ECODESIGN, A NEW PERSPECTIVE IN PRODUCT DEVELOPMENT

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REZUMAT. Lucrarea prezintă aspecte legate definirea unor noţiuni ca ecodesign, dezvoltarea durabilă, ciclul de viaţă al unui produs, precum şi elementele legislative care impun modificarea atitudinii inginerului în dezvoltarea produselor, astfel încât acestea să fie mai prietenoase cu mediul. Sunt prezentate, de asemenea, etapele ciclului de viaţă al produselor şi impactul posibil al fiecăreia asupra mediului.

Cuvinte cheie: ecodesign, ciclu de viaţă al unui produs, dezvoltare durabilă.

ABSTRACT. The paper presents aspects concerning the definitions of some notions as ecodesign, sustainable development, product life cycle, and the legislative pieces which impose the engineer's change of attitude in product development, in order to obtain products more environmental friendly. The product life cycle stages and its potential environmental impact are presented

Keywords: ecodesign, product life cycle, sustainable development.

1. INTRODUCTION IN ECODESIGN

The European Environment Agency (2006) defines ecodesign as *"the integration of environmental aspects into the product development process, by balancing ecological and economic requirements. Ecodesign considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life-cycle"*.

The history of industrial design is not very long. However, designers existed and created useful and good-looking artefacts long before the word "design" has been invented. A different approach permits us to see that innovation, functionality and delight were not features of industrial products, but are treasured in different ways and places on Earth: from the Inuit's igloo to a robotized assembly line in Japan, from the fishing village in Papua New Guinea to the technologically high-risk environment of the International Space Station. All these speak to us about the fact that designer is "universally" accepted as an essential contributor to the society.

The design process deals with the products development – machines, tools, appliances and other objects – and therefore has a direct and profound influence on the environment. We use every day various objects and these objects are created (conceived and produced) by some people in order to fulfill other people needs. Inevitably, the process of building or making products involves the use of natural resources. Until a certain moment, the demands were not so big and the system's (the Earth) capacities insured a situation of balance between what humans took from the environment and what nature could restore. In present, the demands overwhelm the self-sustainable capacities of the system (see Figure 1).

2. ECODESIGN HISTORICAL ISSUES

In the early 70s people were interested into a relatively new science. Ecology, or the home science (from the Greek words *oikos = home/house hold* and *logos = study/science*) studies the relationships between living organisms and their environment.

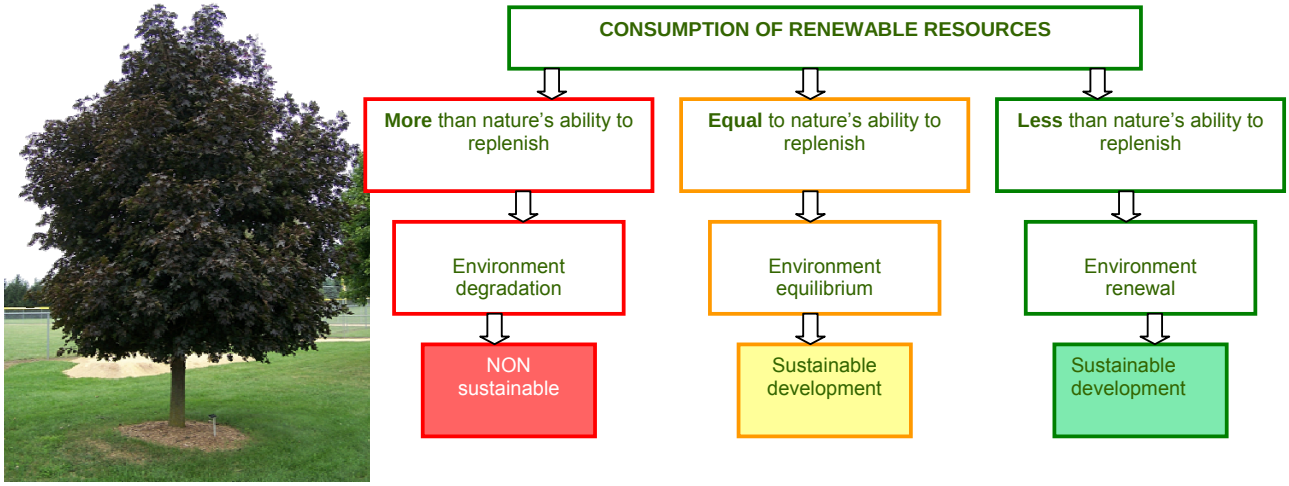

Fig. 1. The human choice in development strategies.

The first move into this domain was made in recycling. The recycling appeared as a necessity because the amount of waste was increasing (generally in developed countries and especially in the large cities) and its weight developed towards materials susceptible to be reused. Materials like steel and plastics used on large scale in products or packages started to represent also a serious problem as regarding the raw materials shortage. *The quantity, the "quality" and the costs of waste became a problem to think about it*. Therefore, appeared the idea of collecting materials from the out-of-use products and re-introduce them into the production process as raw materials. The recycling solution was also caused by the increase of raw materials prices especially after the oil crisis in the early 70s.

It appeared that many materials, such as ferrous and non-ferrous metals – steel, aluminum, copper, bras, lead etc. –, glass, paper, cardboard, artificial and natural fibers – cotton – and so on, can be collected and reprocessed into new products. This process was encouraged by some advantages: the price of the recycled materials was lower than the natural ones as long as their quality is in many cases the same. For example, the recycled aluminum from cans is far less damaging for the environment than obtaining it from bauxite. Its production consumes 5% of the energy and the recycling process is much less polluting than processing the virgin material. In the mid 80s, the problems related to environment became more acute. The case of the ozone layer, for example is well known. Then it has been found that **recycling is not similar with environmentally friendly.** Of course, recycling is good but not enough. Therefore, activities began to focus on:

- environmentally selection of materials;
- careful use of natural resources;
- environmentally friendly products and production methods;
- harmful (for human and environment) emissions and diffusions caused by production processes and their environmental impact.

Therefore, in the early 90s, the concepts of sustainability and sustainable development became of a great interest. Sustainable development is about designing objects that use limited resources; it is also about social responsibility and ethics. According to the **United Nation's Brundtland Commission**, sustainable development is *"development that meets the needs of the present without compromising the ability of future generations to meet their needs"*. This definition of sustainable development contains two key concepts: The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Related to sustainable development, it was considered the necessity to evaluate the product and the product effects/impacts over a longer period in time. This period expands from the early stage of raw materials extraction continuing with the production, distribution, use and disposal steps. This sequence of stages was named *"life of a product"* and reflects the fact that any object is being born (designed and produced), have a life (use/consumption) and finally ends its life (being disposed).

The possibilities of reusing, re-conditioning or upgrading the product and recycling the raw materials from product's parts created the possibility to extend the life of the product giving birth to the concept of

"life-cycle of a product". In this way, designers conceive the product knowing and having in mind the environmental consequences of their work. A series of instruments, like LCA, help them to assess the products and therefore to improve the results of their work.

3. LEGISLATION REGARDING ECODESIGN

At international level, there are several treaties and conventions focusing on environmental laws. The United Nation Convention on climate change signed at Rio de Janeiro (1992), the Basel Convention (1991) concerning transport control beyond country borders of dangerous waste and its elimination, the Vienna Convention (1985) concerning the protection of the ozone layer, the Montreal Protocol (1997) concerning substances which diminish the ozone layer or the Convention regarding persistent organic polluters signed at Stockholm (2001). States that signed the international treaties concerning the environment protection and ecodesign do have to comply with their international obligations.

At the European Union level, the normative framework concerning ecodesign may be found in a broad range of areas of protection of the environment such as:

- waste management;
- electronic and electrical equipment;
- utilization restrictions of certain hazardous substances;
- industrial machines;
- telecommunications and radio equipments;
- responsibility for damaged products;
- security of products etc.

For example, the EU Directive 91/156/CEE, seeks the prevention and reduction of waste production through the use of clean technologies, technical development and marketing of products respecting the environment; the Directive of European Parliament and Council no.2002/95/CE from 27 January 2003 establishes restrictions of the utilization of certain dangerous substances and electrical and electronic equipment (RoHS); the Directive 2002/96/CE regarding the waste of electric and electronic equipment (WEEE); the Directive of the Council no.92/42/EEC from 21 May 1992 regarding the requirements for draining the hot water from liquid or gas combustion boilers; the Directive of European Parliament and Council no. 2000/55/CE from 18 September 2000 establishing the energy storage requirements applicable to fluorescent lightning wastes. Another important directive is no. 2005/32/EC from July 2005 regarding the framework for setting up the ecodesign requirements for energy using products (EuP). It also establishes the ecodesign parameters for EuP, its specific requirements concerning sources, manufacturer, CE labelling etc.

Member states of the European Union must comply with the requirements of the EU directives. In both cases, states not complying with the obligations assumed by the treaties have been confronted with international cases. Directive 2002/96/EC of the European Parliament and of the Council on *waste electrical and electronic equipment (WEEE)* of 27 January 2003, article 14: Member States should encourage the design and production of electrical and electronic equipment, which take into account and facilitate dismantling and recovery, in particular the re-use and recycling of WEEE, their components and materials. Producers should not prevent, through specific design features or manufacturing processes, WEEE from being reused, unless such specific design features or manufacturing processes present overriding advantages, for example with regard to the protection of the environment and/or safety requirements. Therefore, because the environmental issues became of national and international importance, the legislation was supposed to be supported by specific norms and standards. Early 90s marked the "birth" of the regulations created by the International Institute for Standardisation. The family ISO 14000 normative were formulated consisting in a set of norms, which cover six areas:

1) Environmental Management System;
2) Environmental Audit;
3) Environmental Evaluation of Performance;
4) Environmental Labelling;
5) Evaluation of the life-cycle of products (EN ISO 14040-14043);
6) Evaluation of the environmental aspects in production standards.

Then the conditions required for the system to work properly were created. The designers can create products according to the recommendations and evaluate them, auditors can assess, environmental inspectors and NGO members can survey the companies' activities and take legal actions when laws and regulations are not respected.

4. WHAT IS ECODESIGN?

Usually when people speak about pollution as related to products they think mostly about what they can see, hear or smell. The exhausting gases and the noise from vehicles, the smoke from the factories and the garbage in waste dumps poisoning the atmosphere are some examples. More difficult for their perception

is to understand that every tree cut down represents less carbon dioxide transformed into oxygen, the foam plastics from which their food container is made "contributes" to the stratospheric ozone layer damage, his or her car produces injurious gases breathed by themselves and their children causing, in time, severe diseases or even death.

Therefore, **ecodesign is designing for a safer future**. The scope of the designer is to create objects in order to fulfill needs. However, at the same time, the designer can and should be an opinion leader meaning that he is capable to stimulate desires. In other words, the designer can do more than designing and making the product; *he can create the market demands.* From this perspective, the "ecological" role of the designer is far more important.

At the same time, maybe all of us want products to be environmentally friendly but few are prepared to pay for products or services with an outspoken environmental profile.

Sustainability may be understood differently: for instance, for people living in industrialized countries, in North America, Japan or Europe, it might mean some restrictions like walking instead of driving, less air conditioning, less polluting technologies, whilst for people living in less developed regions, sustainability is perceived in terms like "sufficient food", "clean water", "level of education", or "access to information".

5. LIFE-CYCLE OF A PRODUCT

A product system goes through a number of consecutive and interlinked stages potentially ecologically dangerous. These stages are called *"Lifetime of a Product"* because, as previously assumed, a product has a life that starts from "*raw material acquisition or generation of natural resources, over manufacture, transport, and use to the final disposal* (EN ISO 14040/1997)".

In case the product is recovered and somehow re-introduced into use (with or without re-processing), this whole process is called the "Lifecycle" of a product. The Figure 2 presents the five stages of a product life-cycle, including the recovering and non-recovering options.

➢ **Raw materials obtaining** (extraction, harvesting and so on). This first stage consists in natural resources converting into raw materials (e.g. bauxite for aluminum, iron ore for steel, sand for glass, oil for plastics).

➢ **Manufacture** involves product design and development resulting in product specification; according to these documents (2D&3D drawings, lists etc), products are manufactured from raw materials by means of specific processes (e.g. splinting, casting, plastic shaping, forging). In this stage, in the process of raw materials transformation into products, auxiliary materials are needed (oxygen and acetylene are used in the welding process of assembling the parts).

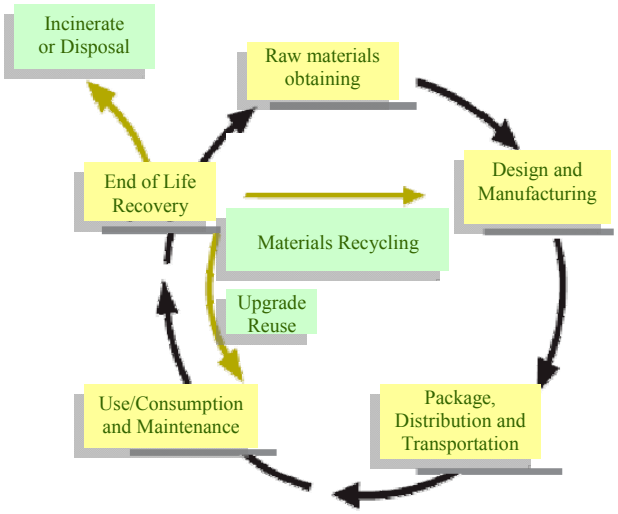

Fig. 2. Life Cycle of a Product.

➢ **Distribution** is the next step after manufacture and product packaging. Products need to be transported from the manufacturer to the client/customer. Sometimes products do not go directly from producer to the customer, but through several intermediary; in this case we have a distribution chain (e.g. bananas are harvested in Columbia and sold to a company that ships them to Europe; the company sales the bananas to another company that distribute them across Europe, so the fruits go to Bucharest to a dealer who sales the bananas to small grocery and supermarkets as well).

➢ **Product use** (or consumption for foods or drinks) may include maintenance and repairs which extend its useful life.

➢ **The end of life stage** is reached when the product cannot be used any longer because of various reasons. The product can be disposed or recovered in order to be reused or recycled (see Figure 3).

Another point of view may be that the life-cycle represents a process of converting raw materials into economic products of high added value in which the objective is to reduce the virgin materials input.

Few decades ago, people became aware that products interfere with the environment as not only a waste, but also when they are used, manufactured, transported etc. and so, in the early stages of ecological

movement, the expression "to evaluate the product from cradle to grave" has been used (and still is). **The Life-cycle Assessment, LCA**, (synonymous: Lifecycle Analysis, Life-cycle Inventory, Eco-balance), precisely represents the evaluation of the environmental impact of a product during all stages of its lifespan. LCA is a very important tool, which can be used by the designers during the process of design and also by the companies in order to keep under control their products (to be conforming with standards and laws).

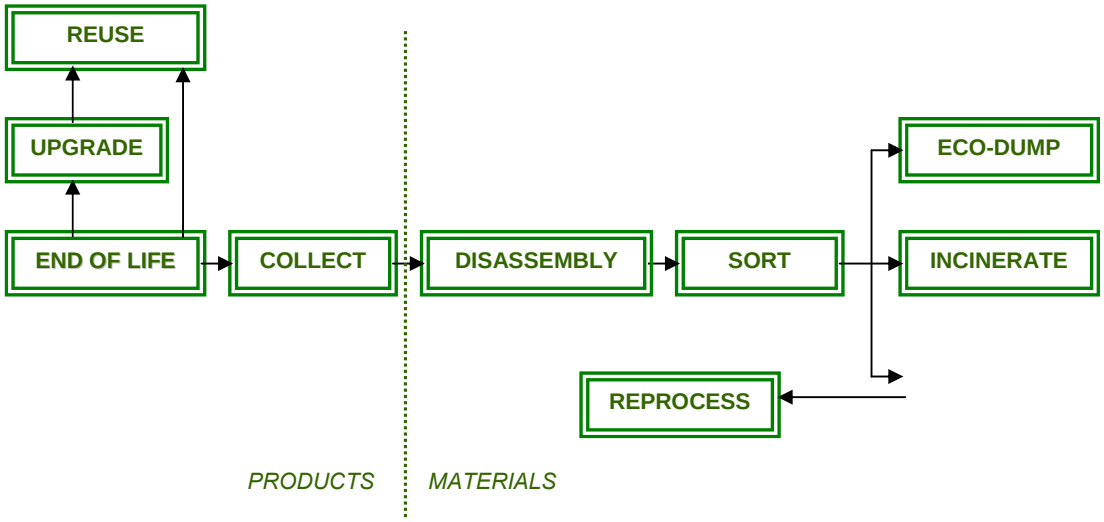

Fig. 3. Product end of life options.

LCA's key elements are:

- identify and quantify the environmental loads involved (e.g. the energy and raw materials consumed, the emissions and wastes generated);
- evaluate the potential environmental impacts of these loads;
- assess the options available for reducing these environmental impacts (European Environment Agency 2006).

LCA is a new tool and can be profoundly complicated, demanding a great deal of *study, testing* and *experimentation.* Because the tool is so complex and sometimes difficult to perform, the formulation Life-cycle Thinking is more likely used. This is a holistic thinking of the environmental impacts of a product caused throughout its life-cycle stages.

6. CONCLUSION

Affected by the consumerism flagellum are all of us, living in poor or rich countries, but the benefits and the responsibilities for the damages are not even, which is not fair.

Designers have solutions to that situation. As previously mentioned, they can design products to last longer and avoid designing useless gadgets. Along the history, human societies have used objects to identify an individual's or family's status and to provide beauty and delight, but true waste is rare. We are living an exertion to this rule despite the fact that consumerism is not deeply ingrained into world's cultures.

Humanity needs to make peace with the nature and people need to be educated in this spirit. The challenge for designers is to understand the critical role they play in shaping our future and to use their skills to move design into a sustainable future.

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