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A NEW APPROACH OF RESEARCHES FROM INDUSTRIAL PRODUCTS MANAGEMENT OVER THEIR LIFECYCLE

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Abstract: The paper presents studies of researches concerning industrial products management over their lifecycle. Actual domains in which is used the "lifecycle product" expression are represented by environmental problems management, enterprises economy and product design. Considering the succession of a product stages, it is important to attain an interdisciplinary approach over Product Life Cycle and Product Life Cycle Management, in order to integrate sustainable concepts and actual demands about projection - development - implementation.

1. INTRODUCTION

The start of researches began with the analysis of product notion. In business, a product is an economic good and accounting good or service, which can be bought and sold. Searching marketing notions, a product is anything that can be offered to a market that might satisfy a want or need. Another view is represented by manufacturing, where products are purchased as raw materials and sold as finished goods. Commodities are usually raw materials, such as metals and agricultural products, but a commodity can also be anything widely available in the open market. In general usage, product may refer to a single item or unit, a group of equivalent products, a grouping of goods or services, or an industrial classification for the goods or services.

In our days, developing products must include as a new parameter - the environment, which implies the eco-conception of the product. Product design has effects over the environment and over the costs, during its life cycle, [1], [2].

Producing, distribution, employment and the end of life cycle of products, which are energy consumers, have environment impact. It is a fact that 80% of environment impact of a product can be determined during product design phase. For an efficient influence in products improvements it has to consider environment aspects.

New politics of Product Eco-Design give a direction over strategies concerning new affairs opportunities and actions according to legislation and market demands. It must develop own ideas for Eco-Design strategies, practical ways of approach to Eco-Design and new views for own products and processes [3], [4].

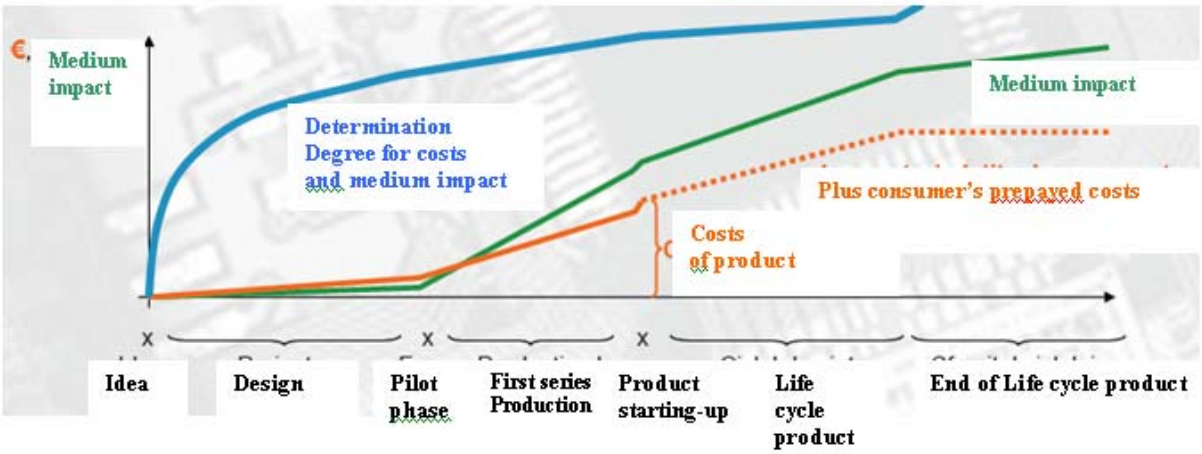


Fig. 1. Environment impact versus Life Cycle Product [3]

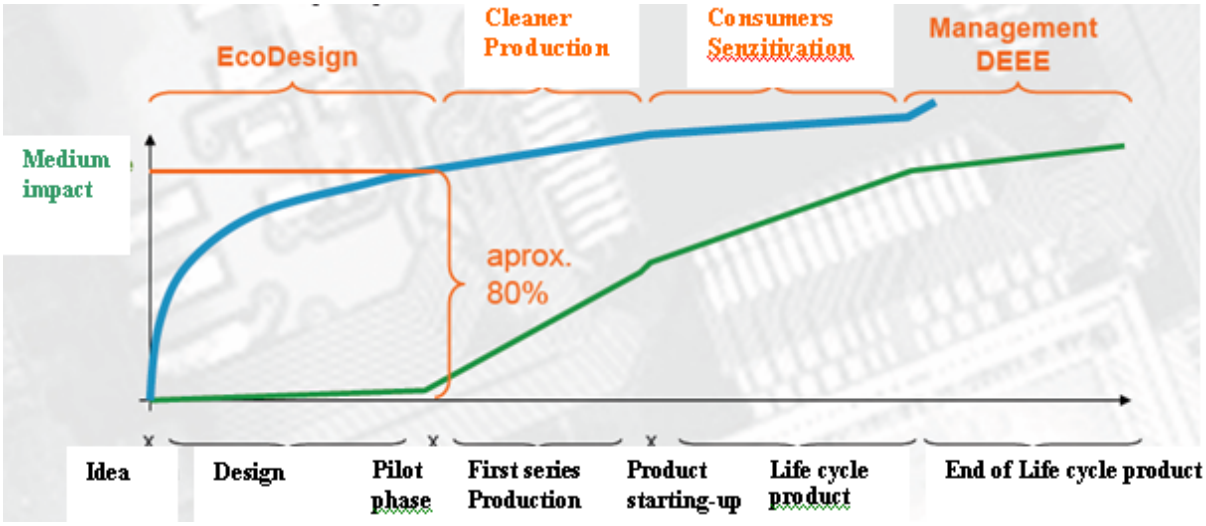


Fig. 2. Environment impact versus Life Cycle Product [3]

2. ECO-DESIGN PHILOSOPHY AND LIFE CYCLE PRODUCTS

Considering different points of view concerning approaches over eco-conception process it must be said about the researches of an American team from Technology Institute from Georgia. They identified and classified five different approaches for the products impacts diminution over environment.

First one is environment engineering, which implies the management and the control of water polluting systems, atmospheric wastes and solid wastes from industrial production.

The second approach is represented by the pollution prevention, as an essential direction for reducing wastes production from the beginning, introducing products recycling, eliminating polluting equipment and polluting stages, during products process.

The third approach is represented by Environmentally Conscious Design and Manufacturing (ECDM), Design for the Environment (DfE) or Life Cycle Design (LCD). Researches are focused over entire product lifecycle, including potential impacts over environment during product process, utilization and elimination.

Industrial ecology represents the extension of product life cycle approach, considering impact and time terms. It is a new orientation, from products to systems. This approach implies a bigger scale – the industrial ecosystem – where wastes of a plant may become raw materials for a second one. This is a concept of an industrial ecosystem and it represents the base of the impact management of energy and materials over environment.

Last approach refers to the sustainable development, as a concept which integrates environment, industrial aspects and also cultural and social aspects, for a long term.

Considering the approach of Life Cycle Design, it must be presented the elementary philosophy of Eco-Design, from ecological point of view. It is about the reduction of the impact over environment, during all product life cycle, using a better product design.

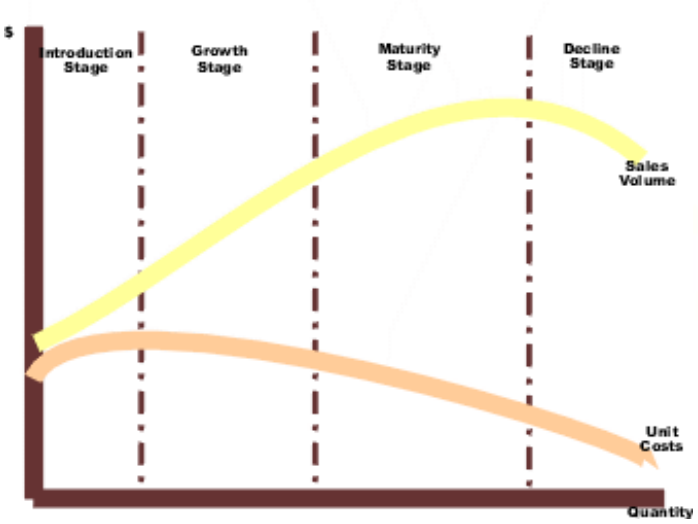
A product life cycle includes the raw materials acquisition, the components production, the products assembly, the distribution, the product utilization; also it may be included the modernization, the reutilization – and the end – with all corresponding traffic.

The Product Life Cycle refers to the succession of stages a product goes through: the new product development stage, the Market introduction stage, the Growth stage, the mature stage and The Decline or Stability stage (Figure 3).

Product Life Cycle Management is the succession of strategies used by management as a product goes through its life cycle [4].

When a product reaches the maturity stage of the Product Life Cycle, a company may choose to operate strategies to extend the life of the product. If the product is predicted to continue to be successful or an upgrade is soon to be released, the company can use various methods to keep sales, else the product will be left as is to continue to the decline stage.

The core of PLM is in the creation and central management of all product data and the technology used to access this information and knowledge (Figure 4). PLM as a discipline emerged from tools such as CAD/CAM and Product Data Management, but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life. It is not just about software technology, but is also a business strategy [5].



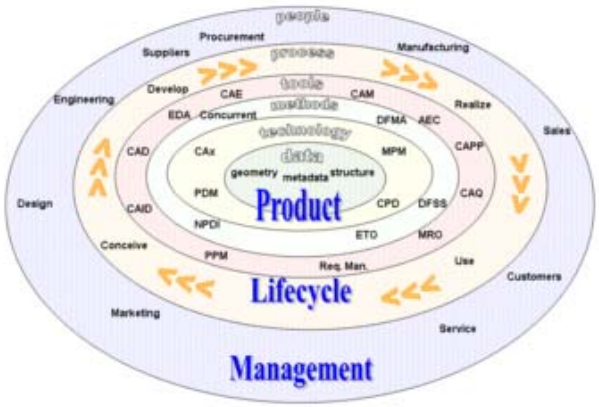


Fig. 3. Typical Product Life Cycle, [4]

Fig. 4. The core of Product Lifecycle Management, [5]

Eco-Design takes account of Life Cycle Assessment and develops instrument, as MET Matrix and also considers working conditions (Table 1), (Table 2), [3].

	Materials Cycle (M)	Energy Consumption (E)	Toxic emissions (T)
Production and Delivery of materials and elements			
Product Production			
Distribution to Customers			
Product Utilization			
End of Life Cycle			

	Materials Cycle (M)	Energy Consumption (E)	Toxic emissions (T)
Production and Delivery of materials and elements	↓ Materials and elements needed ↓ Raw materials acquisition	↓ Energy consumption for raw materials extraction	↓ Toxic wastes during raw materials acquisition ↓
Product	↓ Additional	↓ Energy	↓ Production

Production	Material/ Additional Substances	consumption in production process	toxic wastes Residues
Distribution to Customers	Traffic, Making lots & Packing	Energy consumption in packing Traffic	Packing wastes Traffic emissions
Product Utilization	Type and quantity of consumables products Auxiliary Materials	Energy consumption in using	Wastes from replacing component elements and consumable materials
End of Life Cycle	Using raw materials and auxiliary materials for treatment	Energy consumption for storage / recycling process	Toxic wastes (product) Recycling Saturation

Table 1. The MET Matrix

	Profits			Feasibility		
	Environment	**Affairs**	**Customers**	**Environment**	**Affairs**	**Customers**
Option 1						
Option 2						
Option 3						
…						
Option n						

Table 2. Profits & Feasibility

3. ECO-DESIGN AND MANAGEMENT OF INDUSTRIAL PRODUCTS OVER THEIR LIFECYCLE

Strategic approach considers all enterprise levels. There must be consider all potential environment impacts for a product; engaged actions are an integrated element in enterprise politics [5].

Regarding the eco – conception, there are two different visions over industrial production: the first one is focused on products technological amelioration, less dangerous for environment and the last one is focused on amelioration of way of life using the products conception over sustainable development notion.

Researches made in the first area imply the integration of environment parameter in products development process. The objective is to reduce the product impacts over environment during all its life cycle. The main concept is the Life Cycle model, in which all entries (materials, energy) and all exits (polluting emissions and wastes) in / from process phases and the distribution, utilization and elimination ones are identified and considered (Figure 5).

The enterprise management must focus the objectives for Eco – Development, reaching one or more strategies: resources protection, wastes prevention, product service working optimization [5].

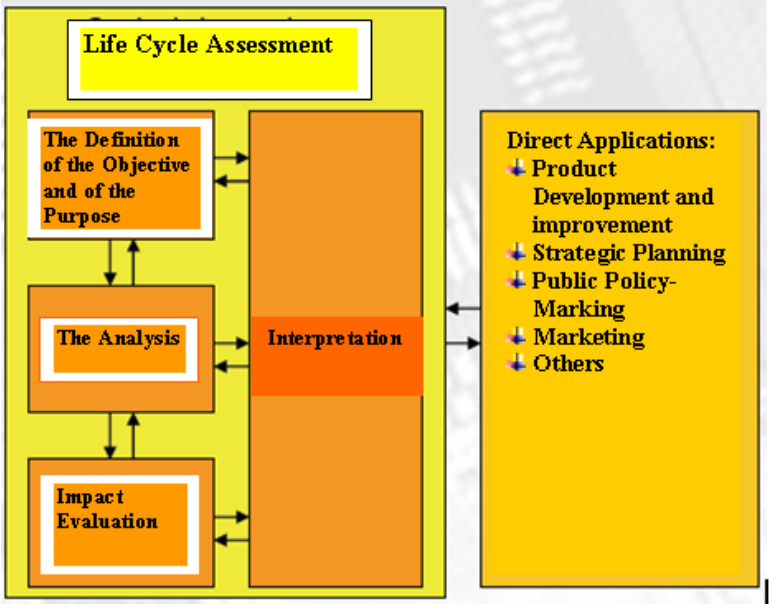


Fig. 5. Life Cycle Assessment, [3]

All products cause environmental degradation in some way, whether from their manufacturing, use or disposal. It was developed a special instrument - Integrated Product Policy (IPP) – which seeks to minimize these by looking at all phases of a products' life-cycle and taking action where it is most effective [6].

The life-cycle of a product is often long and complicated. It covers all the areas from the extraction of natural resources, through their design, manufacture, assembly, marketing, distribution, sale and use to their eventual disposal as waste. At the same time it also involves many different actors such as designers, industry, marketing people, retailers and consumers. IPP attempts to stimulate each part of these individual phases to improve their environmental performance.

With so many different products and actors there can not be one simple policy measure for everything. Instead there is a whole variety of tools - both voluntary and mandatory - that can be used to achieve this objective. These include measures such as economic instruments, substance bans, voluntary agreements, environmental labeling and product design guidelines.

Integrated Product Policy applies to all products. There is no single policy tool that can be used to encourage the greening of all products at all stages of the life cycle, but a combination of a number of policy instruments. These policy tools construct the IPP toolbox. They should be used in coherence with each other, in a way that they reinforce each others' effect [6].

The Directive 2005/32/EC on the eco-design of Energy-using Products (EuP), such as electrical and electronic devices or heating equipment, provides coherent EU-wide rules for eco-design and ensure that disparities among national regulations do not become obstacles to intra-EU trade. The Directive does not introduce directly binding requirements for specific products, but does define conditions and criteria for setting, through subsequent implementing measures, requirements regarding environmentally relevant product characteristics and allows them to be improved quickly and efficiently. Products that fulfill the requirements will benefit both businesses and consumers, by facilitating free movement of goods across the EU and by enhancing product quality and environmental protection [7].

4. APPROACHES IN ENVIRONMENT MANAGEMENT SYSTEMS

There are many devices to approach in environment management systems and they can be applied function the size of activity domain of enterprise and the danger over the environment, which is implied by its activity. Devices may be intern methods, prizes for eco – conscious enterprises or Excellency management systems for environment protection, [7].

These methods can be applied by SMEs, public institutions, services suppliers.

Eco-Design, EMAS, ISO 14001, „Eco-label" notion are methods which allow the integration of environment protection in daily life of enterprise.

Eco-Design involves stages of product life cycle: raw materials acquisition, manufacture, packing, traffic and distribution, installation and maintenance, usage and product "death".

Also Eco-Design involves materials, energy and other resources consuming, emissions in air, water and earth, pollution, wastes production, but also possibilities for re-using, recycling and recovery of materials and energy.

As instruments for environment evaluation there are made lifecycle evaluation for key-products, environment critical points identification and action. Directive 2005/32/EC on the eco-design of Energy-using Products (EuP) doesn't impose Life Cycle Assessment, but it imposes an Eco-profile (figure 6), [7].

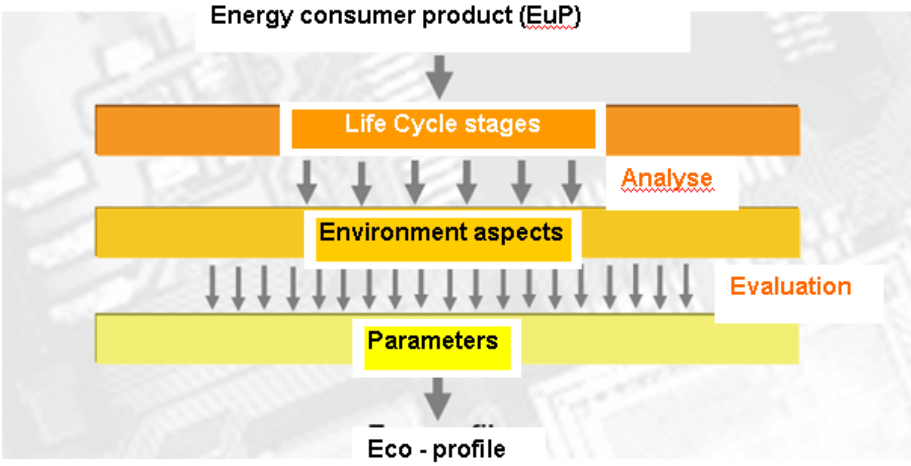


Fig. 6. Eco- profile, [7]

EMAS represents the Eco-Management and Audit Scheme and it is the EU voluntary instrument which acknowledges organizations that improve their environmental performance on a continuous basis. EMAS registered organizations are legally compliant, run an environment management system and report on their environmental performance through the publication of an independently verified environmental statement. They are recognized by the EMAS logo, which guarantees the reliability of the information provided, [8].

The overall objective of Community policy on the environment and business is to contribute to sustainable development. The EU eco-label scheme (as laid down in the new Regulation (EC) No 1980/2000) is now part of a wider approach on Integrated Product Policy (IPP) within the new Action Programme, [9].

The Commission has published a Green Paper on IPP that will be a key innovative element of future environmental policy and sustainable consumption and production. Strategically, the European eco-label Scheme is, and will be, in line with the principles, goals and priorities of the 6th action Programme *"Our Future, Our Choice".*

The European eco-label is based on the vision of greening non-food products all over Europe in a joint and common approach of all European stakeholders brought together in the European Union Eco-labeling Board (EUEB).

The Scheme's core assets are its growing numbers of customers and stakeholders: their information, their ideas and their desire and ambition for green products all over Europe. The eco-label is a rapidly growing brand, which organizes people around the pursuit of common interests and causes. It is, therefore, a very valuable policy tool for the better integration of the Community's environment, single market and other policies.

Products which have been awarded the “Eco-label” will be considered as compliant with the implementing measures in, so far as the Eco-label meets the requirements of the implementing measure. Although the “EMAS registration” on its own does not grant presumption of compliance to the products manufactured by the enterprise, enterprises which have an EMAS registration, which includes product design, may use directly their environmental management system for demonstrating that their product complies with the applicable implementing measure, [9].

The ISO 14000 environmental management standards exist to help organizations minimize how their operations negatively affect the environment (cause adverse changes to air, water, or land), comply with applicable laws and regulations, [10].

ISO 14001 is the international specification for an environmental management system (EMS). It specifies requirements for establishing an environmental policy, determining environmental aspects and impacts of products/activities/services, planning environmental objectives and measurable targets, implementation and operation of programs to meet objectives and targets, checking and corrective action, and management review.

An EMS meeting the requirements of ISO 14001:2004 is a management tool enabling an organization of any size or type to:

- identify and control the environmental impact of its activities, products or services, and to
- improve its environmental performance continually, and to
- implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

ISO 14001:2004 does not specify levels of environmental performance.

The intention of ISO 14001:2004 is to provide a framework for a holistic, strategic approach to the organization's environmental policy, plans and actions. ISO 14001:2004 gives the generic requirements for an environmental management system. The underlying philosophy is that whatever the organization's activity, the requirements of an effective EMS are the same.

Because ISO 14001:2004 does not lay down levels of environmental performance, the standard can to be implemented by a wide variety of organizations, whatever their current level of environmental maturity. However, a commitment to compliance with applicable environmental legislation and regulations is required, along with a commitment to continual improvement – for which the EMS provides the framework, [10].

5. CONCLUSIONS

Government, business and non-governmental organizations can apply the life-cycle concept to their decision-making processes related to environment and product policy, design, and improvement. The life-cycle approach can also be used as a scientific tool for

gathering quantitative data to inventory, weigh and rank the environmental burdens of products, processes and services.
Industry use of life-cycle assessment (LCA) as a tool to improve environmental performance is increasing. An LCA quantifies energy and resource inputs and outputs at all stages of a life-cycle, then determines and weighs the associated impacts to set the stage for improvements [11].
Adopting a life cycle perspective helps ensure that a company's choices are environmentally sound - and that's in everybody's interest. Companies implementing life cycle management may also benefit from competitive advantages, including cost reductions and enhanced public image.
European Platform on Life Cycle Assessment (LCA) was launched in December 2005 and its objective is to promote life cycle thinking in business and in policy making in the European Union by focusing on underlying data and methodological needs. The Platform is planned to provide quality assured, life cycle based information on core products and services as well as consensus methodologies.
Every year take place different conferences and events; their purpose is the continuation of traditional mission to establish a forum for the exchange of knowledge on ecological aspects of designing and manufacturing systems and products, reuse of components and recycled materials used, especially in electronic equipment.
There were made guides to better business decisions in Environmental Life Cycle Management. The guidebooks are designed primarily to help managers and other employees in small- and medium-sized companies, to take a life cycle approach in their business decision-making. Also larger companies may find the concepts and suggestions useful in moving life cycle management out across their organizations. Others possible customers are government agencies and non-governmental organizations interested in supporting effective environmental action by industry, or in minimizing the environmental burdens and costs of their own purchases and practices. Although life cycle management can be applied to virtually any system or activity, the focus to date has been mostly on products, both commodities and manufactured goods [11].

REFERENCES

[1] Box, J. (1983) *Extending product lifetime: Prospects and opportunities*, European Journal of Marketing, vol. 17, 1983, pp 34-49.
[2] Cornescu V., Marinescu P., Curteanu D., Toma S., (2004), *MANAGEMENT – de la teorie la practică*, Universitatea din Bucureşti, Editura Universităţii, ISBN 973-575-831-8, varianta electronica *http://www.unibuc.ro/eBooks/StiinteADM/cornescu/*
[3] http://www.EcoDesignARC.info
[4] *** (2006), *ECOMECA,* Universitatea TRANSILVANIA din Brasov
[5] *„Implementarea eco-conceptiei in intreprinderi - imperativ al protectiei mediului inconjurator si al capitalului natural”*, Contract: 306/ 25.09.2003, Programul MENER
[6] http://ec.europa.eu/environment/ipp/
[7] http://ec.europa.eu/enterprise/eco_design/
[8] http://ec.europa.eu/environment/emas/
[9] http://ec.europa.eu/environment/ecolabel/
[10] http://www.iso.org/iso/iso_catalogue/management_standards
[11] http://www.ec.gc.ca/ecocycle/en/whatislcm.cfm