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# CONSIDERATIONS CONCERNING THE NEED OF SUSTAINABLE ECOLOGICAL DESIGN

***Abstract**: In the case of each new product the ecological design for a sustainable development imposes the choices of correct materials and "clean" technologies with minimum energy consumption, of proper technologies of materials recycling with full awareness of consumers. The paper presents the stages the industrial product devising passed through. References are made to the principles and key factors of modern design with emphases on policies of material recycling. Plastic materials and possibilities of their recuperation are in focus. Products made from recycled materials are presented. Finally, the use of plastic waste in Romania is analysed, by comparing the activity of firms in different regions of the country.*

***Key words:** Industrial Design, Eco-Design, Design for sustainability*

## 1. INTRODUCTION

In the late decades the term design was less used, being replaced with ecological design for sustainable development.

This fact appeared as a consequence of the warning signals made by several scientists and by the ecological movements concerning the negative effects that the increase of population, industrialisation and pollution have upon the environment.

Measures for environmental protection and conservation have been adopted by European and International norms and standards. Numerous conferences on environment protection have been organized and international programs are developed in support of researches in the domain of materials and new sources of energy [2], [3].

The present paper represents a start in the study concerning concrete achievements in the field of the eco-design at European level compared with our country. The recycling activities of materials and products obtained from these are strictly monitored.

## 2. STAGES IN THE ACTIVITY OF DEVISING INDUSTRIAL PRODUCTS

Pursuing the changes the designing activities of industrial products have passed through the late decades we can trace some stages:

- passing from the industrial planning to the industrial design, which is the domain of higher pluri and interdisciplinary activity which aims at creating a concordance between the factors contributing to the general quality of large scale production, factors of technical, functional and economical sorts, but also of ergonomically and aesthetic ones; the transition was slow, starting in the first decades of 20th century increasing its rhythm only after the middle of the same century;
- the transition from industrial design to eco-design or ecological design where aspects related to environment are considered, as respect to the minimum affectation of it; the process became more rapid after 1970 and in Romania after 1990, when the national policy of environment has been aligned to the EU standards and policies (Agenda 2000) [3];
- the appearance of ecological design for sustainable development aiming at reducing to the minimum the impact of technological products and process upon the environment all along the products life cycle, keeping performances and qualities unaltered; in this phase social and ethical factors are implied.

One of the promoters of this type of design was Victor Papanek, who, in his book "Design for the real world" (1971) emphasized the importance of the impact each product has upon people and environment [3].

Figure 1 synoptically illustrates the relation between the stages previously presented.

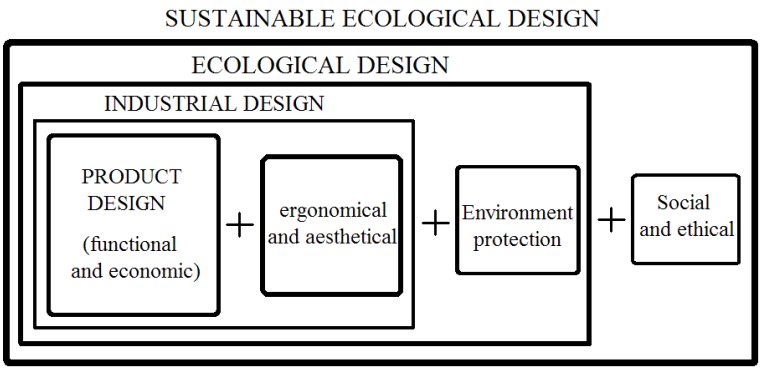


**Fig. 1** Modern design structure

In the *Romanian Explanatory Dictionary* the term durability is defined as the capacity of maintaining a certain process as long as possible or over an unlimited period. The term is being used in many fields with its due specificity. As referring to industrial activities, durability means diminishing resources utilization and their balanced distribution to meet the present and future needs.

The ecological design for sustainable development is a responsible design, a new way of conceiving ideas which implies a preliminary analysis, a correct selection of materials, non-polluting, low energy consuming technologies, a monitoring process of transportation, storage and establishing some correct recycling technologies of materials, keeping consumers all the time informed.

"To produce without destroying" could be the motto of the present time.

## 3. THE PRINCIPLES OF ECOLOGICAL DESIGN FOR SUSTAINABLE DEVELOPMENT

The major perils related to our life in the surrounding medium, pointed out and proved by researchers are: diminishing material resources and the quantity of water consumed, its pollution with noxious compounds, emissions of gases causing photochemical smog, acid rains and transportation of toxic substances, noise, odors and radiations, dangerous wastes and global heating.

It is imperative that even in the conception stage of a product one should evaluate and prevent the possibilities of occurring such phenomena, all along the working life of the product.

In this respect, the principles lying at the basis of the ecological design for sustainable development [2], [3] have been established:

- efficiency, referring to the optimum utilization of materials;
- economy of natural resources;
- integrity of ecosystem's structures and functions;
- diminishing energy consumption;
- cyclicity, that is the possibility of reusing, recycling the products either naturally or artificially;
- safety, namely the use of non-toxic materials in production processes;
- education aiming at increasing social support;
- information.

## 4. CONTROL FACTORS OF ECOLOGICAL DESIGN FOR SUSTAINABLE DEVELOPMENT

There are methods in support of applying the above mentioned principles. We may call them rules of eco-design. So:

- best use of materials are effected by optimization of forms, reduction of weights, replacing scarce materials, including recycled materials;
- for respecting ecosystems integrity, renewable resources are developed and non-renewable are recycled;
- diminishing energy consumption is obtained by using other forms of energy;
- for recycling of materials, the most "green" non-polluting technologies are selected;
- for our safety and health, the process technologies will be revised, both for new product and those recycled, in view of minimizing the quantities of toxic materials used or emitted (the Franhofer Toxic Potential Indicator can be used, which classifies materials by means of an index of potential dangers, evaluated on the basis of radiation level at work places and water pollution level [2]);
- education commences at school level and proceeds with campaigns of rendering the population sensitive with various environmental problems;
- the consumer will be informed by properly labeling using corresponding logos and packages easily handled and recycled;

## 5. RECYCLING – WORLD ECONOMIC POLICY

Recycling, as a principle of modern design, began to develop in Europe in the 1990s. Now one can speak about an industry of packages made from recycled materials.

From an ecological point of view, recycling solves two problems simultaneously: environmental protection on one hand and on the other hand, using another source of materials, as those resulting from fossil or vegetal resources are running out. Also, there is the social aspect of creating new positions of employment, as well as the economic aspect of the appearance of a new industrial branch. Consequently, well-known and influential firms are encouraged to use recycled materials.

Nike is a company which reuses polyesters to produce sports ware. The Sainsbury's commercial chains sell skirts, trousers, shirts all made from recycled plastic bag. Japan is one of the countries where recycling is regulated by the law, each Japanese citizen being involved in this activity.

The major categories of materials, respectively product manufactured from them that are recycled at the time being are: plastic materials, paper and cardboards, glass, metal, wood, DEEE (electrical, electronic and appliances), car batteries.

Further on, we refer to the first category. Recyclable **plastic materials** are [5]: polyethylene terephthalat (**PET**) of which receptacles, bottles, fibers are made; high density polyethylene (**HDPE**) in pipes, canister and recipients for liquids; low density polyethylene (**LDPE**) used for packages and bags; polypropylene (**PP**) from clothes, flasks, buckets; polystyrene (**PS**) for packages for foods, insulating plates, frequently used as extruded and expanded, but hardly recycled; polyvinylchloride (**PVC**) from pipes, furnitures, packages, toys. It is toxical and hardly recycled.

The recuperating technology may be mechanical or chemical with different variations and with their advantages and disadvantages. The proper method is chosen as function of wastes quantity, dimensions of parts, the type of materials, recipients content.

**Fleece - fiber**

**Fiber hand-bag**

**Jackets made in Romania**

**Garden furniture**

**Bottles and canisters**

**Toys**

**Trash bains for parks (Romania)**

**Domestic objects**

**Garden flagstones (Romania)**

**Fig. 2** Products made of recycled plastic materials

Anyway, through recycling energy savings of 60-80% are recorded as compared with processing the petrochemical raw materials.

The mechanical recycling [1] is applied with relatively clean wastes being not contaminated by other substances and consists of the following operations: separation, compacting, multiple washing, sorting-out, elimination of impurities (labels, coverings) and of contaminants by flotation, electrostatically, or decantation, grinding or chopping, turning the material into flakes and then the clean flakes are melted, filtered and extruded in fibers or foils.

The chemical recycling is applied to contaminated wastes and requires a certain technological flux and proper equipment. It can be affected by methanolysis, glicolysis, hydrolysis or aminolysis.

The small plastic objects, difficultly sorted out are incinerated, recuperating the emerging thermal energy.

The second generation products are almost the same as those from which the fibers originated:

- **fibers** for carpets, fillings for cushions and mattresses, toys, insulation materials for sleeping bags, clothes, tapestries, etc.;
- **foils** and plates for roofs insulation, boxes resistant in microwaves ovens, containers, packages for toys;
- **tapes** for fixing products onto palettes and closing boxes;
- i**njected forms**: parts for auto-industry, components for lighting fixtures, domestic appliances, floor tiles;
- **PET flakes** for technical applications: paints, composite materials with organic polystyrene or polypropylene matrices, polyesteric cements [5].

The products of the secondary fabrication are qualitatively ever better due to the perfection of technological cycles. If at the beginning they were especially used as filling materials, after 1994, they were accepted as packages in the foodstuff industrie.

Nevertheless PET mechanically recycled (possibly several times) loses its initial properties due to the transformations at molecular level and to some contamination processes.

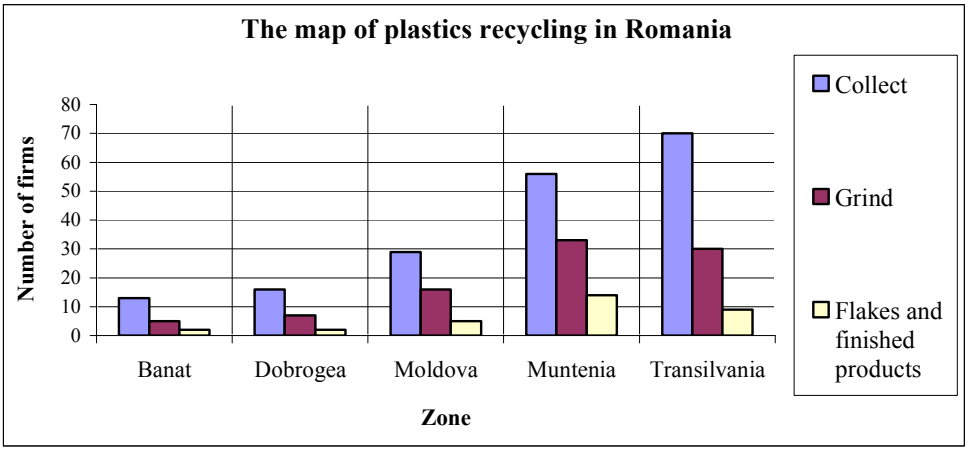


**Fig. 3** Recycling situation by zones

Through the chemical recycling better quality product are obtained, similar to those from the first generation.

## 6. REVALUATION OF PLASTIC WASTES IN ROMANIA

In Romania action was taken at design level (projects, grants, innovations), at standard level, but less at industrial level.

If in the last few years, the statistics, drawn-up by Eurostat showed that Romania and Bulgaria were the only countries in EU where city wastes were not recycled at the present the situation has improved and according to data national Commission for Materials recycling within the Ministry of Industries and Commerce, the degree of recuperation of plastic wastes in Romania is 7% as compared one European mean of 25% (70% in Austria and Germany).

In spite of the advantages offered to society, collection, processing and transportation of wastes require money and energy. That's why, most of recycle projects are economically subsidized. Pilot centers of plastic materials collection have been set up. At these centers, in general, operations of sorting according to type, colour, compacting and balloting necessities of processing units are effected.

In February 2013 at MECMA, 213 authorized economic operators have been matriculated (unofficially much more) for turning into account various types of wastes, or for the incineration with energy recuperation. Of these 184, that is 86.38% also collect plastic wastes [4]. Of the total firms mentioned, half of them (49%) work on chopping (grinding) and a lower number, representing 17.4% extrudates PET flakes. The intermediary products resulting are directed to the internal and external market. Finished products, as those from figure 4 are made in few production units.

On the basis of the above data, the graphics from figure 3 have been drawn-up, which give a general image on the valuation activities of wastes in various zones of the country.

It is obvious that for complete analysis precise informations concerning the capital circulated by each firm under consideration.

Alongside with recycling policy, the reutilization of plastic materials in the household or for various decorative purposes is recommended.

## 7. CONCLUSIONS

The survey started in this article may be extended on other materials that ought to be recycled and on new sources of energy.

From the data analyzed results the necessity of some concrete measures to be taken for developing in Romania of a true waste materials processing industry.

At worldwide scale devising material goods can not be conceived without observing the principles of ecological design for sustained development.

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