SUSTAINABLE DESIGN IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT CONCEPT

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Abstract: Applying the Sustainable development concept involves a different approach in many areas of human activities. Among these, the design process is fundamentally affected by the changes. The whole process should be reviewed, mainly from the methodological point of view. Better products and more environmentally friendly ones can be obtained if the concept would be properly conceived, in respect to the economic and environmental restrictions. Changing ("greening") the client's needs should be also an opportunity.

1. INTRODUCTION

According to the definition of the concept (The Report of the Brundtland Commission, *Our Common Future*, 1987), Sustainable Development involves three aspects: economic, ecological, and social [1]. The fundamentals of the concept are built on two keywords: necessity and limitation. Human society has to continue its *economic* development because this represents the core of the society model we are living in; also, this is the main goal of the design activity: satisfying the *needs*. A problem occurs when sustainability imposes to limit the production to *necessary* products and to insure the access of the entire population to these products. Consequently, the *social* aspect of the concept is about a more ethical distribution of the welfare. Sustainability, on the other hand, reflects the necessity for more correct and safe way of doing this development. The limitation reflects the necessity for reducing the resources used and avoid waste. This connects the two words – sustainable and development – establishing the subordinating relationship: development is necessary, but not in any conditions, only a sustainable one may be accepted.

The application of this concept imposes fundamental changes in the triad relationship: human, product, and environment. Design, and more specific, ecodesign is involved in this complex process of leading the human society towards defining and implementing of a new model of development, a sustainable one. The objective of this paper is to highlight the relationship between sustainable development and design and the fact that following the goal of sustainable development would lead to a new developing system for the human society.

2. SUSTAINABLE DESIGN

Design and designers are involved in all the three aspects of the sustainable development concept, and especially in the ecological one, because of their position of products makers. Designers can develop the existing products, or can conceive new ones, with improved characteristics, friendlier to the environment (eco-efficient), but also useful and attractive for the customers.

How should be a product for a minimum environmental impact?

The analysis performed for the entire life reveals, among others, the weak spots of the design/product in its relationship with the environment. The evaluation instruments (like LCA, ecological footprint, MIPS, eco-rucksack) highlight the source and give the exact measure of the environmental impact [7]. Having information about the sources of the

impact and the way they are affecting the environment, designers take action for improving the situation. For each step of the life cycle, several suggestions could be formulated, following the five stages of the product life cycle [1]. For the first stage, choice of materials, are formulated lots of suggestions for designers in order to "green" their products [3][4].

After choosing the materials, they enter into a process of transforming them into product components. The designer's goal is to choose less polluting processes, friendlier with the environment, according to the design objectives. The processes that are less polluting are called *Clean Processes*, whilst the loss reducing is part of the *Clean Technologies* concept. What links explicitly Clean Technology to Sustainable Development is the focus on meeting human needs rather than providing material artefacts [5]. The advantage of using cleaner technologies consists not only in using some processes that are less polluting and with less integrated energy. The product itself should be reconceived starting from the very low level of components design: fewer components, simpler shapes involving less machining, reducing the waste and the integrated energy.

As concerns the raw materials and the products transportation and distribution, designers are less directly involved and only in connection with choosing the package materials and the assembling solutions; indirectly, of a significant importance are the product weight, shape, and volume, characteristics that lead also to design.

Sustainable design objectives should include the final stage of the product life cycle, the end-of-life, when the product is out of use (reuse and upgrade are no longer possible). For this stage, there are some options, presented in Fig. 1.

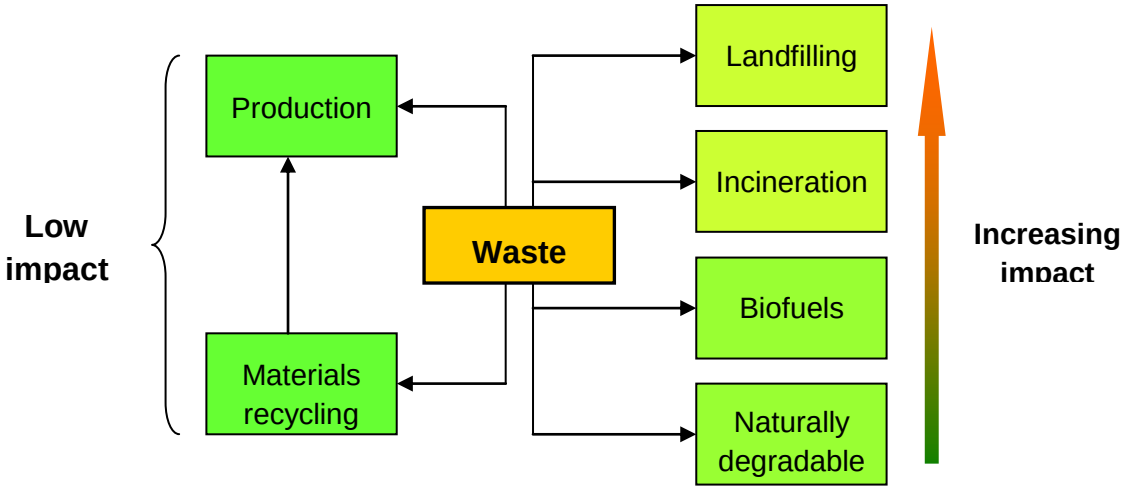

Figure 1. Options for product end-of-life;

As it is not possible to be totally eliminated, the only solution is to reduce waste as much as possible. The "waste" can take different forms: products, parts, packages, or a miscellaneous mass. In Fig. 1 the waste has been "divided" into two main categories: on the left are the options which keep the resources inside the system; as concerning the options on the right side, the materials are lost, requiring new entries into the system (new raw materials). But, can designers create representative and defining products, corresponding to sustainable development principles without giving up the main objective of the design process which is creating products that fulfil the clients' needs?

3. THE DESIGN PROCESS TURNING INTO SUSTAINABLE DESIGN

The extending of the subjects related to pollution reduction and environment protection has reached the area of products designing. The fundamentals of design activity set the designer position in the first line of the battle for fulfilling these objectives. This is

the main reason why among the design constrictions, those connected to the natural environment protection and preservation have been included. When this kind of restrictions become of great importance, the whole design process is orientated towards fulfilling this main goal and, according to a specific objective, one can have Design for Recycling, Design for Environment protection, Design for Assembly and Disassembly, Design for Re-manufacturing, and more recently, in a broader approach, Ecodesign.

Inside the ecodesign process, the design activities should evolve towards anticipating human needs, creating products friendlier to the environment, with improved characteristics, both functionally and aesthetically continuing to educate people and ensuring a better life for them. Therefore, ecodesign does not represent a new process optimised exclusively from this perspective of material and emissions reducing, but should reflect a new and modern approach for creating and building the products we really need.

The environmental impact has a share concordant to each of the five stages, which obviously is different from one product to another and usually has two main components: materials and energy. When speaking about materials, one understands not only the materials from which the product is made of, but also the entire ecological rucksack. Correspondingly, when saying energy, the “material” content is included, i.e. all materials consumed during producing, transporting, and storing the energy, besides coal, natural gas, oil, wood, and biomass. Therefore, the total environmental impact of a product should be calculated as the sum of both material and energetic impacts for each stage of the life cycle.

It is possible that the environmental impact to be partly caused by improper or irrational product exploitation. Some of the causes for this situation are also a problem of designers for it is possible the product misuse to happen because of unclear/complicated design, unclear or missing specifications, functions ambiguity, design errors (like improper materials), bad maintaining and so on. Also, it is possible that designers to have lacks in estimating and presuming the outside disturbing factors [2] during use, like wet or dry environment, shocks, vibrations, high or low temperature, sunlight etc.

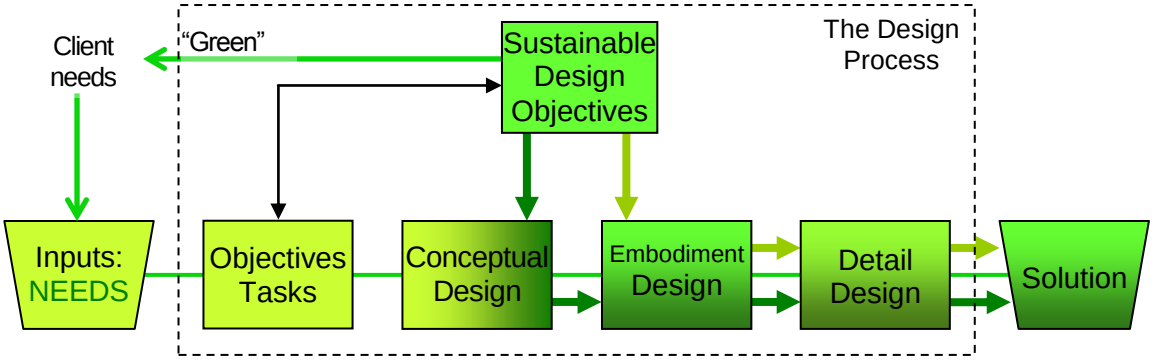

Figure 2. Implementing the Ecodesign objectives;

Ecodesign methodology is based on estimating the environmental damages determined by the product during all the stages of its life cycle, evaluation named Life Cycle Assessment (LCA) [7]. When speaking about damages, one should understand all unscheduled outputs, both material and energetic, either solid, liquid or gaseous. Designers’ job is to anticipate the environmental impact and find the most suitable solutions in order to reduce it without compromising the other qualities like functionality, safety, ergonomics, costs, reliability etc.

Based on previous assertions one conclusion might be that ecodesign represents a new approach for the classic design, both in psychological, systematic and organisational

respects. In other words, the product conceiving and the solutions optimisation should be reconsidered and reoriented in the context of the profound evaluation of the entire life cycle. Also, ecodesign should reconsider the psychological and educational impacts of product itself and of product using upon people.

Thus, a better option to improve the design process from the environmental point of view is to adapt the methodology used into the conceptual design stage (Fig. 2). This is a more profound solution because if the concept has been created with an "environmental thinking" it would be easier to materialise it in the embodiment design stage. The principle of solution resulting from the conceptual design stage will reflect the designer's efforts to create an environmentally friendlier product. New conceptual variants may be created, including solutions capable to fulfil the ecodesign objectives in respect to the other design restrictions, like safety, ergonomics, reliability, costs etc. The picture reflects the classic design situation, when the objectives were implemented in the embodiment design stage. An improved solution is to "think green" and create a environmentally friendlier concept, but the real power of design reside in changing the clients, making them to need and request such "eco-products".

4. CONCLUSIONS

Applying the sustainable development concept will result in many changes for our society. The sector that is mostly affected by these changes is the product design. The surest way of reducing the product environmental impact is to design them properly. This will lead to a reduction in using the raw materials and also of the waste. It will result in better and optimal processes, with less emissions and less energy and material involved.

The industrial design is involved in this process because designers have this position of creators of the objects of every day use. Adapting the design objectives to the sustainable development ones the transition can be done gradually through the objectives and solutions the ecodesign is proposing. One first step can be done in the direction of waste reduction by creating durable products, long lasting ones. A better option could be to avoid designing un-useful products [6]. This will reduce the resources consuming and save us from the "garbage" on the supermarket shelves. The best solution is to change the clients and make them wish the sustainable products.

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