Environmental Performance Indicators and their Evaluation

Environmental performance

Results of an organization's management of its environmental aspects

Environmental aspects

Element of an organization's activities , products or services that can interact with the environment.

Environmental performance evaluation (EPE)

Environmental performance evaluation (EPE) is an internal process to facilitate management decisions regarding an organization's) environmental performance by selecting indicators, collecting and analysing data, assessing information against environmental performance criteria, reporting and communicating, and periodically reviewing and improving this process.

The information generated by EPE can help an organization to:

— identify its environmental aspects and determine which aspects it will treat as significant;

— set objectives and targets for improving environmental performance and assess performance against these objectives and targets;

— identify opportunities for better management of its environmental aspects;

— identify trends in its environmental performance;

— review and improve efficiency and effectiveness;

— identify strategic opportunities;

— evaluate compliance or risk of non-compliance with compliance obligations to which the organization subscribes related to its environmental aspects;

— report and communicate environmental performance internally and externally.

Management commitment to EPE is essential and should be part of the regular business functions and activities of an organization. EPE should be appropriate to the size, location and type of organization, and its needs and priorities. Internally, EPE can help the organization to achieve its environmental performance objectives and targets and also to enlist the involvement of an EMS. EPE can also be used to report and communicate information on the organization's environmental performance to external interested parties to demonstrate its commitment to improvement

EPE, as detailed in this document, follows a Plan-Do-Check-Act (PDCA) management model.

The steps of this ongoing process are as follows:

Plan

1. Planning EPE
2. Selecting indicators for EPE (the process of selecting indicators may include both choosing from existing indicators and developing new indicators

Do

Using data and information which includes

1) Collecting data relevant to the selected indicators
2) Analysing and converting data into information describing the organization environmental performance
3) Assessing information describing the organization's environmental performance in comparison with the organization's environmental performance criteria
4) Reporting and communication information describing the organization's environmental performance

C Check and act

Reviewing and improving EPE

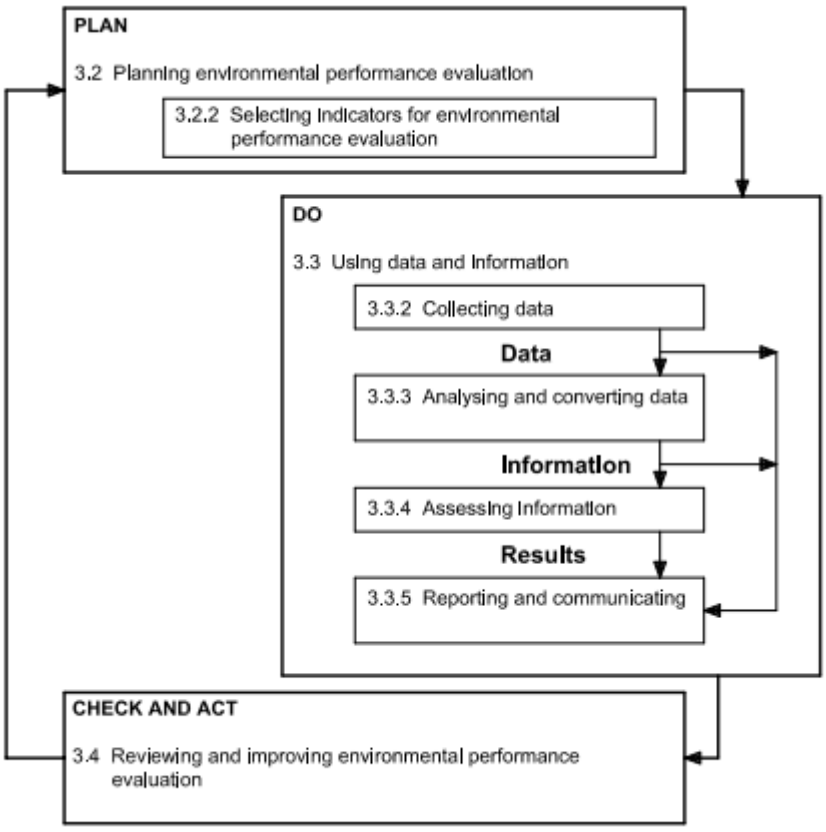

Figure 1 provides an outline of EPE, with references to the numbers and titles of relevant clauses in this international standard

Indicators for EPE

Two general categories of indicators for EPE

1. Environmental performance indicators (EPIs) and
   There are two types
   a) Management Performance Indicators
   b) Operational Performance Indicators

2. Environmental Condition Indicators

Management performance Indicators (MPIs) are a type of EPI that provide information about management efforts to influence the environmental performance of the organizations operations. MPIs relate to the policy, people, practices, procedures, decisions and actions at all levels of the organization"

The management area consists of the various planning, administrative and decision-making processes that make up management.

Management decisions relating to the environment include:

1. deciding how much money to spend on environmental management activities
2. deciding how much training to provide to employees
3. deciding whether to develop an environmental management system Obviously management activities can have a considerable influence on the actual environmental performance of the firm.

The indicators used to measure the environmental aspect of management activities are called management performance indicators (MPIs).

Examples of management performance indicators include:

i. number of environmental objectives and targets achieved
ii. number of employees trained
iii. number of suppliers and contractors questioned about their environmental management practices
iv. frequency of review of operating procedures

One important category of MPIs is financial indicators.

Financial indicators aim to measure the effects of environmental management activities on a firm's financial performance. (The aim here is to integrate the environmental dimension of a firm's activities into traditional cost accounting and business management considerations.)

Examples of financial indicators include:

i. cost (both capital and operational) over time of activities related to environmental performance
ii. ii. savings achieved over time through waste recycling, reductions in resource use or resource substitution
iii. iii. return on investment for environmental improvement projects

Operational performance indicators (OPIs) are a type of EPI that provide information about the environmental performance of the organization's operations

The operational area consists of the operations of the firm's physical facilities and equipment i.e. those activities that have an environmental aspect. Examples of operational activities include manufacturing processes, the heating and lighting of buildings, transport activities, the operation of office equipment. As the activities in the operational area are those which have environmental aspects, they are the activities that determine the firm's actual environmental performance.

OPIs relate to:

1. the design, operation, and maintenance of the organization's physical facilities and equipment;
2. the materials, energy, products, services, wastes, and emissions related to the organization's physical facilities and equipment; and
3. the supply of materials, energy and services to, and the delivery of products, services and wastes from the organization's physical facilities and equipment".

The indicators used to measure the environmental aspects of operational activities are known as operational performance indicators (OPIs).

Examples of OPIs include:

i. Total energy use per year
ii. Waste production per year
iii. Emissions of NOx per unit of production
iv. Water use per unit of production

Environmental Condition indicators (ECIs)

ECIs provide information about the condition of the environment. This information can 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

It measure the condition of the environment.

Examples of ECIs include:

i. contaminant concentration in air/groundwater/surface water/soil/plant tissue/ animal tissue
ii. number of coliform bacteria per liter of water
iii. odor measured at specific distance from the organization's facility

Whereas OPIs measure a company's environmental aspects, ECIs can be used to measure a company's actual impact on the environment i.e. any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services

The decision and actions of an organization's management are closely related to the performance of its operations. Figure 2 illustrates the interrelationship among an organization's management and operations and the conditions of the environment, noting the type of indicators for EPE related to each of these elements

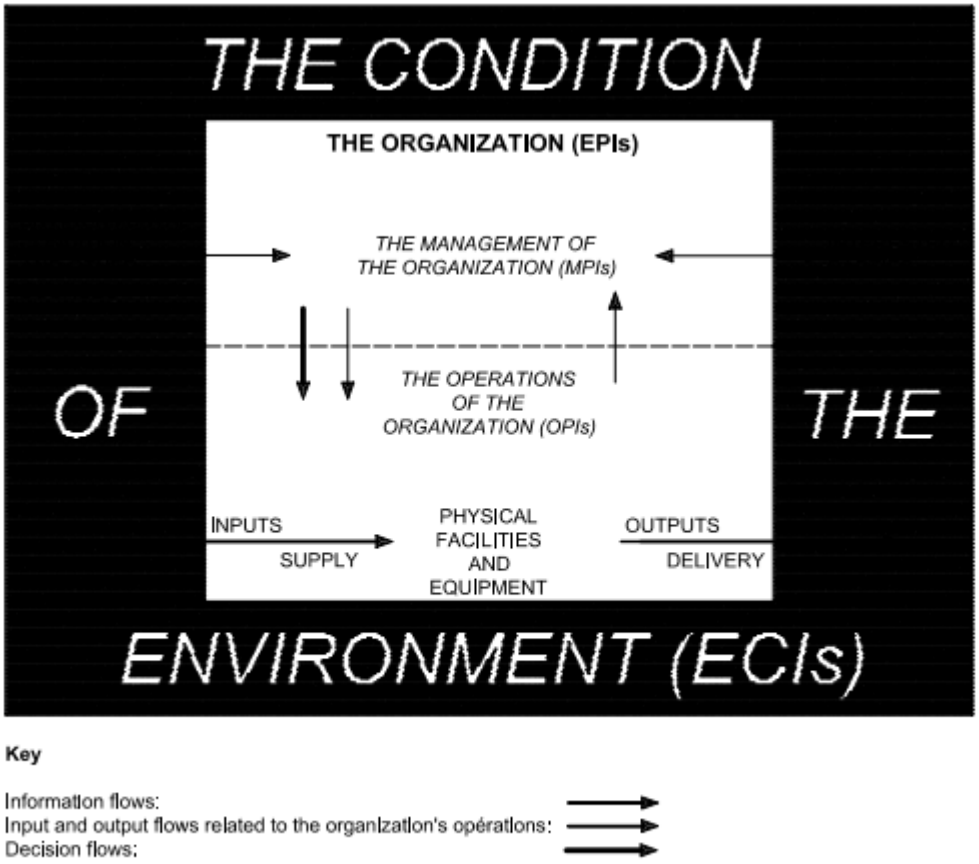

Figure 2 — Interrelationships of an organization's management and operations

Principles for the derivation of environmental indicators also laid down in the standard are

1. Comparability: the indicators must be comparable and reflect changes in environmental performance.
2. Target-orientated: the selected indicators must be chosen so they can act towards goals which are able to be influenced by the firm.
3. Balanced: the indicators must reflect environmental performance in a concise manner, and display problem areas as well as benefits in a balanced manner.
4. Continuity: for sake of comparison, the indicators must be derived the by the same criteria and relate to each other through corresponding time series and units.
5. Frequency: indicators must be derived frequently enough (monthly, quarterly, yearly) so that action can be taken in due time.
6. Comprehensability: the indicators must be understandable for the user and correspond to his information needs. The system has to be lucid and concentrate on the most important figur

TYPES OF EPIS

There are 4 types of indicators

1. absolute indicators
2. relative indicators
3. aggregated indicators
4. indexed and weighted indicators

Absolute indicators

Absolute indicators measure basic data.

Examples of absolute indicators include:

i. Tonnes of CO2 emitted per year
ii. Tonnes of wastes generated per year
iii. Liters of cooling water used per year

Relative indicators

Relative indicators can be used by comparing absolute consumption or emission figures with meaningful reference data.

They can be separated into efficiency ratios and quotas as mentioned below;

i. efficiency ratios describe the use of resources or the amount of emissions in relation to production inputs or production outputs, e.g. CO2 emissions per unit of production, water use per unit of production or quantity of waste produced per unit of input material
ii. quotas describe the sub-section of a measure in relation to the whole measure, e.g. the proportion of company vehicles running on unleaded fuel

Aggregated indicators

Aggregated indicators bring together data from a number of separate categories into a more general category. An example of an aggregated indicator is annual waste disposal. Annual waste disposal is a general category and consists of the sum of all the separate waste streams. Other examples of aggregated indicators include: i. Total energy consumption. ii. Total hazardous waste produced. iii. Total annual vehicle mileage.

Annual vehicle mileage, for example, is made up of the annual mileages of the different types of vehicles used (lorries, vans, cars) and the mileage done on different fuels (petrol, diesel, electric vehicles).

Weighting and indexes

If a firm wishes, it can combine information on all of its environmental aspects into a single number representing its environmental performance. This is usually done by multiplying each aspect by a weighting relating to its environmental significance and then adding all the weighted aspects together. Weighting can be done using a simple scale like the one below. Most significant aspect: weighting factor 10 Least significant aspect: weighting factor 1

Table 1: Examples of Performance Indicators and Metrics

Operating Performance Indicator (OPI)	Management Performance Indicator (MPI)	Environmental Condition Indicator (ECI)
Raw material used per unit of product (kg/unit)	Environmental costs or budget ($/year)	Contaminant concentrations in ambient air (µg/m^3)
Energy used annually per unit of product (MJ/1000 L product)	Percentage of environmental targets achieved (%)	Frequency of photochemical smog events (#/year)
Energy conserved (MJ)	Number employees trained (% #trained/to be trained)	Contaminant concentration in ground- or surface water (mg/L)
Number of emergency events or unplanned shutdowns (#/year)	Number of audit findings (#)	Change in groundwater level (m)
Hours of preventive maintenance (hours/year)	Number of audit findings addressed (#)	Number of coliform bacteria per liter of potable water
Average fuel consumption of vehicle fleet (L/100 km)	Time spent to correct audit findings (person-hours)	Contaminant concentration in surface soil (mg/kg)
Percentage of product content that can be recycled (%)	Number of environmental incidents (#/year)	Area of contaminated land rehabilitated (hectares/year)
Hazardous waste generated per unit of product (kg/unit)	Time spent responding to environmental incidents (person-hours per year)	Concentration of a contaminant in the tissue of a specific local species (µg/kg)
Emissions of specific pollutants to air (tonnes CO_2/year)	Number of complaints from public or employees (#/year)	Population of an specific animal species within a defined area (#/m^2)
Noise measured at specific receptor (dB)	Number of fines or violation notices (#/year)	Increase in algae blooms (%)
Wastewater discharged per unit of product (1000 L/unit)	Number of suppliers contacted about environmental management (#/year)	Number of hospital admissions for asthma during smog season (#/year)
Hazardous waste eliminated by pollution prevention (kg/year)	Cost of pollution prevention projects ($/year)	Number of fish deaths in a specific watercourse (#/year)
Number of days air emissions limits were exceeded (days/year)	Management levels with specific environmental responsibilities (#)	Employee blood lead levels (µg/100 mL)

Appendix A.

Examples of management performance indicators The following Appendices contain examples for environmental performance indicators, mainly taken from the annexes to ISO 14031.

A.1. Implementation of policies and programs

O number of achieved objectives and targets;
O number of organizational units achieving environmental objectives and targets;
O degree of implementation of specified codes of management or operating practice;
O number of levels of management with specific environmental responsibilities;
O number of employees that have environmental requirements in their job descriptions;
O number of employees participating in environmental programs (e.g. suggestion, recycle, clean-up initiatives, reward and recognition, or others);
O number of employees trained versus the number that need training;
O number of environmental improvement suggestions from employees;
O results of employee surveys on their knowledge of the organization's environmental issues;
O number of suppliers and contractors queried about environmental issues;
O number of contracted service providers with an implemented or a certified environmental management system;
O number of products with explicit "product stewardship" plans;

O number of products designed for disassembly, recycling or reuse.

A.2. Conformity

O degree of compliance with regulations;
O number of non-compliances
O degree of compliance with regulations by contracted service providers;
O time to respond to or correct environmental incidents;
O numbers of resolved and unresolved corrective actions;
O number of or costs attributable to fines and penalties;
O number and frequency of specific activities (e.g. audits);
O number of audits completed versus planned;
O number of audit findings per period;
O frequency of review of operating procedures;
O number of emergency drills conducted;
O percentage of emergency preparedness and response drills demonstrating planned readiness;

A.3. Financial performance

O costs (operational and capital) that are associated with a product's or process environmental aspects;
O return on investment for environmental improvement projects;
O savings achieved through reductions in resource usage, prevention of pollution or waste recycling; O sales revenue attributable to a new product or a byproduct designed to meet environmental performance or design objectives;
O research and development funds applied to projects with environmental significance;
O environmental liabilities that may have a material impact on the financial status of the organization.

A.4. Community relations

O number of inquiries or comments about environmentally related matters; O number of press reports on the organization's environmental performance;
O number of environmental educational programs or materials provided for the community;
O resources applied to support of community environmental programs;
O number of sites with environmental reports;
O number of sites with wildlife programs;
O number of local cleanup or recycling initiatives, sponsored or self-implemented;
O favourability ratings from community survey

Appendix B. Examples of operational performance indicators

B.1. Materials

O quantity of materials used per unit of product;
O quantity of processed, recycled or reused materials
O quantity of packaging materials discarded or reused per unit of product;
O quantity of auxiliary materials recycled or reused;

O quantity of raw materials reused in the production process;
O quantity of water per unit of product;
O quantity of water reused;
O quantity of hazardous materials used in the production process.

B.2. Energy

O quantity of energy used per year or per unit of product;
O quantity of energy used per service or customer;
O quantity of each type of energy used;
O quantity of energy generated with by-products or process streams;
O quantity of energy units saved due to energy conservation programs.

B.3. Services supporting the organization's operations

O amount of hazardous materials used by contracted service providers;
O amount of cleaning agents used by contracted service providers;
O amount of recyclable and reusable materials used by contracted service providers;
O amount or type of wastes generated by contracted service providers.

B.4. Physical facilities and equipment; supply and delivery

O average fuel consumption of vehicle fleet;
O number of freight deliveries by mode of transportation per day;
O total land area used for production purposes;
O number of vehicles in fleet with pollution abatement technology;
O number of business trips saved through other means of communication;
O number of business trips by mode of transportation;
O land area used to produce a unit of energy

B.5. Products

O number of products introduced in the market with reduced hazardous properties;
O number of products which can be reused or recycled;
O percentage of a product's content that can be reused or recycled;
O rate of defective products;
O number of units of by-products generated per unit of product;
O number of units of energy consumed during use of product;
O duration of product use;
O number of products with instructions regarding environmentally safe use and disposal.

B.6. Services provided by the organization

O amount of cleaning agent used per square meter (for a cleaning services organization);
O amount of fuel consumption (for an organization whose service is transportation);
O quantity of licenses sold for improved processes (for a technology licensing organization);
O quantity of materials used during after-sales servicing of products.
B.7. Wastes O quantity of waste per year or per unit of product;
O quantity of hazardous, recyclable or reusable waste produced per year;

O total waste for disposal;
O quantity of waste stored on site;
O quantity of waste controlled by permits;
O quantity of waste converted to reusable material per year.

B.8. Emissions

O quantity of specific emissions per year;
O quantity of specific emissions per unit of product;
O quantity of waste energy released to air;

B.9. Effluents to land or water

O quantity of specific material discharged per year;
O quantity of specific material discharged to water per unit of product;
O quantity of waste energy released to water;
O quantity of material sent to landfill per unit of product;
O quantity of effluent per service or customer.

B.10. Other emissions

O noise measured at a certain location;
O quantity of radiation released;
O amount of heat, vibration or light emitted.