

SELF-EVALUATING AND BENCHMARKING ENVIRONMENTAL PERFORMANCE OF BUSINESSES: A WEB-BASED APPROACH

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EXTENDED ABSTRACT

The methodology for the development of web-based Diagnostic Tools for the evaluation of environmental performance of businesses is being presented. A Web node has been developed in order to address the specific needs of the small and medium enterprises (SMEs) of three important economic areas in the Mediterranean region, the food, the textile and the hotel sector. The node provides the targeted businesses with important information on the technological and legislative field.

The Diagnostic Tools evaluate environmental performance on the basis of the business operational data. A limited set of environmental indicators is being calculated, and the business environmental performance is compared to that of its competitors as well as to literature data, representing the concept of the "*Best Available Techniques*".

The performed diagnosis results at the identification of potential environmental problems in the daily operation of a company. The model suggests actions of minor and/or greater cost to be undertaken in order to improve environmental performance and calculates the potential benefit on the operational cost. The overall objective is to assist SMEs to increase their competitiveness and thereby their position in the market.

Key words: Environmental performance, indicators, environmental benchmarking, web-node, competitiveness, SMEs.

1 INTRODUCTION

Most economic activities are imposing a heavy burden on the environment, as they involve the consumption of primary resources and raw materials, whilst generating waste and pollution. In the previous decades, regulatory measures of "*command and control*" type have been mainly used to dictate a certain approach towards the environment for companies and other organizations. Recently a major change is emerging as businesses began to realize that a more conscious and pro-active environmental behavior would result in economic and competitive benefits, ensuring in the same time their legislative compliance.

Leading companies have learned over time that only by systematizing and integrating environmental protection into overall management practices can they achieve affordable, consistent compliance with internal and external requirements [2]. The trend is being expanded to smaller companies, which are trying to survive in the highly competitive global market. The benefits from adopting and implementing improved environmental management may fall into two broad categories:

- The first category addresses the fact that improved environmental management is beneficial for the planet and a fundamental requirement of global sustainability.

- The second category addresses the fact that improved environmental performance could be seen as a future requirement of sustainable commerce.

Parallel to the evolution of environmental management systems, the development of environmental performance evaluation models was initiated. Environmental performance evaluation is the process of selecting environmental indicators and measuring, analyzing, assessing, reporting and communicating an organization's environmental performance against certain criteria [5]. Businesses should fulfill their growing need to obtain more detailed insight into their environmental performance and to benchmark against competitors on one hand, and also to respond to the increasing pressures from the part of regulatory authorities, local communities, employees, NGOs and other stakeholders. This led to a request for developing environmental evaluation systems [6]. Hereafter, companies will be asked to evaluate and assess their environmental performance, in addition to their financial results.

An increasing need for tools allowing for a reliable quantification and measurement of companies' environmental performance has emerged. Environmental performance indicators are not only used for the evaluation of environmental performance, but can also aid businesses in selecting environmental friendly techniques, benchmarking, environmental reporting and establishing an environmental management system [9]. In the process of developing suitable measurement and evaluation systems and tools, some critical questions that require answers have arisen:

- What variables and indicators should be included in a comprehensive and flexible measurement system of environmental performance?
- Should environmental indicators be generic (applicable to all sectors and industries) or sector specific?
- Could a rather restricted set of environmental indicators efficiently assess companies' environmental performance and its evolution over time?
- How could environmental performance benchmarking be achieved within industries at a national, regional or international level?
- How could environmental performance measurement and benchmarking be used as a managerial tool to help companies in decision making?

Multiple initiatives have been undertaken for the development of environmental performance measurement and reporting frameworks by governments, industries, international organizations, NGO's and academics [3, 5, 7, 8, 11]. The scope of these initiatives is different and there is an obvious divergence in their perspectives. However, a remarkable convergence in the final proposed set of environmental performance indicators is evidence of a partial answer to the above questions:

- A rather restricted set of generally applicable environmental indicators, complemented by a few sector or company specific indicators, can sufficiently measure and evaluate companies' environmental performance.
- Environmental indicators used are ratios of environmental variables (e.g. consumption of water or energy, emissions to air) to output (physical or financial) variables.

2 METHODOLOGICAL APPROACH

In the above context, a model has been developed to stimulate SMEs to conduct environmental audits and self-evaluate their environmental performance. The Internet-based tool that has been developed is supporting SMEs to:

- Evaluate their environmental performance and assess its evolution over time.
- Benchmark their performance against competitors at regional and international level.
- Adopt “Good Practice” and/or Cleaner Production Guidelines for improving their environmental performance.
- Evaluate economic benefits from the adoption of the above measures.

2.1 Structure of the Internet-based Tool

The web based node consists of two major domains:

- A *public domain* (Figure 1), intended to provide information and knowledge on issues related to:
 - The structure of the targeted businesses and the operational framework of the industry.
 - The governing environmental legislation.
 - The latest developments on the technology used worldwide in similar businesses.
 - The identified contact points where the end-users would receive assistance on their daily business operation.
- A *private domain* (Figure 2), containing Diagnostic Tools, for the registered SMEs only, where the users would evaluate their:
 - Environmental performance.
 - Administrative performance.
 - Legislative compliance.

Upon completion of the diagnostic sessions, the users would receive guidance on how to improve their performance, by the adoption of simple measures that do not require major capital investment.

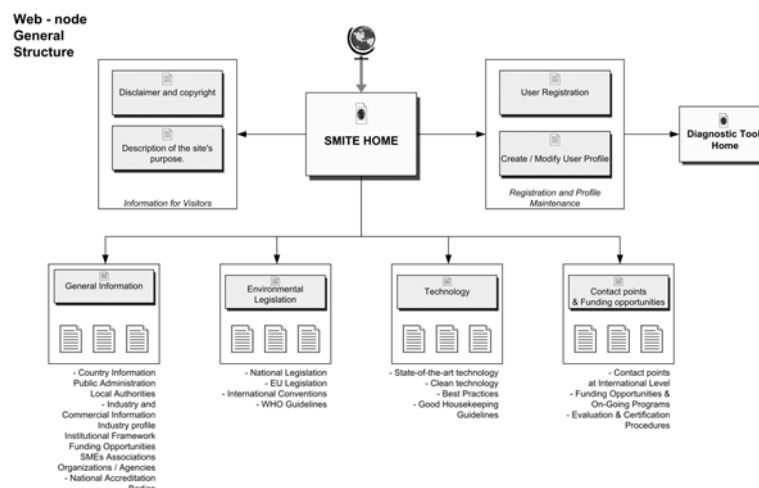


Figure 1: Public domain of the web-based node

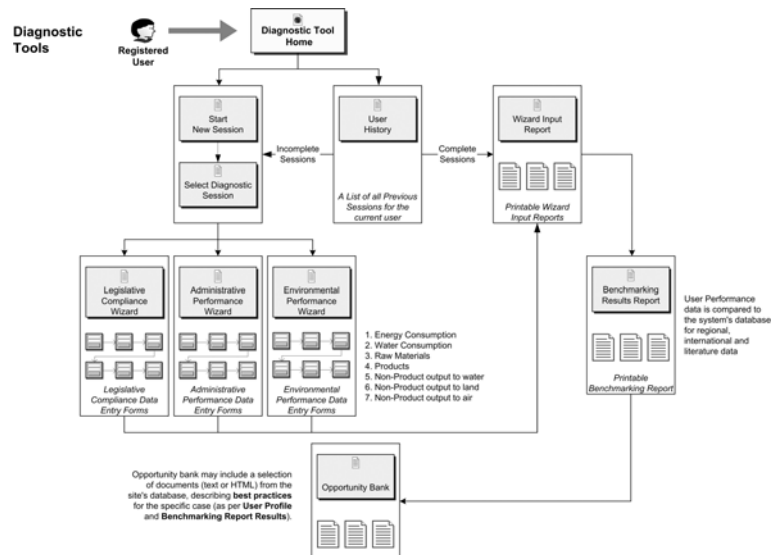


Figure 2: Private domain of the web-based node

2.2 Performance variables and indicators

The evaluation of the environmental performance of the targeted industries is based on a simplified set of *performance indicators*, which allow individual industries to be benchmarked on a regional and international scale. The indicators are estimated on the basis of *performance variables* provided by companies. These are distinguished in *organizational variables* (management and business variables) and *environmental variables*. The above variables are expected to be available for companies, and they can be used as inputs for the estimation of *performance indicators*. Performance indicators are normalized measures of performance, in essence simple ratios of two variables [10]. According to the so far proposed measurement framework, the most common variables used as denominators to construct environmental performance indicators are:

- A standardized unit of production for a given sector (e.g. tonnes of product).
- Total sales for a given company.
- Number of employees.
- Value added (total value of sales minus total cost of materials).

The derived indicators can be *generic* or *sector specific*. In this approach, a set of generic indicators, complemented by sector specific ones, is considered a reliable representation of a company's environmental performance. The proposed set of indicators has been proved to be not only representative, but also reducing complexity while retaining flexibility.

2.3 Aggregation of different dimensions of performance

Industries effect a large number of interactions with the environment. These include:

- Consumption of renewable and non-renewable resources
- Water consumption.
- Energy consumption.
- Waste and wastewater discharge.
- Air pollution, etc.

The multiple dimensions of environmental performance evaluation and assessment are evident. One of the most difficult issues that arise is selecting whether to proceed in producing aggregated measures of environmental performance or not. The

multidimensional evaluation of environmental performance is avoided by presenting separately the proposed set of performance indicators. The challenge is to produce simple environmental indicator figures, which allow individual industries to be compared on a regional and international scale.

Comparison is further complicated by the changes over time, which occur eventually in the business production. These changes may affect the environmental indicators of individual industries. The challenge posed is handled through the selection of few generic indicators. The indicators are applicable to the specific sector allowing for some unexplained variations, thus permitting a general comparison without too much complexity.

“It is argued that environmental performance cannot be compared because companies are different. However, the same could be said of company finances, yet the reporting of financial performance is a matter of routine. Distinctiveness should not stand in the way of comparison between competitors, be it in terms of profitability, market value or environmental performance” [1].

3 ENVIRONMENTAL PERFORMANCE EVALUATION AND BENCHMARKING

3.1 Inputs for the model

Inputs are data and other operational information of the companies, which are usually available. These data are required for the calculation of environmental indicators and include other relevant information for further studies on the environmental performance of the sector. Inputs are distinguished in:

- *Company profile data*, such as:
 - Type of products and processes.
 - Number of employees.
 - Sales value.
 - Raw materials cost, e.t.c.
- *Technical data*, such as:
 - Energy consumption (all types of energy resources reported).
 - Water consumption.
 - Raw material used.
 - Products produced.
 - Non-product output to water, land and air.

3.2 Evaluation of environmental performance and benchmarking

Environmental performance evaluation is implemented through a restricted set of environmental indicators, as they have been previously described. Indicators are calculated by the model, and their current as well as previous values are presented to the user.

Environmental performance evaluation is followed by benchmarking. Companies are guided to compare their current performance to the median values of the same set of indicators, for the same sector, from a sample of competitors in the region (regional benchmarking). Regional values of environmental indicators are produced and updated by the model, based on the input database.

Benchmarking is completed by BAT values, which represent the Best Available Technology – state of the art performance (international benchmarking). BAT values are

provided by the relevant literature and case studies at the international level, relevant to each one of the targeted sectors.

Following the environmental evaluation and benchmarking, technical interventions and practical measures are suggested to the users to reduce environmental impacts and consequently improve business competitiveness through cost savings. The basis for recommendations is the current environmental performance recorded at the previous step and the comparative evaluation with best practices and target values. For each indicator, there is a reference to an “Opportunity Bank” containing suggestions on how to improve performance. The Opportunity Bank serves as a guide for the SMEs aiming to improve environmental performance by means of cleaner technology.

The set of environmental performance indicators calculated by the model for a textile company (a) and the benchmarking results (b) are presented in Figure 3.

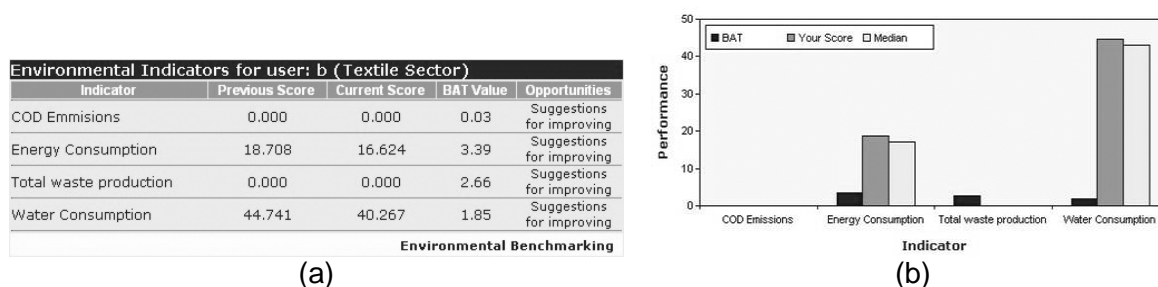


Figure 3. Environmental Performance Evaluation and Benchmarking Results

3.3 Potential cost savings from improved environmental performance

Having evaluated the business environmental performance, the model estimates at the final step the excessive costs related to their current performance, and the potential cost savings achieved when applying BAT. These cost savings are calculated separately for each individual performance indicator (Figure 4) and their sum represents the total potential operational cost savings.

Potential Savings for user: k (Hotel Sector)				
Indicator	Actual Cost	Cost Based on BAT	Potential Savings	Opportunities
Energy Consumption	390,900.00	341,810.41	49,089.59	Optimize your performance
Solid waste	0.00	0.00	0.00	Optimize your performance
Water Consumption	69,200.00	71,542.15	-	Optimize your performance

Diagnostic Tools Home Page

Figure 4. Calculation of potential cost savings

4 ADMINISTRATIVE PERFORMANCE EVALUATION AND BENCHMARKING

4.1 Administrative/operational performance indicators

The improvement of environmental performance requires effective control of company’s activities, products and processes that may cause significant environmental impacts. Consequently, current management practices that influence environmental performance should be identified so that required changes could be introduced.

Management decisions and activities that influence the company’s environmental performance, e.g. implementation of an Environmental Management System or

environmental training of employees, are generally evaluated by “effort” indicators. Qualitative and quantitative effort indicators are registered and evaluated by companies to assess their administrative/operational performance. At the next step, companies’ performance is being benchmarked against other industries of the same sector at a national / regional and international level.

4.2 Administrative/operational performance evaluation and benchmarking

4.2.1 Qualitative or General Awareness Performance

The inputs required by companies (Figure 5), simplified in order to be easily available, are processed by a *weighted score method* in order to evaluate the company’s level of general awareness on environmental issues. After identifying which criteria will be used for performance evaluation, each criterion is assigned with a *relative importance* and a *weighting factor*. These factors are used for measuring the company’s final score.

General awareness		Quantitative
No.	Environmental issue	Answer
1.	Is there any mention of environmental issues and concerns in the company's mission statement?	No <input type="radio"/> Yes <input type="radio"/>
2.	Has your company nominated a management representative for environmental issues?	No <input type="radio"/> Yes <input type="radio"/>
3.	Has your company realised employees training programs pertaining to environmental issues?	No <input type="radio"/> Yes <input type="radio"/>
4.	Is there any established procedure to identify and prevent environmental accidents and emergencies?	No <input type="radio"/> Yes <input type="radio"/>

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Figure 5: Inputs for general awareness on environmental issues

4.2.2 Quantitative Performance

Quantitative evaluation of administrative performance is implemented by input data, referring to management practices towards environmental performance improvement and the results of their implementation (Figure 6). These data can be easily processed to give a set of administrative performance indicators, which are directly comparable and can be further used for benchmarking.

General awareness		Quantitative	
No.	Item	Measure	Unit
1.	Environmental Investments (% of total investments)	<input type="text"/>	%/year
2.	Environmental cost savings (% of total costs)	<input type="text"/>	%/year
3.	Environmental training hours (hours/employee can be derived from the general input table)	<input type="text"/>	hours/year
4.	Environmental training cost (euro/employee)	<input type="text"/>	Euro/year
5.	Environmental accidents	<input type="text"/>	accidents/year
6.	Community complaints	<input type="text"/>	complaints/year

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Figure 6: Inputs for Administrative / Operational Performance

4.3 Administrative/operational performance benchmarking

The calculated values of administrative performance indicators as well as the weighted total score of environmental awareness are communicated to the companies compared to the median value of all inputs at the regional level and to the Best Practices values at an international level.

5 DISCUSSION

One of the most important issues arising through this approach is the reliability and the validity of the available data [4]. Evaluation of performance is based on a limited amount of operational data. Minor or major variations in the production line (or the services offered) within the same economic sector cannot be reflected in the values of the calculated indicators.

Although a detailed registration of all the processes is foreseen by the model, the calculation of a single median value for each indicator would lead to misleading results, if the identified variations in the production line are ignored. On the other hand, if these differences are taken into consideration, the number of businesses on which benchmarking should be based would be very limited, and the median values would not be reliable.

The same applies to the data taken from the literature. The actual values of the environmental performance indicators form the “BAT” approach that are used for benchmarking at international level may hide the same uncertainty. An additional problem is the fact that these data are collected from different sources, and in many cases the possibility of cross-checking the data reliability is very limited.

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