

# ECODESIGN EDUCATION - A VALUE-BASED APPROACH FOR SUSTAINABLE PRODUCT DEVELOPMENT AS AN ANSWER TO UPCOMING GLOBAL CHALLENGES

**J. Jerlich<sup>1</sup>, H. Ostad Ahmad Ghorabi<sup>2</sup>, F. Reichl<sup>3</sup>**

<sup>1</sup> Institute for Engineering Design, Vienna University of Technology, Getreidemarkt 9, A-1060 Vienna, Austria

(jerlich@ecodesign.at)

<sup>2</sup> Institute for Engineering Design, Vienna University of Technology, Getreidemarkt 9, A-1060 Vienna, Austria

(ostad@ecodesign.at)

<sup>3</sup> E-Learning Center, Vienna University of Technology, Gusshausstrasse 26, A-1040 Vienna, Austria

(franz.reichl@elearning.tuwien.ac.at)

## **Abstract**

The implementation of Ecodesign and sustainable product development methodologies should not only help companies in developing products with a good environmental performance but also reduce internal costs. But it is kind of a paradox that even if costs can be reduced, Ecodesign methodologies and strategies are not fully accepted by product developers. This paper will discuss why it is essential to include beneath technological aspects, ethical as well as social aspects into any kind of Ecodesign education and training.

*Keywords: Ecodesign, sustainable product development, Ecodesign education, Ecodesign training*

## **1. INTRODUCTION**

National borders can not stop environmental impact from spreading into neighbouring countries or even from crossing oceans. Realizing this is the basis for recognizing the need to work together and collaborate on developing solutions for environmental problems.

Apart from the importance of underlying legal and political systems, national borders have lost much of their significance in marketing and sales due to globalization. Products are sold and available concurrently in large geographical regions. To survive in the market it has become a pre-requisite to attract and retain the best human capital. Continuous training in state-of-the-art technology as well as a practiced climate of knowledge sharing, supported by the appropriate infrastructure, are the nerves of a company.

In today's time of exploding production quantities and resource consumption, sustainable development should be a code of practice. Education and professional training in sustainable development, including sustainable engineering and product design, are the key success factors for a change towards a socially fair and value-based economy.

This kind of education helps to raise awareness of the decisions made by engineers during their daily work. Understanding the influences and consequences of their decisions in a

broader sense beyond just their own contribution to the product's development is the first step towards gaining and implementing social fairness and social values into product development and the economy respectively.

A demonstrative example for a global product is jeans trousers [8]. The manufacturing stages of common jeans trousers involve more than eleven countries around the world. Beneath approximately 50.000 km of distance which is covered due to sending the product and product materials (cotton, paint, etc...) from one country to another. This path is demonstrated in Figure 1. After their use in Europe, the trousers are shipped to African countries. Taking the economical and social aspects of the product's manufacture into account, one derives that:

- only 1% of the final price is the salary of the sewers and workers (which work in unfair conditions in some countries)
- 13% are material costs
- 11% are transport costs and customs dues
- 25% are costs for advertising, research and development by the brand company
- 50% are costs for retail sales staff, rental fee for stores, administration and profit

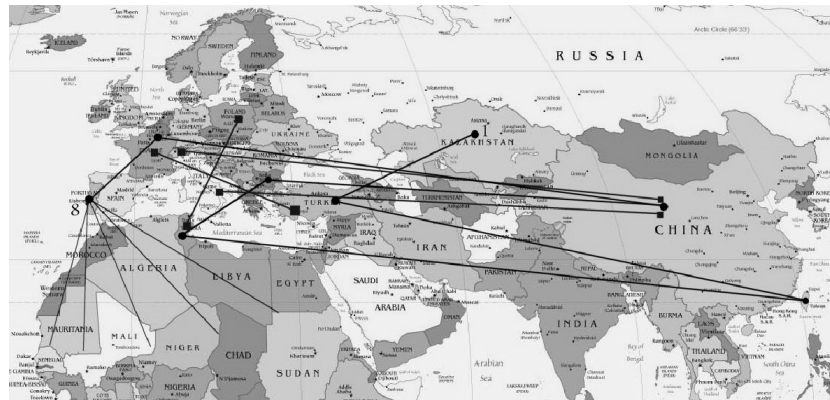


Figure 1: Journey of jeans trousers

Sustainable product development needs to address at least social, environmental and technical aspects at the same time.

Sustainable product development theories and methodologies are well developed and broadly discussed. However, the implementation of the theories and methodologies into industry and product development is still a challenging task. Researchers predict again and again that eco-products should enter the market. Eco-products show reduced environmental impact contribution through their life cycle.

## 2. ECODESIGN RESEARCH AND TRAINING

Over the last ten years the Vienna University of Technology (VUT) has developed and maintained a set of services including a blended learning course for sustainable product development, freely accessible Ecodesign tools as presented by [6]. The Ecodesign Research group of the VUT is building up an expert network to enable easy access to sustainable product development knowledge. The experiences showed that free availability and easy to use material is not enough for initiating and introducing the methods and processes into the daily practice and work of companies. This is even more astonishing when taking into account the laws and regulations, such as the European directive on the restriction of certain hazardous substances [1] or the European directive on waste electrical and electronic equipment [2], which demand products with environmentally sound performance.

The reason for this barrier may be lying in the focus on solely hard fact and analytical product development approaches and methodologies. This is, of course, the basic toolbox for implementing innovation and gaining product improvement.

During the course of several R&D projects undertaken at the Vienna University of Technology with industrial partners it became obvious that the production of ecologically sound products is generally not favoured. The reason given by companies was that costs are higher. Even though the application of the Ecodesign method showed that environmentally sound product can be produced at reduced costs, the objection against green products stayed. The fear and risk that eco-products would not be successful on the market seemed to be too high.

There are very successful product examples on the market. Comparing these two controversial facts the insight started to manifest itself that the absence of ethical and social considerations could be the main reason for rejecting even economically favourable sustainable product development.

In contrary to the analytical approaches mentioned, soft value-based approaches contain ethical and instilled social values which should influence the decision making and product development process. In our technology centred world, these values seem to be neglected. The instilled moral codex asking for an economical use of resources needs to be nurtured again. Market trends show that it is especially attractive to consumers taking responsibility for their actions in buying environmentally friendly products.

Further in this paper the term Ecodesign will contain the soft values as the basic idea and the analytical hard facts as the implementation approach, Figure 2.

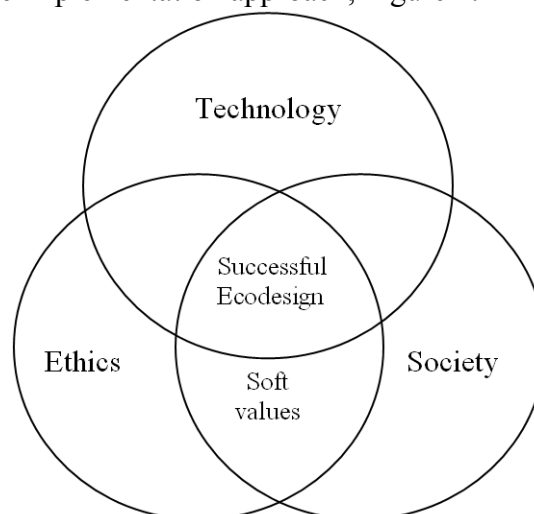


Figure 2. Successful implementation as a combination of technological, ethical and social aspects

It is possible to implement Ecodesign by simply following a systematic methodological approach, hence only considering the technological aspect. As mentioned above, considering that this aspect is no guarantee for a successful implementation of Ecodesign and sustainable product development into the daily work of product developers. As shown in Figure 2, a successful implementation of Ecodesign can only be achieved by harmonizing social, ethical and technological aspects.

It is kind of a paradox that companies have lost focus on using their resources efficiently because Ecodesign is not just a marketing strategy, but it pays off. Our experience has shown that applying Ecodesign methods and analyzing products along its complete life cycle does not only bring direct results for the immediate goals – the product improvement – but also diverse ideas and cost saving potentials for general management and other business areas.

One could also argue that the trend for companies acting in a more responsible way could also be derived from Corporate Social Responsibility (CSR) efforts that are adopted by a growing number of companies [3]. The motivating reason for a decision towards a more CSR based strategy of a company is to integrate all stakeholders and to create a business model taking all parties into account: the shareholders, the employees and the society.

If these soft value-based approaches are introduced in engineering education as early as possible engineers will be trained to take them into account for a decision processes they face in their daily work.

The VDI Guideline 3780 states [9] following criteria for decisions processes for engineers, such as:

- functionality
- environment
- economic efficiency
- prosperity and wealth
- security and safety
- health
- personality development
- social quality

However, engineers may face serious difficulties aiming at balancing all these criteria at the same time. However, today solutions are needed which satisfy these competing aspects. Engineers have to take them into account for every decision they take along the pathway starting from the idea to the final product to be produced and ready for the market.

Decision making involves dealing with values comprising goals, norms and standards on technical, ethical and social level.

The engineer as a specialist has to become a globalist. Today's challenges are multi-disciplinary problems in multi actor spaces. Education preparing students for their future work life has to change. Traditional singular roles do not exist any more [4].

The experiences gained during the Ecodesign learning course show that there are barriers between experts from different disciplines - with an impact reaching far beyond the course itself. These social barriers have to be overcome; in case of the Ecodesign course run by the E-Learning Centre of Vienna University of Technology this role was taken by the active tutor [5].

### 3. CONCLUSION

Ecodesign research and training should enable engineers to analyse the problem or task, find possible alternatives, assess them and determine their impact regarding all aspects referred to in VDI Guideline 3780 [9], including the often neglected environmental and social aspects. Based on this complete view, the decision making process will become reproducible: Depending on the value system applied, different results might be the outcome. The advantage is that it becomes clear how a certain decision result was achieved. It can be analysed how the result changes if a different value system is applied.

The Ecodesign research and training modules point out the existing dualism of hard fact based analytical product development methodologies and the soft value-based approach. In the sense of sustainable product development, the latter is extremely important but unfortunately still often neglected by engineers in practice.

The modules aim at combining the technological level of expertise and social part of product development as a key competence for engineers to satisfy the demand of innovative companies and consequently the labour market for this expertise. This was done through the module implicitly but there is an essential need to point out the soft value-based approaches more clearly and explicitly to guarantee the understanding and implementation of these approaches.

### References

- [1] Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003 on the restriction of the use of certain hazardous sub-stances in electrical and electronic equipment (RoHS)
- [2] Directive 2002/96/EC of the European Parliament and of the council of 27 January 2003 on waste electrical and electronic equipment (WEEE)
- [3] Economist.com, "The good company", [www.economist.com](http://www.economist.com), retrieved 10<sup>th</sup> May 2007.
- [4] J. Jerlich, F. Reichl, E. Obermüller, "The role of E- and Blended Learning in the stress field of a fast changing industrial world for continued engineering education". ASEE Proceedings of the 5th Annual ASEE Global Colloquium on Engineering Education, Rio de Janeiro, Brazil, 2006.
- [5] J. Jerlich, F. Reichl, E. Obermüller, "Promoting Trans-Disciplinarity by Active Learner Support", Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2005, P. Kommers, G. Richards (Pub.); AACE, Chesapeake (2005).
- [6] H. Ostad Ahmad Ghorabi, W. Wimmer: Tools and Approaches for Innovation Through Ecodesign - Sustainable Product Development. Journal of Mechanical Engineering Design, 2005. Vol. 8. p. 6 - 13.
- [7] F. Reichl, J. Jerlich, E. Obermüller, I.R. Herbst: Applying Active Online-Tutoring to Motivate Online Learners in a Work Based Environment. M3 - Interdisciplinary Aspects on Digital Media & Education, 2nd Symposium of the WG HCI&UE of the Austrian Computer Society, Vienna, Austria, 2006
- [8] Umweltpraxis.de, [www.umweltpraxis.de](http://www.umweltpraxis.de), retrieved 10<sup>th</sup> April 2005
- [9] VDI Guideline 3780, "Begriffe und Grundlagen der Technikbewertung", VDI Report Nr.15, 1993.

## **Curriculum Vitae (CV)**

### ***Jutta Jerlich***

Jutta Jerlich is an economist with a university degree in international trade from the Vienna University of Business and Economics. Her expertise is technology marketing. She attended Technology in Education courses at the University of California in Sunnyvale. She has been working in the area of business development, international marketing and distribution for more than ten year. As a business consultant she gained extensive experiences in the implementation of knowledge management systems. She is working in the function of a project consultant and coach and teaches as an online tutor at the Vienna University of Technology.

### ***Hesamedin Ostad Ahmad Ghorabi***

has studied mechanical engineering at the Vienna University of Technology (VUT) where he graduated in 2005. Since 2002 he works in the Ecodesign research group of the Institute for Engineering Design of VUT. His main reserach activities are the development of methods and strategies for the implementation of Ecodesign into early decisive design stages in industry. On this behalf he has written many papers and journal articles and was invited to different universities and conferences to give talks and lectures, such as at the Michigan Tech University or the ETH in Zurich.

### ***Franz Reichl***

Dr. Franz Reichl is director of the E-Learning Centre of Vienna University of Technology. From 1993 to 2003, he has been director of the University Extension Centre of Vienna University of Technology. He has been co-ordinator and representative of Vienna University of Technology several European Projects on e-learning, distance education and continuing education, and he has published many papers about the application of distance learning and e-learning at international conferences.