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Indicators of technological processes environmental estimation

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ABSTRACT

Purpose: The paper presents a possibility using indicators of technological processes estimation which make possible decrease negative environmental influence these processes on the environment.
Design/methodology/approach: The article shows the direction of enterprises efficiency estimation in favour of environment. It also presents the necessity of production with responsibility of environment. It requires formulating definite aims and justification of workers to integration of the environment protection.
Findings: The environmental indicators should have more and more meaning in the enterprises development. Complying to suitable principles makes possible technological processes realization and products producing which do not negative influence on the environment. They save energy and getting out natural resources and assure the safer work conditions.
Research limitations/Implications: Using environmental indicators is connected with many advantages for enterprises, for example: control by given indicator of characterized areas, help in decision making in the range of environment protection, enlarging efficiency and effectiveness of companies.
Practical implications: Knowledge of environmental indicators (develop by ISO, GRI, CWRT, etc.) makes possible conducting of ecological activity effects estimation of every organization.
Originality/value: In this article the main indicators of technological processes ecological estimation were reviewed. It identifies major functions of indicators and proceeds to presenting the role of indicators in achievement of sustainable production.
Keywords: Environmental management; Sustainable production; Environmental indicators; Technological process

1. Introduction

Since the Earth Summit in Rio de Janeiro in 1992, in many countries workings in direction to reducing environmental influences connected with the social and economic development of the world were undertaken [1,2]. It results from tragic character of present ecological problems that solution is possible only in co-operation of many countries. European Union many legal governings that define the requirements for environmental management systems elaborated. These systems treat the environment protection as the integral part of politics and economic practice [3,4]. Possession and applying the environment management systems is not only the symptom of manufacturers ecological consciousness but also improves the firm picture and creating its market position [3,5].

The principle: "management by the environment" is applied more and more often at the production and service plants level and at the work position. In the workings in favour of sustainable development this principle joints economic and ecological aspects [6,7,8].

EMAS (I, II) and ISO 14001 propagate "management by the environment" as the essential element of workings in favour of sustainable development (SD) introducing the duty of continuous uplifting of requirements level and improvement mechanisms [3].

The definition of sustainable development shows, that the economic and civilization development of the present generation should not exhausts unrenewable resources and destroys the environment because future generations have to possess right to theirs development [8].

To achieved SD must be three aims fulfilled: economic (material), environmental (natural) and social (human).

In case of sustainable development of enterprises the object of development becomes enterprise and not the world and civilization [5].

2. Sustainable production

The concept of sustainable production has emerged in 1992. It is a main model of sustainable development, which considers three principal requirements: social, economic and environmental [6].

In the professional literature many authors [9,10] define sustainable production as: "the creation of goods and services using processes and systems that are: non-polluting, conserving of energy and natural resources, economically viable, safe and healthful for employees, communities and consumers and socially and creatively rewarding for all working people".

We can distinguish many necessary conditions that firms must fulfill to be sustainable [11]:

- reducing the use of materials and energy in products and their production,
- minimization of waste,
- reuse and recycling of products,
- environmental industries,
- cleaner production technological processes,
- efficiency in transport networks, etc.

Because of many advantages connected with improvement efficiency companies begun to work on reduction of their impact on the environment [9,10,11,12].

3. The basis of enviroment protection indicators creating

The indicator of the environment protection is a value on the basis of parameter received which treats to information or delivers information describing environmental phenomenon or the part of the natural environment about wider meaning than parameter value [9]. The enterprise environmental performance evaluation with suitable indicators using, delivering definite information, it is connected with knowledge both from the range of the environment protection and also from the range of the technical and organizational aspects of enterprise functioning using.

In creating the model of conducting "ecological effectiveness" estimation should be committed numerous interdisciplinary projects group. This group consisting from the employees of various levels and the enterprise areas. The first step of the model creating is the estimation planning, which identifies all enterprise environmental aspects and sorts from them preference aspects. For chosen preference aspects generated the indicators of the environment estimation (using existing or new introducing) that deliver the most precise information about individual aspects. To obtain the final indicator (indicators) version which describes the definite aspect, we can accomplish multiple changes in its choice. It depends from suitable data for this indicator gaining [13].

Figure 1 presented a schema of enterprise environmental performance evaluation process.

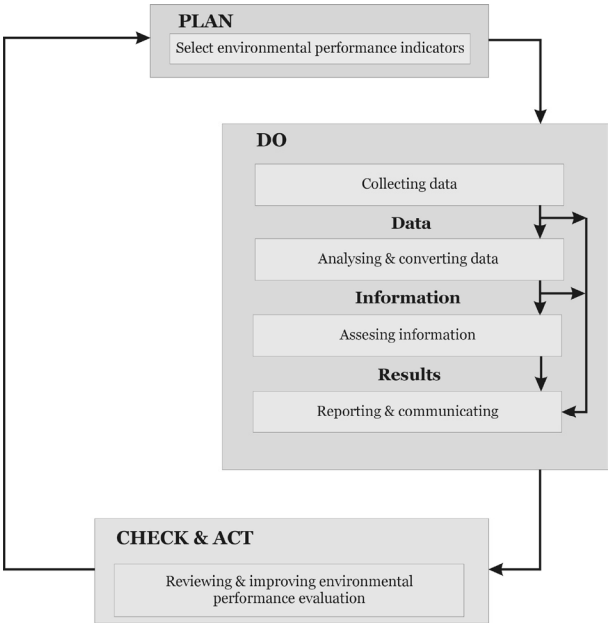

Fig. 1. Schema of enterprise environmental performance evaluation process [13]

4. Examples of enviroment protection indicators

4.1. ISO 14031

Environmental Performance Evaluation (EPE) is based on the headword "what gets measured, gets managed". It has been used globally by companies not only in the manufacturing but also in health services, transportation, electrical utility and municipal sectors. Its main aim is improves environmental performance, provides a basis for performance benchmarking, demonstrates compliance to regulations and increases operational efficiency.

EPE is a new term used to describe a formal process of measuring, analyzing, reporting and communicating an organization's environmental performance against criteria set by its management.

Certain concepts and components of EPE have been applied for more than a decade. Nowadays ISO 14031 provides a structured approach for organizations to follow independent of location, complexity and type of activity [13].

ISO 14031 is an international standard. It describes a process for measuring environmental performance. It is not a standard for certification like ISO 14001.

It describes two general indicators categories to support the implementation of EPE [13]:

- environmental performance indicators (EPIs) and
- environmental condition indicators (ECIs).

Management performance indicators (MPIs) are a type of EPI. They provide information to support the evaluation of management efforts to influence the environmental performance of the organization's operations. MPIs relate to the policy, people, planning activities, practices, procedures, decisions and actions.

Operational performance indicators (OPIs) are also a type of EPI. These indicators provide management with information on the environmental performance of the organization's operations.

ECIs provide information about the local, regional, national or global environment condition. This information may help an organization to better understand the actual impact or potential impact of its environmental aspects and thus assist in the planning and implementation of EPE [13].

4.2. Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) was originally convened in 1997 by the Coalition for Environmentally Responsible Economies (CERES), along with the United Nations Environment Programme (UNEP). In 2002, at the World Summit on Sustainable Development, the GRI became a permanent institution, with headquarters in Amsterdam. The GRI is a collaborating centre of UNEP and works in cooperation with UN Secretary-General Kofi Annan's Global Compact.

In many publications we can find that [14]: "the GRI was established to develop, promote and disseminate a generally accepted framework for sustainability reporting".

The GRI Guidelines are a framework for reporting on an organization's economic, environmental and social performance.

The Global Reporting Initiative has more than 100 optional performance indicators for sustainability. Their recommendations are [14]:

- they do not establish any codex or any collection of the functioning principles,
- they do not establish the activity standards (on example they do not define any admissible emissions of specific substances pollutioning the environment),
- they do not mark any management system.

Areas and the reporting indicators showed in table 1.

Indicators are divided on so-called basic indicators, that they are important both for the company preparing the report and for social partners and so-called additional reports indicators.

Every indicator has a short description informing, what data you should put in the report.

Around 750 companies use the guidelines and the GRI predicts that by 2010 up to 5000 companies will be using them.

Table 1.
Chosen reporting indicators in GRI [14]

Area	GRI number	Indicator
		Economic performance indicators
Customers	EC2	Geographic breakdown of markets
Suppliers	EC4	Percentage of contracts paid in accordance with agreed terms, excluding penalty arrangements
Employees	EC5	Total payroll and benefits (including wages, pension other benefits and redundancy payments) broken down by country or region
Public sector	EC8	Total sum of taxes of all types paid broken down by country
	EC9	Subsidies received broken down by country or region
		Environmental performance indicators
Materials	EN1	Total materials use other than water, by type
Energy	EN3	Direct energy use segmented by primary source
	EN4	Indirect energy use
Water	EN5	Total water use
Emissions, effluents and wastes	EN11	Total amount of waste by type and destination
		Social performance indicators
Strategy and management	HR2	Evidence of consideration of human rights impacts as a part of investment and procurement decisions, including selection of suppliers/contractors
		Social performance indicators – human rights
Non discrimination	HR4	Description of global policy and procedures/programs preventing all forms of discrimination in operations, including monitoring systems and results of monitoring
		Social performance indicators – society
Community	SO2	Description of the policy, procedures/management systems and compliance mechanisms for organizations and employees addressing bribery and corruption
		Social performance indicators – product responsibility
Products and services	PR2	Description of the policy, procedures/management systems, and compliance mechanisms related to product information and labeling

4.3. The Center for Waste Reduction Technologies (CWRT)

The Center for Waste Reduction Technologies (CWRT) is an industry sponsored, non-profit organization, affiliated with the American Institute of Chemical Engineers (New York). This professional organization represent 57,000 chemical engineers [15].

The CWRT is a consortium of 30 sponsors, largely from the manufacturing sector which is focused on the development of innovative waste elimination technologies and tools for sustainable development. It promotes source reduction by novel technologies, waste management and in situ remediation.

Industries represented range from chemicals to pharmaceuticals to building materials and appliances.

The most useful of the tools are: Total Cost Assessment, Automated Lifecycle Inventory and Sustainability Metrics. These tools have been refined and tested in many companies [15].

The Total Cost Assessment (TCA) methodology consists of seven phases [15]:

1. Identify the best industry practices for total cost assessment.
2. Acquire methodologies, automation tools and build databases of available information on direct, indirect and future and contingent costs. Test the tool in three CWRT companies.
3. Automate the tools and develop methodology for internal and external intangible costs.
4. The development of methodology for evaluation and monetization of societal costs where no cost data are relatively available.
5. Develop comparable mechanisms for identifying and monetizing benefits.
6. Meld the concepts of TBCA (Total Benefit and Cost Assessment) with those of metrics and indicators.
7. Extend concepts beyond manufacturing.

This methodology gave a good start for indicators and metrics (e.g. Material Use Metric, Water Use Metric, Energy Metric, Pollutant Dispersion Metric, Toxics Dispersion Metric, Land Use Metric) of industrial performance [15].

5. Conclusions

Indicators are typically numerical measures that provide key information about a physical, social or economic system. They have three key objectives: to raise awareness and understanding, to inform decision-making and to measure progress toward established goals.

Indicators have numerous applications. Companies can use indicators to set targets and monitor consequent success.

Numerous organizations are presently trying to develop a set of indicators to state the progress of a company towards sustainability [16]. Among them we can favour: International Organization for Standardization, Global Reporting Initiative and Center for Waste Reduction Technologies. Nevertheless results demonstrate that most indicator frameworks are still under development and none is applicable as a whole to evaluate sustainable production.

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