Ecodesign methodology development within the Indian European Ecodesign Program

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Ecodesign Methodology Development within the Indian European Ecodesign Program

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Abstract

During the last decade Ecodesign has been tested and implemented successfully in West and Northern Europe, Japan and parts of the United States. However, in many parts of the world, particularly in the newly industrializing countries in Asia, Latin and South America and Africa, experiences with Ecodesign are scarce

The Indian European Ecodesign Program (IEEP) is a three-year collaborative project that aims at the promotion of Ecodesign, exchange and development of Ecodesign knowledge, methodology and expertise in India involving people from scientific and business backgrounds. This paper will discuss our experiences of introducing the Ecodesign concept and Ecodesign methodologies within the Indian context.

1. Introduction

1.1. Need for Ecodesign in India

In the manufacturing sector the big companies are separated from the SMEs if their general environmental track record is considered. A significant number of companies, though not nearly enough if a single pointer like the quality of water in the rivers and ground water is considered, comply with some legal norm or another. Product manufacturing companies are slow to accept the need for environmental management systems, but the visibility of the ISO14000 certification is a draw and the number of certified companies seems to be growing. The general awareness about ecodesign is low, even in the environmental sections of these companies. This is matched by the fact that except for the IIT Delhi, where the subject figures as an elective, the other design institutes do not offer courses dealing with the environment.

1.2. The IEEP Project

In this context the Indian European Ecodesign Programme is visualized to act as the change agent to generate consensus on the need for good environmental performance in all sectors of society and industry, and to make available the necessary mechanisms to aid in the change process. The Indian European Ecodesign Programme (IEEP) is a three-year collaborative project partly funded by the European Commission under the EU-India Cross Cultural Programme. The Indian Institute of Technology Delhi (IITD), the Delft University of Technology (DUT), Netherlands and INETI, Portugal, are the Network partners. The programme, which started in 1999 aims at the development of Ecodesign capability, through the exchange and development of Ecodesign knowledge and expertise and by forming a strong network among design professionals, academia and industry. To make this introduction of Ecodesign successful in Delhi, the strategy of the project is to train 50 industrial designers and make aware 50 companies and put them together to start the critical mass of demo projects. This is being done through workshops, pilot demo projects with companies and academic exchange.

2. Ecodesign methodology development

During the three-year program continuously attention is being paid on the development of an appropriate Ecodesign methodology for the Indian context. At the start of the IEEP program representatives from India, Portugal and the Netherlands presented and exchanged their own Ecodesign experiences, methodologies and business examples to each other. Based upon the original Ecodesign methodologies from the European partners (DUT & INETI) like the Ecodesign Strategy Wheel (ESW), Material-Energy-Toxic (MET) matrix and the Ecodesign checklist method a new more customized

Ecodesign methodology for the Indian context is under development. During the development of the Indian Ecodesign methodology differences in product development processes, other Ecodesign drives, Indian company cultures and societal context have been taken into account.

In this paper we would like to discuss our experiences of applying and adjusting Ecodesign tools for different purposes:

1. Industry demonstration projects;
2. Awareness creation workshops;
3. and Educational courses for Industrial Designers.

2.1 Ecodesign Toolbox

At the beginning of the project a virtual toolbox was created consisting of Ecodesign tools developed by the European partners, DUT and INETI. All the project members were trained in applying the Ecodesign tools to enable them to support the activities of the IEEP program. The main Ecodesign tools in the virtual toolbox are:

- MET-Matrix
- Ecodesign Strategy Wheel (ESW)
- Ecodesign checklists
- Ecodesign benchmarking
- Life Cycle Assessment (LCA)
- Life Cycle Costing (LCC)
- Ecodesign feasibility matrix
- Back-casting
- Disassembly sessions

Besides, the toolbox also consisted of ordinary design tools like brainstorming and consumer research. First we will shortly describe the most often applied Ecodesign tools and thereafter our experiences with them in the Indian practice.

2.2. MET Matrix

The MET (Materials, Energy and Toxic emissions) matrix is a simple qualitative method of assessing and prioritizing environmental impacts of products and processes during the total lifecycle (see figure 1). Teams with members from different background and profession discuss together the causes of environmental impact by the production use and disposal of a product system and put these results in a simple 4*4 matrix. As a next step the team prioritizes the processes with the most serious environmental damage.

MET Matrix	Material cycle (input/output)	Energy use (input/output)	Toxic emissions (output)
Suppliers			
Production			
Distribution			
Use			
Disposal			

Figure 1. MET-Matrix

2.3. The Ecodesign Strategy Wheel.

The Ecodesign Strategy Wheel (ESW), as developed by DUT, distinguishes 33 Ecodesign principles (clustered in 8 Ecodesign strategies), possible ways to improve the environmental profile of a product system taking all the stages of its life cycle into consideration (see figure 2). First of all it provides an overview of possible Ecodesign objectives, secondly the wheel can be used as an Ecodesign oriented creativity technique for generating ideas in various product development processes to help systematically conceive options for improvement. Thirdly both the company's managers and the development team can use the wheel as a tool to visualize a product's current, desired and achieved environmental profile. The size of the area covered by the lines drawn in the wheel indicates the importance of Ecodesign according to the design team.

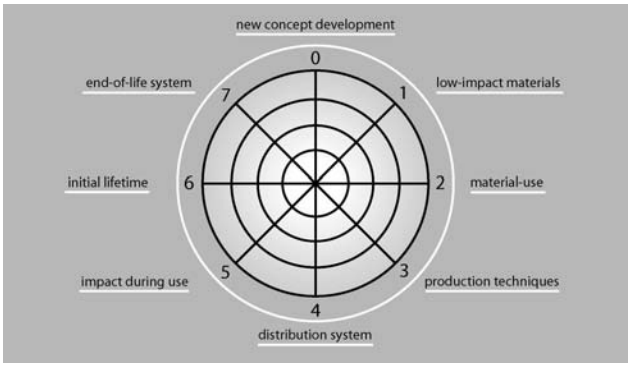

Figure 2. The Ecodesign Strategy Wheel (ESW)

2.4. Eco-Design checklist

<u>For this part I still need information from INETI</u>

The Eco-Design Checklist, developed by INETI in collaboration with research partners in Germany, and the Netherlands, is another tool to identify weaknesses in an existing product or facilitate the development of new products.

A catalog of criteria for design and evaluation of environmentally sound products was put together. The

overall context of environmental and disposal problems during the whole life cycle of a product from design to the use of recycled substances and waste disposal is treated. An environmentally desirable product design, based on a careful treatment of resources and the prevention of waste and harmful substances and allowing closed cycles for as many substances as possible has the highest priority. Requirements for establishing closed cycles or the minimising of certain harmful substances are formulated for product design. In order to make environmental product design operational, the catalog**ue** is development as a criteria checklist. An ABC-scheme is integrated in the checklist, enabling designers to quickly reveal weak spots.

1. Achieving Environmental Efficiency / Optimal Function
2. Saving Resources
3. Use of Renewable and Sufficiently Available Resources
4. Increasing Product Durability
5. Design for Product Reuse
6. Design for Material Recycling
7. Design for Disassembly
8. Minimizing Harmful Substances
9. Cleaner and Safer Production and Mining
10. Environmental Impact of Product during Use
11. Environmentally Sound Disposal of Non-Recyclable materials
12. Optimising packaging System
13. Implementing Environmentally Friendly Logistics

Figure 3. Ecodesign checklist principles:

2.5. Life Cycle Assessment and Eco-Indicators

Besides the use of qualitative Ecodesign tools like the ESW and the MET-matrix, also a first attempt has been made to apply more quantitative Ecodesign tools like Life Cycle Assessment (LCA) and simplified quantitative tools like the Eco Indicator 99 standard lists within the Indian context. For executing a LCA there are two main steps:

1. Describe which emissions will occur and which raw materials are used during the life of a product. This is usually referred to as the inventory step.
2. Assess what the impacts of these emissions and raw material depletions are. This is referred to as the impact assessment step.

At the moment there are not (yet) extensive databases available with data of the emissions of local (production) processes (necessary for step 1), neither is there an Indian or Asian impact assessment method (necessary for step2). To overcome this problem it was decided to use European databases and the Eco Indicator 99 as impact assessment method.

Within the project the LCA software tool Simapro has been applied to execute the LCA activities. Besides a list with the predefined Eco-Indicator 99 scores of 200 commonly used materials and processes has been downloaded from the web site of PRE consultants in the Netherlands.

2.5 Other tools

Next to the MET-Matrix, Ecodesign Strategy Wheel and the Ecodesign Checklist several other Ecodesign tools have been incorporated in the toolkit like environmental benchmarking and disassembly sessions. Within an Environmental Benchmark a company products is compared to its competitor's products on five focal area's: Energy, Material application, Packaging and Transport, Chemical Content and recyclability. In order to learn form competitors environmental activities and to see how the company's product scores compared to competitors. Often also short do-it-yourself disassembly sessions are organized for the participant groups to analyse the composition of a product, its function, connections applied and its recyclabilty.

3. Application of Ecodesign tools

The above mentioned Ecodesign Toolkit has been applied within the activities of the Indian European Ecodesign Program. In the following paragraphs some of our first experiences are presented and evaluated.

3.1. Project in Industry

The objective of the demonstration projects is to show industry, the design profession and the stakeholders involved that Ecodesign can produce results that provide benefits in economics, ecology and societal well being.

The development of Ecodesign projects in Industries is one of the most effective ways to detect the real need for the development and use of an Ecodesign toolbox. Several demonstration projects have been effectuated since the beginning of the IEEP program, giving excellent results in the big final objective - create conditions to the companies to develop effective Sustainable products, having in consideration that the major focus of any Industry is the economical factor.

Both of the concepts Ecological and Economical were the base of the brief in one of the demonstration projects occurred recently executed in the city of Pune, India, in Electronic company

The methodology used on this project was based on a common product design methodology but with the integration of the Sustainable factor – supported with the use of Ecodesign toolbox.

The following map shows the application of the Ecodesign tools during the stages of the product development process.

Eco Design strategy map and eco Design tools for use in an Indian based electronic company.

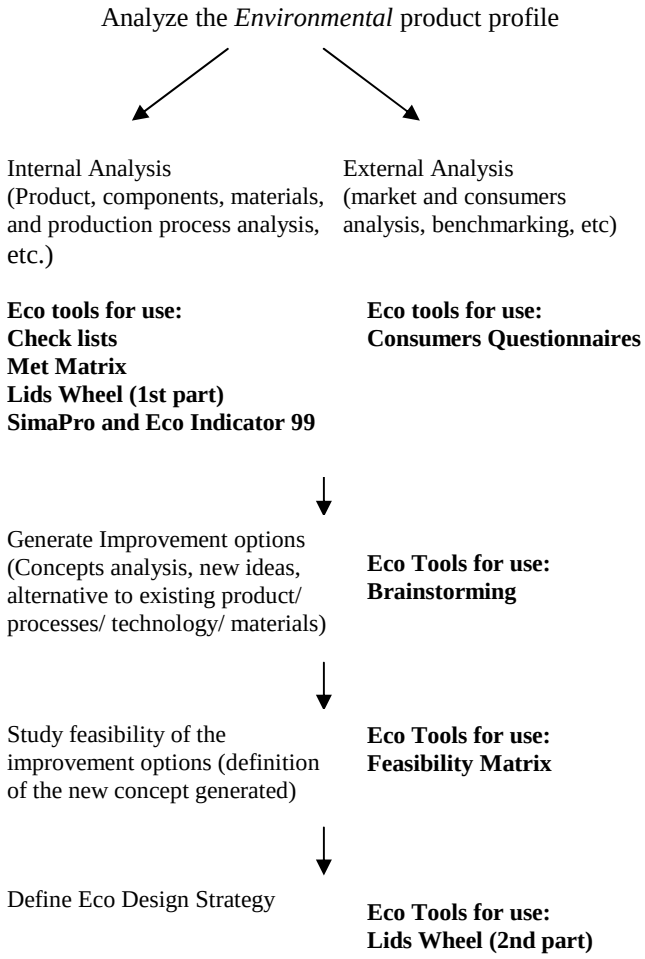

Figure 4.

As we see the integration of the Eco tools in the methodology was made before the Project details, this means until the definition of the Design Strategy.

In each step of the map, an Eco tool was integrated to have an Eco evaluation in all phases of the development of the product. This tools helps the designer to have a good understanding of the main problems the product causes during its total life cycle what is essential to Eco Design.

In this project to obtain the better results Eco Tools were used in conjunction with each other, that is serious recommended. Here a brief analysis of its use:

With the **Check Lists** and based on its 13th principles it was possible to realize the main urgent situation in order to act. General concepts for the product eco improvement were founded, concepts like the urgent need for the use of renewable resources, the urgent need of the reduction of material variety, the urgent need of attention for select the transports mode, etc.

With **MET Matrix** it was possible to detect the most toxic materials and substances in order to eliminated or substitute them, also realize the type of energy use and resources.

SimaPro and **Eco Indicator**, an more technical LCA analysis, supported by Eco Indicator 99, considering the life cycle stages of a product, like pre-production, energy, end of life, etc.

The tools exercise is also a motive to join all development product group, creating the ideal conditions for the creation and consolidation of new Eco ideas. This process can always be completed with a always used **Brainstorming –** a space open to discuss other possible ideas.

The **Questionnaires** are a tool use in any Product Design methodology and it can contribute a lot to understand what consumers expect from the product, here, we specially focus, in what consumers expect from the environmental profile of a product.

The use of **Feasibility matrix**, gave a quickly over view of what could be the evaluation of the new ideas focusing Technical feasibility, financial feasibility, market opportunities, expected environmental profit and action plan by qualitative evaluation.

Finally**, Lids Wheel**, the most graphic tool, helped the team to make an synthesis of "the state of the product" (1st step) following its 8 main strategy (see fig. 2), that it helps the Product development group to find directions for the new product. Here you can concentrate in each strategy and propose new scenarios for the Product Eco Improvement, in short, medium and long term (2nd step), this is also based in brainstorming ideas evaluation and the analysis of feasibility Matrix, when Lids Wheel is finalized the eco design strategy is defined.

The Tools for this project represented an Indispensable technical support where easily it was possible to "seat" together with designers, engineering's, marketers, managements and also consumers - all product development professionals- make an effective reflection about the Eco problems of a product and find ways to elaborate strategies and practical solutions for the company and its products.

3.2. Workshop with SME's:

The IEEP project visualizes five workshops each addressing a specific target group: Industrial Designers, NGOs and the allied sectors, SMEs, Mass Industry, and academia. The third Ecodesign workshop titled "Ecodesign with SMEs" was conducted in collaboration with the Punjab, Haryana and Delhi (PHD) Chamber of Commerce and Industry and primarily focused on serving the environmental needs of the SMEs. The workshop aimed at providing an exposure to SME participants for whom Ecodesign could translate into cost reduction and savings through product improvement and product redesign. It is imagined that after this initial start up workshop the Chambers would take the initiative to make this a periodic training module for their members. In turn the members are expected to initiate Ecodesign projects in their companies by networking with industrial design consultants trained in Ecodesign.

The first day of the workshop the participants were exposed to the Ecodesign tools and techniques in theoretical way to raise Ecodesign awareness and understanding of the tools. The exercises on the second day allowed small groups of participants the opportunity to see the tools being applied on products like a telephone, air-heater and kettle to get real practical experience.

Each group was built up by representatives of different industries and was facilitated by one of the IEEP Ecodesign experts. Goal of the exercises was to analyze the environmental impact of the product life cycle and to generate improvement options within half a day. For the exercises locally produced and used electronic products were selected to make the experiences of relevance for the daily work of the participants. As a first step the groups disassembled the products and discussed the function of the components and the product itself. As next step the groups analyzed the environmental impact and created improvement options by using either a combination of the MET-matrix and the Ecodesign Strategy wheel or only the Ecodesign checklist.

Since economical aspects are of high importance for SMEs it was decided to add a “Cost column” to the MET-matrix in order to cover not only the environmental aspects along the lifecycle of the product but also the life cycle costs (LCC) (See figure 4).

After half a day of exercises the environmental analyses and proposals for redesign were presented. The Ecodesign checklist method needed more time to come to results compared to the MET-matrix & ESW combination. One of the groups did have problems to prioritize the environmental problems within the MET-Matrix. Even how, both methods have shown to be able to come to useful results within only half day with participants that are new to the subject. For the participants the lifecycle thinking approach was an eye-opener and the practical hands on exercises were much more appreciated compared to the theoretical lectures on the first day. To have locally produced products as subject and the ability to disassemble them has shown to be an advantage to make the experiences more substantial.

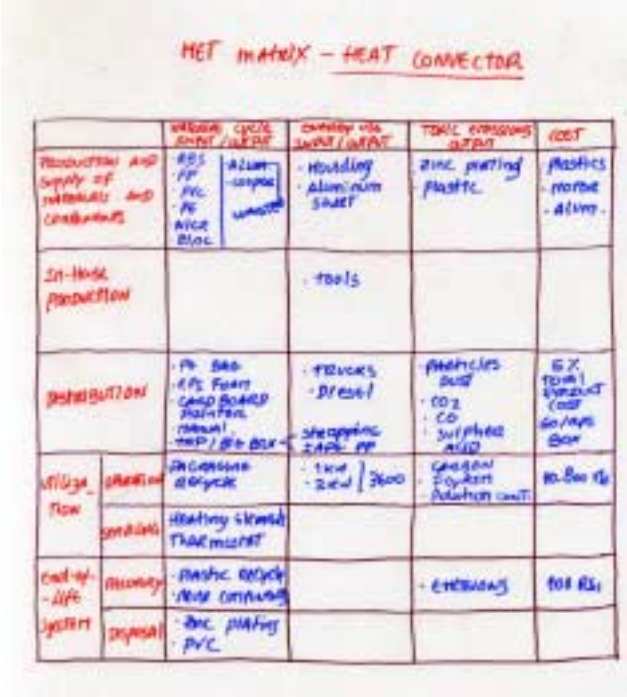

Figure 4. Filled in MET-matrix with added Life Cycle Costs column of the workshop.

3.4. Sustainable product development course at IIT

The project aims to develop a robust curriculum which, functioning for a course or integrated into other learning modules would develop Ecodesign capability in graduate Industrial Designers. An elective course titled Design for Sustainable Development has been offered in the design programme at IITD since 1999. The earlier version of this course emphasized local initiatives, craft and appropriate technology. This change of focus reflects the change that most institutions teaching design would consider in the workshop to be held in March 2002.

3.5. Evaluation

of usefullness of the different tools for the different prurposes

A Customization of the indicators and the databases are necessary to make LCA useful tools.

There is not one and only perfectdesign ol In some case oneis better suitable tha the other. In other case both

together. We will continue to devlop a toolkit containg differentr tools..
Even within a different context, economical, economical, cultural the qualitative European ecodesign tools seem to work effectively/
However the use of more quatitaive tools like LCA simapro not yet possible because of lack of databases and an appropriate local Indicators.

It is generally recognized that the first stage is extremely important. The result of the LCA is heavily dependent on the decisions taken in this phase.

More energy should be put in reaching a bigger audience to iintroduce and implemt the the Ecodesign methodology within Industry and and Design & Engineering education

Quesition is how the use of the tools will continue inside the companies without the support of the expert so f the program.

4. Conclusion

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- Transfer of knowledge