necessary for a sustainable development. The producer becomes responsible for the products from cradle to grave and has, for instance, to develop products, which have improved performance in all phases of the product life cycle.

The main aim of Product Life Cycle Thinking is to reduce resource consumptions and emissions to the environment, as well as improve the socio-economic performance, in all stages of a product's life. Life cycle thinking expands the older concept pollution prevention to include the complete product life cycle and sustainability. This facilitates the links between the economic and environmental dimensions within a company.

## Definition of Life Cycle Management

Life Cycle Management (LCM) is a *systematic application of life cycle thinking* in modern business practice with the aim to provide the societies with more sustainable goods and services and to manage the total life cycle of an organization's product portfolio towards *more sustainable production and consumption*.

Life Cycle Management can facilitate the link between the economic, social and environmental dimensions within a company.

LCM is explicitly aimed to modify and improve the performance of product systems and supports the business assimilation of, for example, environment-oriented product policies.

LCM is not a single tool or methodology but a flexible *management framework of programs, concepts, techniques and procedures* incorporating environmental, economic, and social aspects of products, processes and organizations.

LCM is *systematic integration of sustainability* e.g. in company strategy and planning, product design and development, purchasing decisions and communication programs to minimize environmental and socioeconomic burdens associated with a product or product portfolio over its entire life cycle and value chain.

LCM is *voluntary* and can be gradually adapted to the specific needs and characteristics of individual organizations.

Implementation of LCM is a *dynamic process*; organizations may begin with small goals and objectives with the resources they have and get more ambitious over time.

### **For whom is Life Cycle Management?**

Life cycle management (LCM) is for businesses, which have *adopted a strategy* expressing a wish among others to:

- Improve their public image, visibility and general relations to stakeholders.
- Increase their shareholder value and keep it persistent.
- Work towards being a sustainable business and be in the forefront of competitors.
- Be at the edge of and prepared for present or future legislative developments.
- Produce or trade products, which should be as sustainable as feasible. That means for instance:
  - Most sustainable manufacturing processes in all parts of the business chain
  - Long product life time and technological efficiency
  - Lowest possible environmental and health impacts in the whole product life cycle
  - Lowest possible use of non-renewable resources in the whole life cycle
  - Design for disassembling and reuse/recycling
  - Preferable usage of renewable and re-used materials
  - Social responsibility
  - No child labour

### **Organizations must go beyond facility boundaries**

Organizations with facility-focused Environmental Management Systems should expand them to incorporate product life cycle management. The organization must be willing and able to expand its collaboration and communication in the product/value chain.

Shifting the focus from within the organization's fence to the entire product chain includes:

- The product life cycle: flow of materials from acquisition of raw materials to production, transport, use and disposal.
- The market: a value and currency flow from the consumer to the producer.
- Communication and cooperation in form of exchange of knowledge and experience.

In an environmental context, focus up to now has been directed towards the flow of materials measured as life cycle assessment. However, in a life cycle perspective the flow of values is as important in order that cleaner products meet the demands of the market. What expectations does the consumer have concerning the product's characteristics? How do consumers rate environmental and social considerations relative to other product aspects such as price, quality, functionality, design, etc.?

For enterprises, the challenge is to make linkages in the product chain in such a way that there is focus on both environmental optimisation of the material flow in the supply chain; and on the customer's expectations regarding environmental and social issues in the value chain. Communication and cooperation between the partners involved will build connections between the supply chain and the value chain (Figure 3):

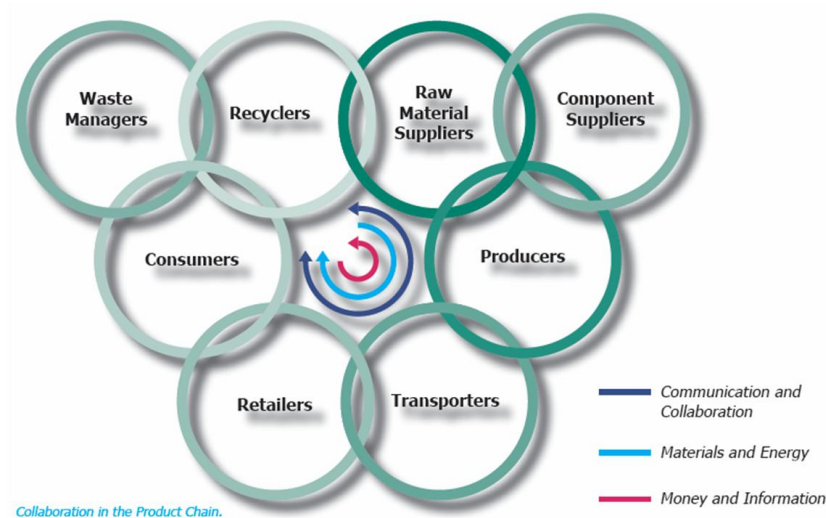


Figure 3: Collaboration in the product and value chains.

## The Life Cycle Management Toolbox

Companies can integrate sustainability and life cycle thinking into everyday management and decision-making processes using combined information from various available strategies and concepts, systems and processes, programs, and tools and techniques, which are operated at a management system level, a program level, or a technical level.

General strategies and concepts such as:

- Sustainable Production and Consumption
- Dematerialization, Factor 4-10
- Industrial Ecology
- Eco-efficiency

General company-oriented systems and processes such as

- Environmental Management Systems (EMAS, ISO14000)
- Environmental Auditing
- Environmental performance evaluation
- Green Accounting
- Corporate Social Responsibility (CSR)
- Supply Chain Management

Product-oriented programmes such as

- Environment-oriented product policy (e.g. IPP)
- Product Stewardship
- Supplier evaluation
- Design for Environment (DfE)
- Ecolabeling
- Environmental Product Declarations
- Public Green Procurement
- Resource productivity

Analytical and procedural tools and techniques such as

- Life Cycle Assessment (LCA)
- Substance Flow Analysis (SFA)
- Materials input per service unit (MIPS)
- In- and Output Analysis (I/O)
- Cost-Benefit Analysis
- Life Cycle Costing (LCC)
- Quality Function Deployment (QFD)
- Total Cost Assessment (TCA)
- Environmental Risk Assessment (ERA)

### **Any Organization can implement an LCM Program**

Product life cycle initiatives have often focused on the method, for example, a detailed life cycle assessment (LCA), followed by determination of the most significant environmental impacts in a product's life cycle. Such efforts are resource-intensive for a small organization, and do often end up focusing on data collection, rather than concrete strategies concerning how to improve the environmental and social profile of a product.

An organization needs not “jump into” tools like LCA, but instead take a step-by-step approach and begin with focusing on the life cycle perspective and on concrete possibilities to improve the environmental characteristics of a product. Various levels can lead to good LCM practices.

Organizations began to implement environmental management systems (EMS), like ISO 14001 and the EU EMAS scheme, to secure continuous improvement of their environmental performance. Integrating quality and EMS created new opportunities for organizations, such as lower resource consumption, image recognition and/or improvement, and better relationships with external stakeholders like local communities, authorities, etc. In various countries initiatives have been reported with the aim of promoting life-cycle thinking in EMS implementation or bridging the gap between product-oriented environmental strategies, and environmental and quality management systems.

Product related standards:

- ISO 14020 series on Environmental labelling
- ISO 14040 series on Life cycle assessment
- ISO Guide 64 for inclusion of environmental aspects in product standards
- ISO 14062 for integrating environmental aspects into product design and development
- ISO 14063 on Environmental communication
- ISO 14064 on Greenhouse gases

### LCM must involve many levels of the Organization

LCM must be a high priority for all parts of management, and all relevant departments and functions must participate. Participation of employees ensures that LCM initiatives will be deeply rooted in the organization, and that the focus will be on concrete improvements to a product’s environmental profile, rather than mere talk and data collection. The roles and interests of the various departments are illustrated in Figure 4:

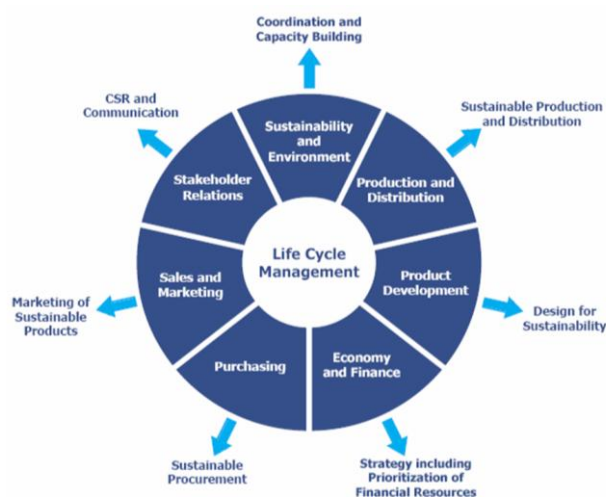


Figure 4: The Roles and interests of various departments in a business.

Introduction of LCM has to be a *top management decision* and be according to the company's policies and strategy. The Management Board or top management of a firm is responsible for company policy and strategy and the decision to implement LCM. Continued support from top management during implementation of LCM is also needed. Some of the incentives are:

- Financial sector requirements
- Reduce costs: Increased operational and resource efficiency.
- Less risky business with decreased liabilities giving lower insurance rates and reduced fines.
- Competitive advantage: being at the forefront of competitors. Increased market share: advantages to 'first movers' on sustainability issues.
- Increased brand value ('sustainable' products).
- Improve public reputation, image and general relations to stakeholders
- Expansion of product stewardship programs.
- Joining Corporate Social Responsibility Programmes.

The Environment/Sustainability Department coordinates and supervises the LCM implementation and the training of employees. *It is crucial that the whole company is motivated and speak the same language.*

The Product Development department is responsible for enhanced product innovation. Design of new products determines 70~80% of the total project life cycle costs and most of the total life cycle environmental impacts. An early assessment of the cradle- to-grave environmental aspects of the product system can lead to effective integration of environmental considerations into the design process and resource efficiency and reduced costs.

The Production and Logistics Departments may optimize operations by setting-up a material and energy flow based cost accounting.

The Procurement Department is responsible for integration of sustainability issues in supplier requirements and supplier evaluation. Improvement of the transparency in the organization and between the companies in the supply chain Innovation through development of new procedures and relations in the supply chain

The Sales and Marketing Departments addresses all market information likely to have an impact on the organization and has to ensure a better knowledge of the requirements, needs and expectations of all stakeholders in order to improve the external image of the organization. It is responsible for eventual developing of ecolabeling, Environmental Product Declarations (EPDs) and participation in green public procurement.

### **Early history of Life Cycle Management**

The Life Cycle Management concept was originally proposed by OECD [3] in 1992 as part of a sustainable product policy development and taken up by Environment Canada in 1997 [4]. The concept was developed further by a SETAC Working Group on LCM beginning

its work in 1998 and a report was published in 2004 after eight meetings [5]. A Danish report on life-cycle thinking and management was published in 2003 [6].

A LCM conference series was initiated with the LCM2001 conference in Copenhagen, Denmark, on 25-27 August 2001, LCM2005 in Barcelona, Spain, on 5-7 September 2005, and LCM2007 will be held in Zürich, Switzerland, on 27-29 August 2007. A future conference LCM2009 will be held in Cape Town, Switzerland, on 6-9 September 2009 [7].

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## The UNEP-SETAC Life Cycle Initiative



The UNEP-SETAC Life Cycle Initiative began in 2002 with three subprograms [8]:

- Life Cycle Management
- Life Cycle Inventory, and
- Life Cycle Impact Assessment

The LCM program had six Task Forces:

- Task Force 1: LCM Handbook
- Task Force 2: Life cycle based product development
- Task Force 3: Communication of life cycle information
- Task Force 4: Management along the life cycle
- Task Force 5: Stakeholder engagement along the life cycle
- Task Force 6: Development of training materials on LCM

Task Force 1 became responsible for development of a LCM Handbook with input from the other Task Forces. This LCM Handbook was later changed to a 108 pages "Background Report for LCM Guide", which was published first time in December 2004. In the spring of 2005 a slide show with more than 80 slides intended for promotion, education and training purposes were made based on the Background Document.

The more recent result was The UNEP/SETAC LCM training kit and LCM Introductory Guide: "Life Cycle Management – a business guide to sustainability", published in 2007 [2]. Another report about LCM communication was published in 2008 [9]. As part of the second phase of the Initiative a follow-up report on LCM and the value chain developed in cooperation with World Business Council for Sustainable Development (WBCSD) is to be published in 2009.

## Discussion

The concept of product Life Cycle Management is still at an early stage of development but LCM is increasingly being applied given different names and contents but

*mainly* in large multinational businesses with a widespread supply chain. We still need more practical experiences and exchange of information!

The LCM conferences and the UNEP/SETAC Life Cycle Initiative will have an important role to play in promoting and coordinating the further developments! Life Cycle Thinking and Life Cycle Management has to be further promoted for use in SMEs and in developing countries! A global dissemination of information and initiation of various educational and training exercises are needed.

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## REFERENCES

- [1] Elkington J. Cannibals with Forks: The Triple Bottom Line of 21st Century Business. Oxford: Capstone, 1997.
- [2] Remmen A, Jensen AA, Frydendal J. Life Cycle Management – A Business Guide to Sustainability. Paris, France: UNEP DTIE, 2007. <http://lcinitiative.unep.fr>
- [3] OECD Technology and Environment. The Life Cycle Approach: An overview of product/process analysis. OECD/GD(95)118. Paris: OECD, 1995.
- [4] Environmental Life Cycle Management: A Guide for Better Business Decisions. Ottawa: Environment Canada, 1997.
- [5] Hunkeler D, Saur K, Rebitzer G, Schmidt W.-P, Jensen AA, Stranddorf HK, Christiansen K. Life Cycle Management. Pensacola, FL, USA: SETAC Press, 2004.
- [6] Remmen A, Münster M. An Introduction to Life-Cycle Thinking and Management. Copenhagen: DEPA, 2003. [www.mst.dk](http://www.mst.dk)
- [7] <http://www.lcm2009.org/>
- [8] <http://lcinitiative.unep.fr/>
- [9] Fullana P, Frankl P, Kreissig J. Communication of Life Cycle Information in the Building and Energy Sectors. Paris, France: UNEP DTIE, 2008. <http://lcinitiative.unep.fr/>