

Development of Eco-efficiency Indicators Regarding Products

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ABSTRACT

In Japan, some leading industries and companies have started to apply the eco-efficiency concept in their business decision-making and/or communication tools with stakeholders. Although still experimental, eco-efficiency indicators are considered to be applicable at the sectoral /corporate level and at a product level.

In this poster, I first describe eco-efficiency indicators of corporate activities at a company level and at a product or level for which there are multi-attribute evaluation items. Second, I present an overview of Project Factor X (supported by the Ministry of Economy, Trade and Industry of Japan and coordinated by the Japan Environmental Management Association for Industry), which is an eco-efficiency indicator project that deals mainly with electronics, chemical, metal and construction materials and ICT services. Finally, I introduce one of the project activities, an eco-efficiency indicator handbook that has been issued recently and describe developing methodologies and steps in the development of eco-efficiency indicators.

The Project Factor X has been examining the establishment of common standards, keeping in mind the fact that the diversity of existing indicators should not be lost, and working toward the development of *de facto* standards. If the project is successful, the indicators are set to become powerful tools that will enhance the competitiveness of environmentally conscious and valuable products in global markets and will also prove useful for purchasers and consumers. Several analyses have been conducted through the project: the principles of a product related to eco-efficiency, the practices of a product to improve its performance and the current product's performances with regard to impacts on the environment and the value. The observation of a variety of implementation of eco-efficiency concept in Japanese industries is carried out.

In the early 2004, the Project Factor X has published a handbook about detailed calculation of the eco-efficiency indicators of products for the first time. The intention is to enhance the concept and apply it into the product sustainability in the practical manner by presenting quantitative evaluation. The handbook presents the methodological aspects and the selection of appropriate eco-efficiency indicators to help companies contribute to sustainability, as well as how the data can be used in the analysis. Economic value (sales, prices, profit etc.) cannot be always appropriate as the evaluation items. Product function needs to be evaluated when the eco-efficiency concept is adopted for sustainable product evaluation.

Status on eco-efficiency indicators in Japan

The indicators have been so far mainly used as decision making/evaluation tools within companies, intending to give incentives for improvement and to serve as the driving forces. But recently the companies start to use the indicators as communication tools with outside. Their purpose is to demonstrate and capitalize on the competitive performance of the products and bring the concept of the eco-efficiency into the market. Such indicators can be conclusive and communicative tools for sales.

Eco-efficiency for company = $\frac{\text{Sales amount}}{\text{Environmental impacts}}$ Example; NEC, SONY, Canon, Ricoh, etc
*Please refer to each company's environmental report

Eco-efficiency for product = $\frac{\text{Product's value}}{\text{Environmental impacts}}$ Example; Matsushita (Panasonic), Mitsubishi, Hitachi, Fujitsu, Toshiba, Nippon Paint
*Please refer to each company's environmental report

Each company's indicator shows a slight difference in terms of system boundaries (gate-to-gate of life cycle basis) and the environmental impact items selected (Table 1,2).

The Project Factor X in Japan

Project Goals and Scopes;

Create Factor (indicator / index) for products and services:

1. To provide quantified environmental information as a single or several integrated numbers
2. To provide comparability across a wide range of industry sectors, companies, and products
3. To accelerate sustainability development of business segments
4. To serve analytical foundation as political tools
5. To link quantified evaluation provided by the factor with DfE and Eco label, or other environmental management tools, and promote them

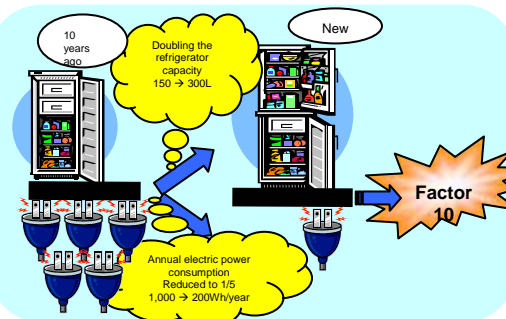


Fig.1. Operation of eco-efficiency and factor approach

$$\text{Eco-efficiency} = \frac{\text{Product's value}}{\text{Environmental load}}$$

$$\text{Factor} = \frac{\text{Eco-efficiency of the assessed product (new)}}{\text{Eco-efficiency of the yardstick product (old)}}$$

In the project, probable Factors based on eco-efficiency were examined (Table 3). Historical trends were tracked for some products. Economic value, price were also examined as the indicators. Prices cannot be always appropriate as the evaluation items. Product function needs to be evaluated when the eco-efficiency concept is adopted for sustainable product evaluation so that planners and engineers are motivated to take an active role.

Release of "Eco-efficiency Indicator Handbook for Products" in 2004

Objective;

The "Eco-efficiency" and "factor" concepts were proposed about ten years ago, but the definition of indicator and the study and application of the formulae and other specific methods has barely begun in Japan. These concepts are at the early stage in a sense, when companies where they have already been introduced are working to increase their staff's understanding of them and encourage their staff to apply them to their activities. But interest in the concept of eco-efficiency that aims to lower environmental impact and increase value is growing steadily as a concept essential for corporate management. This handbook responds to this growing interest by introducing outlines of the significance of the eco-efficiency and factor concepts and of the benefits of their application by explaining practical application methods. The targeted readers are assumed to be primarily business sectors. <http://www.jemai.or.jp/english/eco-efficiency/>

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CONCLUSIONS

It seems that methods for devising company-level eco-efficiency indicators are similar to each other. However, the boundaries for quantifying the emissions of CO₂, for instance, are not universally agreed on. If comparisons are to be made in the future, then standards or consensus with regard to methods are required. What kinds of data and what boundaries should be used are critical issues. At a product level, the existing eco-efficiency indicators cover the same issues. There are still many unresolved challenges concerning eco-efficiency and Factor, but it is important to know they have just begun. These challenges will not be overcome quickly. There are various conditions including products that are expected to rise in value rather than to reduce environmental impact, and others whose environmental impact should be reduced while maintaining a constant value. Setting calculation rules for the environmental impact and product value for each group of products might be a shortcut to mutual understandings. Many items and calculation methods concerning eco-efficiency and Factor are being tried out, and the direction has been becoming clearer and closer. Attention often focuses only on differences between calculation methods, but at corporations that have aggressively undertaken this task, they have become an important foundation for determining the orientation of the indicator. We hope that this handbook will be a valuable reference for corporations developing products that benefit the environment by introducing indicator in order to achieve sustainable society.

Table 1 Example of Eco-efficiency indicator (environmental impact)

Major items	Items	Examples of items
Input	Energy consumption	Energy consumption (electric power, fossil fuels, etc.)
	Resource consumption	Materials (raw materials, solvents, intermediate products, etc.) Water
	Chemicals	Lead, toluene, mercury, etc.
Output	Quantity of outputs	Quantity of output of substances harmful to the ozone layer
		Quantity of output of greenhouse gasses
		Acidification coefficient, Waste material

Table 2 Comparison of existing eco-efficiency indicators for product

	Denominator						Numerator	Example
	Resource consumption		Energy consumption		Toxicity (chemical use)			
	Apply or not	Life cycle or not	Apply or not	Life cycle or not	Apply or not	Life cycle or not		
Fujitsu	No	-	Yes	Yes	No	-	Yes	PC, scanner
Matsushita (Panasonic)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Home electronics
Hitachi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Washing machine
Mitsubishi	Yes	No	Yes	No	Yes	No	Yes	Home electronics
Each environmental impact is integrated								

Table 3 Results of examining various products Factor

Product	Nominator of E.E.	Denominator of E.E.	Year of evaluation	Year of baseline	Factor
Toilet	Width (cm ²)	Life cycle CO ₂	2002	1996	2.182
PC	MPU processing capacity, hard disk capacity (GB)	Life cycle CO ₂	2001	1998	7.800
Printer	Printing speed (ppm), image quality (dpi)	Life cycle CO ₂	2002	2000	3.314
DVD	No. of functions, weight	Electricity for use	2002	2000	2.995
Radiator	Ease of disassembly, product service life, number of parts (unit: coefficient)	Weight	Latest	Previous	6.716
Paper	Amount of production	Life cycle CO ₂	2001	1999	0.933
Watch	Amount of sales	CO ₂ for production	2001	2000	0.987

The handbook points out the way of effective use, adding explanation that Factor concept originally had a global perspective, but it is a concept that can be applied to products. When it is applied effectively, it assists the progress in efforts to lower the environmental impacts while increasing value;

Effective Use

1. Incentives for planners and developers
2. Driving force behind the creation of eco-products
3. Communication tools for responding to customer's requests for environmental product information

Through experiences, the handbook suggests some principles for applying eco-efficiency and Factor;

Principle for applying eco-efficiency and Factor

1. Clarify definition of eco-efficiency and disclose
2. Select items of eco-efficiency to ensure transparency and reliability
3. Clarify the definition of Factor
4. Clarify the baseline year or the product model name that is yardstick when disclosing Factor
5. Clarify the definition of Factor that discloses eco-efficiency calculation data for both the nominator and denominator