AN ECO-LABEL SCHEME OF ENVIRONMENTAL SUSTAINABILITY FOR INDUSTRIAL FACILITIES

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ABSTRACT

The aim of the specific study is twofold: a) provide a quick presentation of the available industrial Eco-labeling schemes with a view to discuss their adequacy and b) describe a new Eco-label scheme for assessing and improving the environmental sustainability of industrial facilities and processes. The proposed Eco-Label can act as an efficient tool for monitoring and communicating the environmental sustainability of the examined facility to various stakeholders and general public.

The Eco-label scheme is based on the results from the implementation of an innovative environmental sustainability assessment framework developed by the authors. The framework consists of ten (10) well defined steps that include specific guidelines and tips for its gradual implementation. Indicative actions to be taken during Eco-labeling procedure include the quantification and analysis of key environmental sustainability indicators, the enrichment of knowledge within industry regarding sustainability notions and goals, the identification of sustainable reference points, the extraction of environmental sustainability sub-indices and others. The implementation of the framework results in the extraction of a final environmental sustainability assessment index (ENSAI index). As a result, the proposed Eco-Label can be assigned to industrial facilities meeting a minimum level of sustainability performance thus encouraging industries to improve themselves and reach more sustainable goals.

Keywords: sustainable development, green industries, eco-label, environmental assessment

1. Introduction

Eco-label schemes seek to encourage a transition towards sustainable and more environmentally friendly consumption patterns. Those schemes, could serve as the basis to urge industry to increase the environmental performance of the facilities, products and services (Gallastegui, 2002). The economic and environmental opportunities that an eco-label could potentially offer are well acknowledged by industry and governmental and non-governmental organizations. Eco-labeling schemes can provide a tool for industries/organizations to fulfill their commitments imposed by legislative frameworks or international agreements on important environmental issues. From an economic point of view, eco-labeling is seen as an important element for gaining access to new and/or green markets. Producers see an opportunity to add value to their products by fulfilling sustainability requirements and gain a competitive advantage in the existing markets (Wessells *et al*., 2001). According to numerous surveys reported in the literature, a significant percentage of consumers are willing to pay up to 5%-25% premium for products with verified environmental performance (Gallastegui, 2002). Consequently, industries could use Eco-labels as a key marketing tool. From a consumer/customer point of view, eco-labeling schemes could become a primarily market tool to evaluate their options and express their preferences through their purchasing choices, as long as they are fully informed about the meaning and requirements of each labeling scheme (Testa *et al*., 2013).

On the other hand, eco-labeling schemes have received a lot of criticism regarding the outcome of their implementation. The keystone of this criticism is associated with the potential

manipulation of the market power from industries by using those schemes. Another key point that has been used to criticize eco-labeling is the lack of transparency during the development of environmental and product standards due to the difficulties arise from the quantification of sustainability issues in different sectors of industry and in different countries. Furthermore, regarding mandatory eco-labeling schemes, the lack of financing in developing countries, leaves producers and markets struggling, as a result of higher costs of production and operation (Wessels *et al*., 2001; Bruce *et al*., 2006). As of now, there are over four hundred eco-labeling schemes worldwide and that variety of schemes and criteria can cause confusion both in consumers and also for the producers and manufacturers (Edser, 2009).

2. Eco – labeling in industry

An initial literature review was performed to identify and present key eco-label schemes with a view to discuss their adequacy. Due to the vast availability of eco-labels, a number of selection criteria were set to filter the available choices:

i. The labels must certify companies, organizations and industries and not only the final product (can potentially be applied to assess industrial facilities).

ii. The labels can be applied in an international level (not national or case specific).

iii. The labels can be used in various industrial and organizational sectors (not only for a specific type of industry, e.g. chemical).

In total, nine (9) eco-labeling schemes meeting those criteria were identified and are presented in Table 1. Based on the criteria set, it became evident that there is a shortage of existing schemes that could specifically be applied to different industrial and organizational sectors. Most of the available choices are solely focusing on calculating the carbon footprint and reducing the GHG emissions of a company/industry. Six out of nine schemes presented, are evaluating the carbon footprint and GHG emissions and only one of them is considering sustainability issues via a Life Cycle approach.

A point of emphasis should be given on the way that these schemes are verified. The information presented in Table 1, shows that there is a balance between second (verification by the developer of the eco-scheme) and third (verification by an independent external agent) party verification. According to a relevant research, the majority of consumers and environmental organizations operating were more favorable towards third party eco-labeling schemes (Erskine *et al*., 1997). This fact highlights the need for transparency in labeling policies, to avoid misleading the consumer decision making process.

Despite the fact that that there are over four hundred eco-labels and that number is continuously growing since the mid 00's, few of them are able to efficiently assess industrial facilities/organizations regardless of their type and spatial characteristics while in parallel take into account all significant environmental issues that contribute to the environmental sustainability of the examined system. The authors are planning to perform a more detailed literature review to extract safer results, since the screening review indicated that there is a noteworthy gap in this field. Additionally, in order to cope with the above mentioned challenges, a new eco-labeling scheme is proposed in the specific study.

Table 1: Eco-label schemes identified.

Name	Label logo	Established by	Year est.	Certifies	Evaluates	Levels of certification	Verified by	Renewal after
CarbonNeutral Protocol		Carbon Neutral Company in association with an independent advisory group	2002	- Companies - Products - Services	Carbon Footprint	One Level: Carbon Neutral Certification Logo (entity certification, product certification, activities certification)	Independent third party	One year
Carbon Neutral Certification		Verus Carbon Neutral	2008	- Businesses	Carbon Footprint	Six seals of certification (Standard seal, Window Decal, Transportation, Product Packaging, Outdoor Signage for Groups of Businesses, Carbon Neutral in 25% increments)	Verus (second party)	One year
Carbon Trust Standard		Carbon Trust Standard Company Ltd	2008	- Organizations	Carbon Footprint	One Level: Carbon Trust Standard certification	Independent third party	Two years
CEMARS/ CarbonZero		Landcare Research New Zealand Ltd	2001	- Organizations - Industries - Products - Services	GHG Emissions	One Level: CarbonZero certification	Independent third party	One year
Cleaner and Greener Certification		Cleaner and Greener Leonardo Academy	2000	- Companies - Events - Buildings	GHG Emissions	Four Levels of certification for companies (Bronze-25% of GHG emission offset, Silver -50%, Gold-100%, Platinum - 100% of GHG and health related emissions offset)	Leonardo Academy (second party)	One year
EMAS: European Eco-Management and Audit Scheme		European Commission	1995	- Organizations - Industries	Environmental Performance	One Level: EMAS Logo	Independent third party	Three years
Environmental Warrant of Fitness		EWOF Ltd	2009	- Businesses - Organizations	Environmental Performance	One Level: EWOF certificate and logo	EWOF Ltd (second party)	One year
GreenTick		GreenTick Certification Ltd	2001	- Organizations - Product - Production processes	Sustainability (Life Cycle Based Certificate)	One Level: GreenTick certification (6 different options of certification)	Independent third party	Two or Three years
NoCO2		Carbon Reduction Institute	2006	- Businesses - Organizations	Carbon Footprint	Two Levels of certification (NoCO2 Standard – Carbon Neutral, LowCO2 Standard – percentage reduction in carbon footprint)	Carbon Reduction Institute (second party)	Continuous monitoring (Quarterly)

**all data were collected from the official website of each company*

3. Ensai index: a new eco-label scheme

The proposed Eco-label scheme is based on the results from the implementation of an innovative methodological framework able to assess the environmental sustainability of various industrial systems regardless their type and location (Angelakoglou, 2015). The framework consists of ten (10) steps that include specific guidelines and tips which allow its gradual implementation (Figure 1).

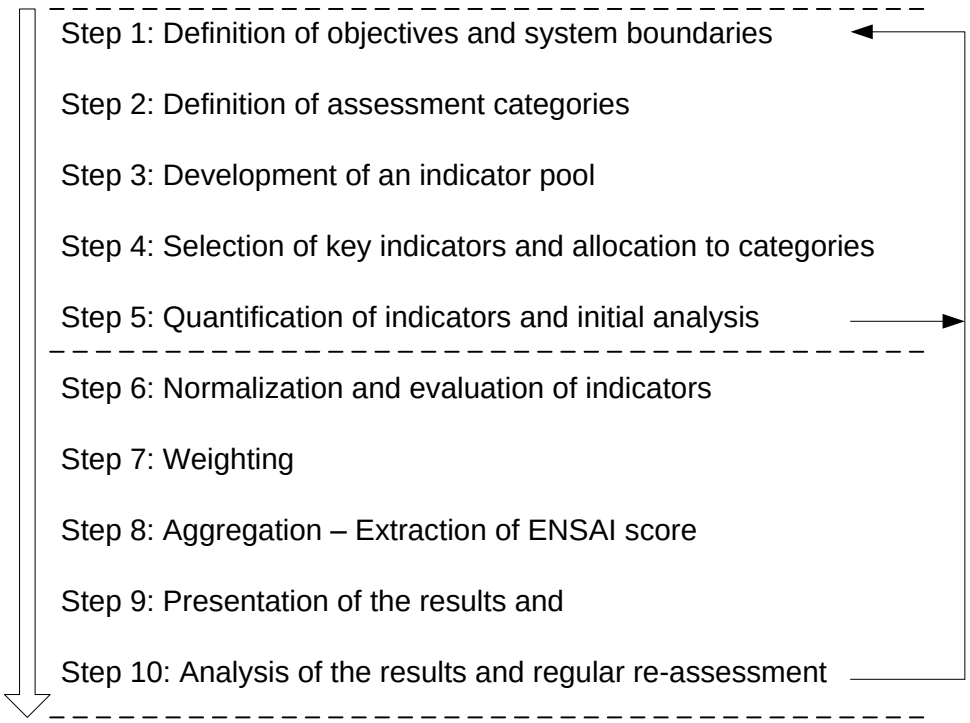

Figure 1: Methodological framework for assessing the environmental sustainability of industrial facilities.

The steps were selected with a view to address major shortcomings identified during the analysis of relevant assessment methods available in current literature such as their ability to help decision making, the adequacy of environmental aspects examined, the applicability by non-experts and the integration of spatial and temporal characteristics in the assessment. All steps have been translated into practical procedures to be followed by the industrial facility under examination. Key highlights of the proposed methodology include:

- Eight (8) assessment categories (Table 2) that were selected based on the principles and tools of Industrial Ecology (IE), in order to ensure that the most significant issues in terms of environmental sustainability will be assessed and sustainable actions highlighted by IE will be promoted (e.g. development of synergies, reduction of scarcity of materials utilized, etc.) (Angelakoglou and Gaidajis, 2014a).
- The categories are assessed with the application of thirty five (35) core indicators carefully selected from a pool of environmental indicators according to pre-defined ranking criteria (Table 2). The indicators are separated into two levels of assessment: a) performance and b) concern in order to enhance transparency of the analysis and better reflect the notion of environmental sustainability. Specific guidelines for the estimation and analysis of every indicator are available.
- A normalization procedure is applied following a distance to a sustainability reference point approach, which enables the parallel evaluation of every indicator in comparison with a commonly accepted sustainability goal or threshold (Angelakoglou and Gaidajis, 2014b). Specific sustainability reference points have been identified for every indicator to facilitate the assessment.

- A five (5) point ranking scale is applied to perform the evaluation. Aggregation of performance and concern indicators enables the extraction of various sub-indexes and a final index of Environmental Sustainability Assessment of Industries (ENSAI index - I_{ENSAI}). The ENSAI index rates in a holistic way, the examined facility on a scale from one (1) to five (5) points where five (5) indicates maximum environmental sustainability performance.

Table 2: Overview of the categories and indicators applied to assess the environmental sustainability of industrial facilities.

Performance indicators	Concern indicators
Category 1: Sustainable consumption of materials and resources	
P.1-1: Total consumption of materials/resources	C.1-1: Depletion time of materials/resources utilized in production
P.1-2: Percentage of raw materials from recyclable/reusable materials	C.1-2: Percentage of products that can be recycled/reused at the end of life
Category 2: Waste and emissions minimization	
P.2-1: Air emissions per type and total	C.2-1: Air emissions of industrial sector
P.2-1: Liquid waste per type and total	C.2-2: Liquid waste of industrial sector
P.2-3: Solid waste per type and total	C.2-2: Solid waste of industrial sector
Category 3: Sustainable use/management of energy	
P.3-1: Total energy consumption	C.3-1: Energy self-sufficiency at national level
P.3-2: Percentage of energy from renewable sources	C.3-2: Energy needs of industrial sector
P.3-3: Integration of energy efficient technologies	
Category 4: Sustainable use/management of water	
P.4-1: Total water consumption	C.4-1: Water risk at national level
P.4-2: Percentage of water that is recycled/reused	C.4-2: Annual rainfall in the industrial area
P.4-3: Integration of water efficient technologies	C.4-3: Water needs of industrial sector
Category 5: Sustainable transportations and locality	
P.5-1: Total distance of suppliers	C.5-1: Environmental performance of suppliers
P.5-2: Initiatives to improve the environmental performance of fleet	C.5-2: Transportation network adequacy in the industrial area
Category 6: Environmental equity and synergy	
P.6-1: Initiatives to promote environmental accountability and equity	C.6-1: Compliance with environmental laws and regulations
P.6-2: Synergies developed to improve the environmental performance	
Category 7: Conservation of ecological health and biodiversity	
P.7-1: Global warming potential	C.7-1: Distance of industrial facility from protected areas/areas of high biodiversity
P.7-2: Ozone depletion potential	C.7-2: Land use characterization of the industrial area
Category 8: Conservation of human health	
P.8-1: Risk to human health	C.8-1: Extent of potential accident impact from residential areas
	C.8-2: Air quality of the industrial area

Building upon the methodology summarized before, an Eco-label scheme can be developed that will be able to award, industrial facilities meeting a minimum level of sustainability performance thus encouraging industries to improve themselves and reach more sustainable goals. The final scheme is still under development since a number of issues need to be clarified such as the value of the minimum score (will all industries be able to acquire the eco-label?), the external body that will perform the evaluation, the validity of the eco-label and so forth. However, the scheme is expected to include the following generic actions:

- Implementation of the proposed methodology by the industrial facility and extraction of the ENSAI index. A number of adaptations may be needed to facilitate the analysis.

- External evaluation/verification of the results by a group of experts in order to ensure the transparency and quality of the results.
- Assignment of the ENSAI Eco-label to the facility according to defined criteria (Figure 2).
- Communication of the results and periodic re-evaluation of the facility. The proposed scheme should be applied annually to examine the progress of the facility and better reflect the current environmental sustainability.

Figure 2: Indicative example of the Eco-label to be awarded to industrial facilities.

The final eco-label scheme will assess in a holistic way, by taking into account various spatial, temporal and life cycle related parameters, the environmental sustainability of an industrial facility, offering an efficient tool for monitoring and communicating its performance to various stakeholders and general public. The key advantage of the proposed eco-label scheme against other eco-labels is that it takes into account the most significant environmental factors contributing to the environmental sustainability of the industry, whereas it includes specific sustainability reference points thus integrating into the final score the actual distance from a truly sustainable performance (best in class industries do not necessary receive a high score if they do not meet sustainable goals). Except from the strategic and marketing benefits deriving from the adoption of an eco-label scheme, its application can strengthen the quality of the sustainability, the corporate social responsibility (CSR) reports and environmental impact studies, by providing a quantitative image of the environmental sustainability performance.

4. Conclusions

More industries are expected to assess and report their environmental sustainability in the near future. There is a lack of available eco-labels that can assess in a holistic way, industrial facilities and/or organizations, taking into account various parameters contributing to the environmental sustainability of the examined system. This study presents the first steps of an attempt to develop an efficient eco-label scheme that can cope with the problems identified.

The proposed scheme utilizes a new methodological framework for assessing the environmental sustainability of industrial systems that is able to summarize their performance into one single quantitative index (ENSAI index). In order for the framework to be implemented, key environmental sustainability indicators need to be assessed and sustainable goals to be determined. As a result, the scheme will not only assign an eco-label to the examined industry, but will also provide specific information and directions for the improvement of the environmental performance of the facility. Final steps for the completion of the proposed eco-label scheme include the development of supportive tools to facilitate the estimation of the ENSAI index (e.g. data sheets), the finalization of verification process and final design of the Eco-label.

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