CONSIDERATIONS UPON ECO-EFFICIENCY MEASUREMENT AND REPORTING

MARIA-DANIELA BONDOC, RAMONA-FLORINA POPESCU
UNIVERSITY OF PITESTI
1 TARGU DIN VALE STREET, PITESTI, ROMANIA. 110040
daniela.bondoc@upit.ro, rf.popescu@yahoo.com

Abstract:
Our paper aims at presenting the Eco-efficiency concept in order to offer an understanding of the characteristics and of the steps to be followed in measuring and reporting eco-efficiency. The paper starts from the basic version of the concept developed by World Business Council for Sustainable Development (WBCSD). Eco-efficiency refers to two of the three pillars of sustainable development: economy and environment. It is used as a method of benchmarking the industry's impact on the environment.

Key words: *eco-efficiency, performance, reporting*

JEL classification*: M14, Q01, Q51, Q56*

Europe and the whole world are faced with a number of problems that must be approached immediately and simultaneously: the acceleration of the degradation of resources, climate changes, world economic crisis. A European eco-efficient economy marks an integrated approach for energy, environment and industrial policy, highlighting how we can combine the minimization of climate changes with the security of energy supply and with economic performance and competitiveness.

The assessment of the eco-efficiency is necessary because it can be seen, on the one hand, as a performance measurement tool at a system level (process, product, company), and on the other hand as a tool used to compare various options, i.e. benchmarking.

In 1992 the Summit in Rio de Janeiro approved eco-efficiency as a means of implementation by the companies of Agenda 21 (the United Nations programme for sustainable development) in the private sector, and the term "eco-efficiency" became the synonym of a sustainability-driven management philosophy.

Eco-efficiency is an economic and environmental concept focused on sustainable development. It makes reference to two of the three pillars of sustainable development: economy and environment. EE is used as a method of benchmarking the impact of the industry on the environment. Social issues are rarely included (except for those related to public health) due to the lack of quantitative models able to highlight the connection between the economic activities and the social impact.

The World Business Council for Sustainable Development (WBCSD) created the concept of eco-efficiency to sum up the business end of sustainable development in its 1992 publication *Changing Course*. The WBCSD is a global association of some 200 companies worldwide dealing exclusively with business and sustainable development that are united by a commitment to the principles of economic growth and sustainable development.

The WBCSD defines eco-efficiency as being "achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle, to a level at least in line with the Earth's estimated carrying capacity."

Besides the definition given by WBSCD, other bodies such as the Organisation for Economic Co-operation and Development (OECD) or European Environment Agency (EAA) also attached importance to this concept and formulated their own definitions.

For example, OECD defines eco-efficiency as a ratio of an output (the value of products and services produced by a firm, sector, or economy as a whole) divided by the input (the sum of environmental pressures generated by the firm, the sector, or the economy).

EAA defines eco-efficiency as "a concept and strategy enabling sufficient delinking of the "use of nature" from economic activity needed to meet human needs (welfare) to allow it to remain within carrying capacities and to permit equitable access and use of the environment by current and future generations", in other words, "more welfare from less nature" .

Eco-efficiency is thus the synthesis of the economic and environmental efficiency at the same time. The essence of eco-efficiency is often presented as "creating more value with less impact" or "doing more with less" (WBSCD).

Among the challenges of an eco-efficient behaviour of a company there are:

- to add more value with a lower impact on the environment;
- to separate welfare increase from the excessive use of resources;
- to improve economic efficiency, as well as the ecological (environmental) efficiency.

Companies should adopt the eco-efficiency principles because this is a management tool that:

- improves performance;
- contributes to the identification of opportunities to increase business competitiveness;
- helps decision-making related to the product or service portfolio, in order to increase its eco-efficiency.

Environmental performance was defined by Schaltegger and Wagner (2005) as "an absolute descriptive (e.g. absolute emissions), a relative descriptive (e.g. emission relative to turnover or physical production output) or as a normative (e.g. an environmental improvement target of a company for a specified period of time), which could refer to an absolute or a relative descriptive, i.e. there are four possible combinations".

The methodology of the environmental performance assessment was also provided in standard ISO 14031-1999. ISO 14031 is an international standard that describes a process for measuring environmental performance and defines environmental performance as "the results of an organization's management of its environmental aspects".

How an industry responds to environmental problems may, in fact, be a leading indicator of its overall competitiveness. (Porter and van der Linde, 1995)

DeSimone and Popoff (2000) detail the seven dimensions of eco-efficiency that every business should taking into account:

1. Reduce material intensity (make more goods with fewer inputs)
2. Reduce energy consumption (make more goods with less energy)
3. Reduce dispersion of toxic substances (make more goods with less poisonous waste)
4. Enhance recyclability (make the goods recyclable)
5. Maximize use of renewable (make goods out of materials that won't run out)
6. Extend product durability (make goods that last)
7. Increase service intensity (meet demand with a service and not with goods)

These seven elements could be attributed to three broad objectives for eco-efficiency: reducing the consumption of resources, reducing the impact on nature and increasing good or service value.

Reducing the consumption of resources includes the minimization of the consumption of energy, materials, water and soil, increasing recycling and product life

Reducing the impact on nature implies reducing emissions into the atmosphere, discharges into waters, eliminating wastes and dispersions of toxic substances, and promoting the use of renewable resources.

Increasing good or service value by supplying higher benefits for clients through the functionality, flexibility and modularity of the product, by supplying additional services (such as maintenance, revamping and exchange services) and focusing on the functional needs required by the clients.

Eco-efficiency is measured by the ratio between what was produced (the volume of production, its value, its incomes, the number of jobs created. etc.) and the total effects on the environment, generated by the respective product during its lifecycle. It therefore expresses the ratio between the value of a good or service and its impact on the environment with the equation:

$$EE = \frac{product\_or\_service\_value}{environmental\_influence}$$

The expression of eco-efficiency can be synthesised as follows: an indicator referring to the impact on the environment divided by an indicator related to the economic results or vice versa. An increase in eco-efficiency is made by providing more value per unit of environmental influence or unit of resource consumed. (WSCD, 2000)

WBSCD recommends the use of eco-efficiency ratios as value per environmental influence, cu although some companies and users prefer the inverse of the formula set by WBSCD (the environmental influence per unit of value).

Eco-efficiency allows for measuring the individual impact (unitary) of the goods or services (consumption of energy and raw materials, emissions of greenhouse gases, wastes, toxic substances, etc.), so it has a relative nature and we can say that it refers to the eco-efficiency of the product.

The impact on the environment includes aspects related both to the product manufacturing stage, as well as to its consumption or use. An eco-efficient company understands the need and seeks to minimize the impact of its products on the environment their full lifecycle.

Thus, the improvement of the eco-efficiency indicators does not necessarily signify that the company has decreased its global impact on the environment, but only its output unit (product or service) impact.

Eco-efficiency indicators can be obtained starting from databases that should include, for example:

For the volume of goods and services:

– quantity of goods or services produced;
– net sales.

For the expression of the impact on the environment:

- the energy consumption (MJ or kWh) : energy consumed per year (MJ or kWh), natural gas consumed per year (MJ or kWh), liquid fuel consumed per year (litres or MJ), gasoline or Diesel fuel consumed per year (litres or MJ);
- materials consumption : raw materials, parts, solvents, catalysts etc. (Kg or tonnes, litres);
- water consumption (m^3);
- greenhouse gas emissions (kg or t) in CO_2 equivalents;
- emissions of substances which deplete the ozone layer (kg or t);
- emissions of acid pollutants (m^3 or kg);
- generated wastes (kg or t).

Starting from such data, annual environmental indicators can be compared with economic ones and vice versa and eco-efficiency indicators are obtained, such as:

- the production obtained per unit of energy consumed (kg/megajoule);
- turnover per unit of energy consumed (Euro/ kWh);
- total weight of the products per unit of water consumed (kg/m^3).

So there are several options for the calculation of the eco-efficiency indicators starting from the base report. Both the value of the product and the impact on the environment can be reflected by several indicators, and it rests with the company to choose the eco-efficiency rates that best suit the information and decision-making processes. The calculation methods will depend on specific needs, and an indicator may not be adequate to another.

In choosing indicators to reflect eco-efficiency, WBSCD recommends taking into account eight principles, as follows:

- be relevant and meaningful with respect to protecting the environment and human health and/or improving the quality of life;
- inform decision making to improve the performance of the organization;
- recognize the inherent diversity of business;
- support benchmarking and monitoring over time;
- be clearly defined, measurable, transparent and verifiable;
- be understandable and meaningful to identified stakeholders;
- be based on an overall evaluation of a company's operations, products and services;
- identify relevant and meaningful issues related to upstream and downstream aspects of a company's activities.

As for eco-efficiency reporting, WBSCD has a project on Eco-efficiency Metrics and Reporting, the mission of which is to develop a framework on indicators and their reporting. Reporting should make reference to the following elements:

- organization profile: number of employees, business segment it represents, main products;
- the profile of the indicators used to express the value of the products: financial information, quantity of products, indicators specific to the functionality of the products;
- the profile of the indicators used to express the impact on the environment (indicators that are generally applicable for the influence on the environment and indicators specific to obtaining and using the company products);
- eco-efficiency rates;
- methodological information concerning the choice of indicators, data collection methodology, any limitations in the use of information.

However, what is NOT eco-efficiency? Eco-efficiency was not created to be a panacea, is only a practical approach. Thus, even if the WBSCD reports specify that:

- it is not a solution for all the issues related to sustainable development or as a guarantee against bankruptcy, it is just a puzzle piece (it covers two of three elements of sustainability);
- it is not a rigid framework or a single strategy, but a method to improve comparability practices with other company strategies;
- it is not a certifiable standard or a reporting format, but can contribute to the improvement of the communication of the results;
- it is not like a "cookery book" with receipts that can be applied by anyone, it needs interpretation and implementation specific to each company.

As Stephan Schmidheiny said (1992), eco-efficiency is achieved only by profound changes in the goals and assumptions that drive corporate activities and change in the daily practices and tools used to reach them. An eco-efficient behaviour

improves environmental performance, helps companies gain market share and contributes to sustainable development.

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