

Preface

Development of environmentally friendly products gains an increasing importance in science and in industry. While product development was strongly dedicated to achieve quality, cost and time targets, environmental issues indirectly had always been under consideration by engineers, see Fig. 1. Furthermore a methodology for the development of environmentally sound products was missing. Despite of significant progress in using computer aided tools for product development and design, environmental aspects were attended. Computer aided tools typically do not include methods for considering environmental issues enabling the designer to assess a product's environmental effects.

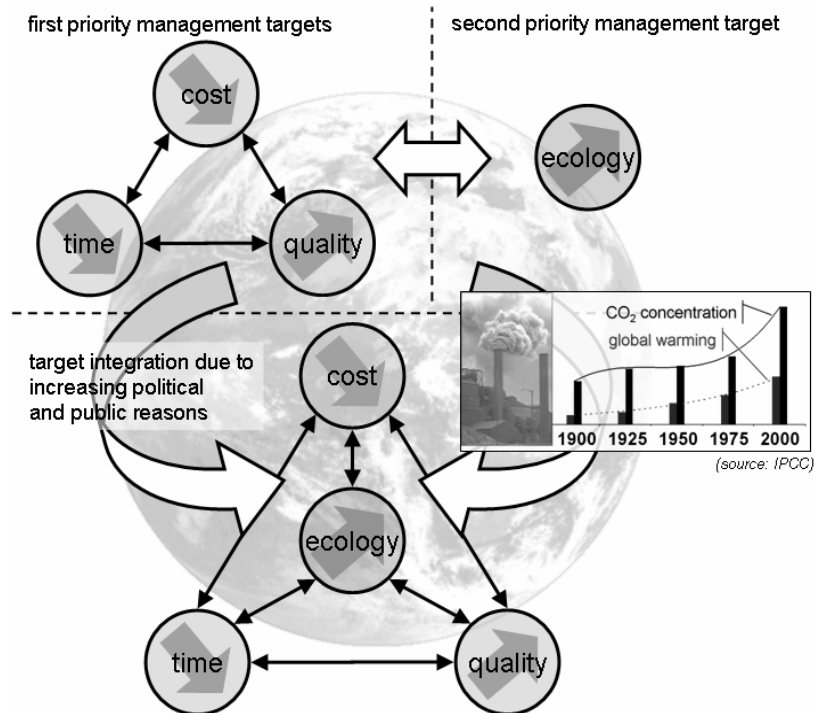


Fig. 1. Vision of Environment as a key target for product development

Product related environmental issues are getting more and more political and public awareness. Development of environmentally friendly products has become an action item for both, politics and industry (UNFCCC 1997). Energy consumption is on the agenda and covers pollution and resource saving. Typical topics of directives of the European Union are waste, noise, air pollution, water, nature and biodiversity, soil protection, civil protection and climate change. After the translation into national law the development of environmentally friendly products is a basic approach to contribute to the fulfilment of the topics mentioned above. In the European Community a “Communication from the Commission to the Council and the European Parliament” on “Integrated Product Policy” was adopted on 18th June 2003 (EC 2003). An integrated product policy (IPP), based on a strategy focusing on three stages in decision making processes, is defined in this paper:

- **Tools for creating the right economic and legal framework**
The principle refers to “polluter pays” and “producer responsibility”. Within a right economic framework all environmental impacts (all costs of the environmental impacts that a product creates by internalising the environmental externalities) should be accurately reflected in the price by taxes and subsidies, e. g. energy-related taxes.
Besides the integration of environmental aspects into the European standardisation process directives like “Restriction of Hazardous substances in Electrical and Electronic equipment” (RoHS 2003) or the forthcoming directive “Framework for the eco-design of energy-using products” (EuP 2003) substantiate the producer responsibility.
- **Promoting the Application of Life-Cycle Thinking**
Eco-design of products is considered as a very promising approach. This approach aims at a simulation of the product’s environmental impact throughout its life cycle phases. Life cycle assessments (LCA) are considered as the most important methods to analyse and to monitor the environmental impacts of products currently available.
Furthermore environmental awareness gained importance at the management level. Environmental management systems (EMS) have been developed and norms such as the Eco-Management and Audit Scheme¹ (EMAS 2003) or ISO 14001 (ISO 14001 1996) have been established. Companywide EMS

¹ Eco-Management and Audit Scheme

have become a standard for many industrial companies and environmental expertise has become a new engineering qualification.

- Giving Consumers the Information to Decide

Informed consumer choice is based on the encouragement of environmentally friendly products in the market by creating consumer awareness. Public procurement and environmental labelling are methods to make consumers aware of the environmental impact of products. The Eco-Label of the European Union provides consumers with reliable information and that the product is certified to be more environmentally friendly than most other like products across whole of its life cycle.

Most of the activities mentioned above just analyse and monitor the status of the environmental impact and aim for improvement of environmental quality. The challenge of reducing a product's environmental impact starts much earlier, it begins in the product development process. The challenge is

To improve next-generation products by developing environmentally friendly products right from the beginning for the whole life cycle.

Following the product development process the number of potentials comprised is high, compared to any product changes and activities for environmental protection after the product market launch. Therefore new product development methods that enable the introduction of a new development paradigm, the development of environmentally friendly products, are required.

Hence in 1996 a German research group called "Design for Environment - Methods and Tools" was established. The so-called "Collaborative Research Center 392" (CRC 392) was sponsored by the "German Research Foundation" (Deutsche Forschungsgemeinschaft - DFG) from 1996 to 2004. To provide fundamental research on product development methodologies, methods and tools dedicated to design and to develop environmentally friendly products was the main goal.

The results achieved are remarkable. A product development methodology based on the observance of technical, economic and environmental criteria across all of the product's life cycle phases (herein after referred as "holistic") has been specified. Methods were defined enabling designers, developers and engineers to prospectively analyse the environmental impact of a

product before it is getting materialised. At this stage a product solely exists virtually. Computerised methods and tools to evaluate a product's environmental behaviour were implemented prototypely and should become an integral technology for the development of environmentally friendly products. A holistic life cycle concept consisting of product life cycle phases which cover all-in from raw material acquisition to the final disposal is the main research approach.

The research team of the Collaborative Research Center 392 "Design for Environment - Methods and Tools" has successfully finished its fundamental research. During these years many international contacts, partnerships and friendships have been established. I do thank all researchers, my colleagues, the highly motivated research assistants and the committed students for their excellent work and their ongoing support. I am strongly convinced we contributed and still contribute to improve the environment and to create a live worth future.

Acknowledgement

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