EFFECTIVE ECODESIGN: FINDING A WAY FORWARD FOR INDUSTRY

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ABSTRACT

This paper states the findings and highlights the questions which have arisen from the initial stages of a collaborative research project in ecodesign, between Cranfield University and Electrolux UK. It discusses the initial findings arising from combining a critical analysis of the literature in this area with observations of industrial practice at Electrolux UK. It concludes that ecodesign at industrial design stages has under-utilised business potential. Future research should attempt to determine how ecodesign can be incorporated into industrial design and be managed through a structured process, such as the Integrated Product Development Process at Electrolux.

INTRODUCTION

Ecodesign is a key element in the journey towards sustainable development, having the potential to reduce the environmental impact of products and open up real opportunities for industry to make progressive steps beyond compliance. Several authors have spent time giving clarity to this generic definition. Dewberry and Goggin [1] describe ecodesign as: an approach to design where all the environmental impacts of a product are considered over the life of the product. Graedel and Allenby [2] define it as a practice by which environmental considerations are integrated into product and process engineering design procedures. Ultimately ecodesign can be seen as an industrial activity, which involves integrating environmental considerations into the design process, while maintaining price, performance and quality standards.

The aim of the first stage of this research was to provide background information with respect to improving the environmental performance of (mass produced) electronic/domestic products by looking at the current focus of ecodesign in academia and industry. This was achieved by carrying out a literature review into the subject area and by undertaking empirical research at Electrolux UK.

METHODOLOGY

The Literature Review

The literature review aimed to identify the current position of 'state-of-the-art' thinking in ecodesign, by investigating the subject area with respect to the following aims:

- To determine what ecodesign issues are currently being researched.
- To consider how ecodesign is being taken on board by the most proactive companies.
- To determine the direction of current ecodesign thinking.
- To look at the current and potential roles for industrial design and design engineering in ecodesign.
- To determine any interesting and important gaps in ecodesign research and practice, regarding the anticipated progress of design and industry for the next decade.

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Information was drawn from industrial case studies and academic research, concentrating specifically on the product design industry.

Empirical research with Electrolux Industrial design department.

All designers at Electrolux work through the Integrated Product Development Process [IPDP], a methodology for managing product development. Through this process, Electrolux focuses on three 'types' of industrial design, *Primary Design*, *Core Design* and *Continuous Improvement*. The latter two feed into design engineering, where specific elements of the design are looked at in further detail by small teams of specialised engineers.

Primary Design	Innovation driven – looking towards the future
Core Design	Present day projects – continuation of families of products
Continuous Improvement	Improving parts of products

Figure 1 Summary of the 3 'types' of Industrial Design undertaken at Electrolux [3]

The work with Electrolux UK combined document analysis, observation, discussion and survey work. The aim was to assess, in a non-critical way, the current level of ecodesign knowledge within the company and observe how this knowledge was applied.

The primary stages involved analysing all internal, environmental documentation, to determine the quantity and quality of knowledge held within the company. From this, the appropriateness of this information for industrial designers and design engineers was determined.

The empirical research involved semi-structured interviews with managers, designers, project engineers (design engineers) and the home economist, as well as observations and a survey to identify ecodesign knowledge.

FINDINGS

The position of ecodesign within industry

Findings from the literature review support the idea that it is widely recognised that industries should reduce the environmental impact of their activities. It is also confirmed that it is still only the most proactive companies, which are moving beyond legislation compliance, being proactive in shaping future markets, recognising consumer needs and influencing legislative developments. These companies see the environment as an opportunity rather than a threat, recognise that 'prevention is better than cure' and are attempting to 'design out' rather than simply manage the problems. Through working with research institutions and through far-sighted thinking they are realising that ecodesign *is* compatible with business and has the potential to bring commercial benefits, and help maintain their position as market leader. The Royal Melbourne Institute of Technology (RMIT), a leading research institute dealing with environmental issues summarises that,

> *Any business that strives to remain competitive, open to new markets and new opportunities, [must]… recognise the challenges– and the opportunities – of global demands for environmental quality…* [4]

It is this shift in attitude by industries from "Reactive to Receptive to Constructive"[5], which has lead to the creation of ecodesign. The most forward thinking companies believe that the implementation of ecodesign practice into businesses can create new business opportunities, through new and innovative approaches to problems, and help develop a competitive edge for the company, as well as keeping the company ahead of imposing legislation.

Ecodesign provides reward through commitment

An important point arising from the research, was that it should be recognised that the level of commitment a company gives to ecodesign is intrinsically linked with the level of benefit achieved. Figure 2, shows a strategy grid, which illustrates how moving beyond compliance and minor modifications, towards innovation can not only lead to cost reductions and savings but will ultimately add integral value to the product/company. This is highlighted by comparing reactive 'pollution prevention', which reduces costs, with 'product concept innovation' which requires greater effort, but not only reaps cost benefits, but may lead to improved company perception and the flourishing of innovative and creative thinking stimulated by solving problems in new ways.

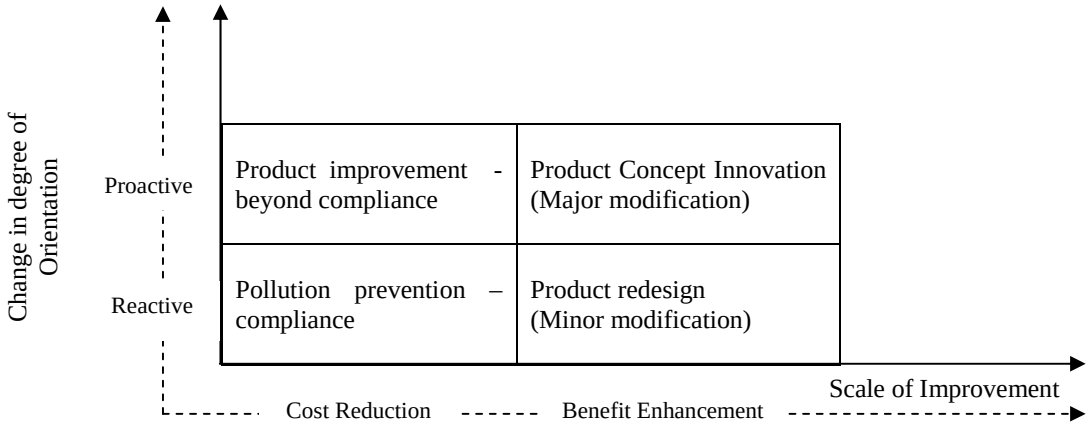
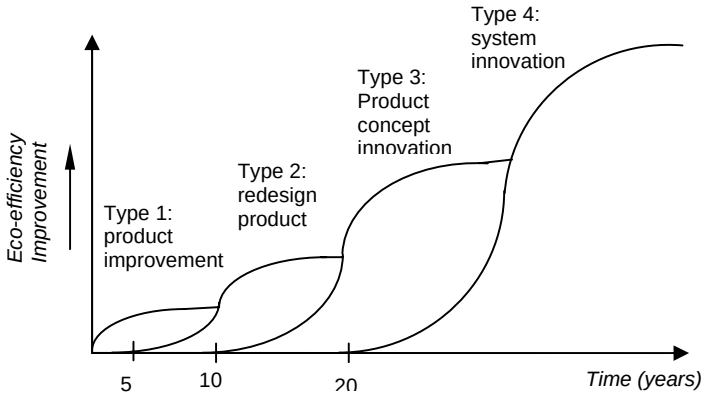


Figure 2 Environmental Strategic Postures [6]

Four levels of ecodesign

It has recently been agreed that there are four different levels of ecodesign. Figure 3 [7], illustrates Brezet's model, developed at the Rathenau Institute, which clearly illustrates the different levels of ecodesign. It shows that in order to move towards sustainability, by achieving significant resource and energy reductions and generating the required levels of eco-efficiency (commercial benefit resulting from ecodesign considerations [8]), design must move through the different levels of ecodesign, from 'product improvement' to 'systems innovation'. It is understood that as the level of eco-efficiency improves so does the scale of the project and the level of design involvement. Through the implementation of ecodesign, industry has the potential to progress along the x-axis in the direction of sustainable production and consumption.

To achieve greater levels of eco-efficiency businesses must encourage their designers to move beyond incremental improvements (types 1 and 2) and make radical leaps in innovation, to allow them to advance to types 3 and 4 on the ecodesign model.



- **Product improvement**. The improvement of existing products with regards to pollution prevention and environmental care. – Products are made compliant.
- **Product redesign**. The product concept stays the same, "but parts of the product are developed further or replaced by others." Typical aims being: "increased reuse of spare parts and raw materials, or minimizing the energy use at several stages in the product life cycle."
- **Product concept innovation**. This involves changing the way in which the function is fulfilled. Examples include, a move from "paper-based information exchange to E-mail, or from private cars to "call-a-car" systems"
- "**System innovation**, in which new products and services arise, requiring changes in the related infrastructure and organisations. A changeover in agriculture to industry-based food production, or changes in organisation, transportation and labour based on information technology, belong to this type of innovation."

Figure 3 Four Types of Ecodesign Innovation – The Ecodesign Model [7]

Current focus of ecodesign

It is observed that whilst many companies remain at the 'product improvement' level, a handful of companies and research organisations, are looking at the potential to be had from investing in 'systems innovation', (the move from products to services [9-11]). However, the implementation of 'redesign methods' is at present the most popular approach to ecodesign, indicating that the majority of companies are still addressing ecodesign in a limited way. Although it is recognised that the process of concurrent engineering means that there are areas of overlap between industrial design and design engineering, it appears that 'redesign methods' are generally the remit of design engineers, rather than industrial designers, as they tend to involve, minor alterations to materials or fastenings. So to clarify this point, it could be said that 'redesign methods' are more beneficial to design engineers, and constitute a fairly minor area within industrial design.

Through the research it was clear to see where there was potential for design engineers to play a major part in reducing the environmental impact of the products that they produce. Some of these areas are listed below:

- Design for efficiency and Resource conservation
- Design for disassembly (coupled with assembly techniques and servicing considerations)
- Closing the loop (design for recycling and reuse)
- Materials selection and use
- Design for appropriate durability

By comparison, it was clear to see that there are very few documented examples of projects where industrial designers have played a valid role in ecodesign projects. Company literature tended to be focused towards the needs of design engineering, and there was a lack of information stating how industrial designers might go about incorporating ecodesign principles into regular design practice. This is not just specific to Electrolux, but typical across the industry as a whole.

In recognising that there is currently very little attention being paid to determine potential ways for industrial design to contribute to ecodesign, a gap in the research in this area has been identified. This finding suggests there is a need to ask the following questions:

- 'Why isn't the potential for industrial design to play a role in the implementation of ecodesign, being researched?'
- 'Is there a role for industrial design in ecodesign?'

Why isn't the potential for industrial design to play a role in the implementation of ecodesign, being researched?

This situation may have occurred due to the fact that a great deal ecodesign research has been focussing on looking for the perfect technological fix. With the majority of companies achieving a maximum of types 1 and 2 in ecodesign, there has been a preoccupation with developing analytical methods and systems (Life cycle analysis, environmental impact assessments etc.) in an attempt to try and quantify/understand the subject area in a manageable way [12]. It has been this way of thinking that has directed development away from the progressive ecodesign model illustrated in Figure 3 and, it could be argued has created a situation whereby,

> *"Ecodesign is presently… owned by the engineering departments within companies, the territory of scientists, technologists and engineers, rather than product design or marketing."* [12]

However, it has already been seen through this paper, that the focus needs to move beyond technical issues and take a more holistic approach, if the greatest benefits are to be reaped.

Is there a role for industrial design in ecodesign?

The answer to this question appears to be a resounding 'Yes'. This section will highlight the main findings which indicate that industrial design is the most obvious discipline to implement ecodesign.

- It has been recognised that ecodesign should be an integrated part of the product development process. To be most effective it is important that it should be introduced at the earliest possible stage, when the design is most flexible. This is because, it is an established fact that approximately 80% of a product's design (and hence cost) is fixed during the initial development stages, considerably limiting any subsequent changes which can be made. As industrial designers have a great influence over every aspect of a design during this early, very flexible stage of the development process they have an excellent opportunity to incorporate ecodesign principles. They must be educated to recognise appropriate environmental considerations and learn how to deal with them accordingly.
- Brezet [7] recognises that a greater level of design involvement is required, if companies are to move through the ecodesign model and achieve both business and environmental benefits. In addition to this it is understood that the greatest levels of improvement/ reward can only be achieved by moving beyond incremental improvements (now recognised to be the realm of the design engineer), towards, 'product concept innovation'. It is the author's belief that 'product concept innovation', which aims for radical rather than incremental leaps in innovation, provides the niche for industrial designers.

"Designers are in a unique position to effect change. They are responsible for specifying the majority of resources used to produce goods. More significant however, designers make the link between products and people. They can change the way people use and respond to these goods or services." [1]

It is recognised that innovation and creativity are the key tools to achieving significant breakthroughs and radical product changes, and it should be acknowledged that these tools belong in the toolbox of Industrial Design, so making them the obvious candidates to deal with ecodesign.

EVALUATION

It has been shown that there are very few product examples where industrial designers have taken part in the implementation of ecodesign. We know that no one appears to be looking at methods to help industrial designers. It has been identified that it is a difficult area to tackle.

In conclusion to the research so far, it appears that there is no existing information/research being carried out to determine how industrial designers can make a valid contribution in the field of ecodesign. This highlights a very important and interesting area, which should be researched into. Research of this nature would raise the question of, 'what part can industrial design potentially play in the implementation of ecodesign'?

CONCLUSIONS

With regards to improving electronic/domestic products, it appears that by not using the skills of industrial designers as a complimentary strategy to the 'redesign methods' of design engineering, businesses are missing much of the commercial potential to be gained from ecodesign. This is happening because the correct 'tools' and 'processes' to achieve this have not yet been recognised and developed. It is important that work is carried out to determine how to tap the creativity and innovation of industrial designers so that they are included in the business plan.

The next stage of this collaborative project with Electrolux UK will concentrate on working with the designers to determine how ecodesign can be successfully integrated into industrial design, through the structured Integrated Product Development Process, which Electrolux uses. It is proposed that this will involve running and assessing a series of workshops with the three 'strands' of industrial design; Primary, Core and Continuous Improvement. This will help determine how the different ecodesign requirements change at each level of innovation, and aim to consider what type of consumer benefits can come out of the different levels of ecodesign.

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