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Challenges in the evaluation of the impact of consumer stakeholders on  
the environmental dimension of product sustainability

Topic: Consumer stakeholders

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*Abstract*

The present work aims to contribute to the area of sustainability evaluation by identifying three challenges that arise in projects that evaluate the impact of consumer stakeholders on the environmental dimension of product sustainability. This will be illustrated by reviewing the implementation of programs for environmental labelling and declarations, and more specifically, the area of carbon footprinting. Initially, an introduction to what can be understood as product sustainability is presented. Then, key concepts used in the evaluation of product sustainability – product system, system boundaries and consumer stakeholders – are defined. With this background, the challenges are presented and discussed.

The first challenge has to do with the identification of the consumer stakeholders on the basis not only of how the product itself is consumed but also on the environmental information associated to it. The second challenge has to do with the engagement of consumer stakeholders on the characterization of product consumption. Representative consumer stakeholders participate in the processes where methodologies for product assessment are defined; a larger group of consumer stakeholders participate on the data collection processes. Lastly, the third challenge entails the definition of the logical framework that underpins the evaluation project and the establishment of chains of effects that bring together consumer behaviour and information about the environmental impacts of a product.

1. Introduction

Traditionally, projects, policies, programmes and corporations have been subjected to sustainability evaluations. Increased concern on the societal patterns of production and consumption has given rise to the examination of product sustainability. It is necessary, as a first step, to define what is understood as product sustainability. On this basis, the environmental, social and economic impacts associated to the product along its life cycle can be assessed. Finally, strategies can be developed to address the impacts at different stages of the product life cycle.

The present work aims to contribute to the area of sustainability evaluation by identifying three challenges that arise in projects that evaluate the impact of consumer stakeholders on the environmental dimension of product sustainability. This will be illustrated by reviewing the implementation of programs for environmental labelling and declarations, and more specifically, the area of carbon footprinting. These programs are based on the standards ISO 14020:2001; ISO 14021:2001, ISO 14024:2001 and ISO 14025:2006, to which references are made here.

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The first challenge has to do with the identification of the consumer stakeholders on the basis not only of how the product itself is consumed but also on the environmental information associated to it. The second challenge has to do with the engagement of consumer stakeholders on the characterization of product consumption. Representative consumer stakeholders participate in the processes where methodologies for product assessment are defined; a larger group of consumer

stakeholders participate on the data collection processes. Lastly, the third challenge entails the definition of the logical framework that underpins the evaluation project and the establishment of chains of effects that bring together consumer behaviour and information about the environmental impacts of a product.

## 2. Product sustainability

In line with the standards for Life Cycle Assessment, in the present work, a product is understood as a good or a service (ISO, 2006a). Before embarking on the preparation of a project aimed at the evaluation of the sustainability of a product, it is necessary to pose two simple yet significant questions whose answers will guide the course of the project:

- What function does the product perform?
- Can the function be performed by other product(s)?

The first question enquires about the purpose of the product, why it was designed and developed in the first place. Having established the function in a clear way, the second question seeks to determine if the product under evaluation is unique and cannot be substituted. If, on the other hand, the function can be performed by alternative products, it is necessary then to ascertain whether the product is the best at doing so or not. On the basis of the answers given to these questions, the evaluation project can follow two avenues:

- a) a narrow focus on the sustainability of one product, or
- b) a broader focus on the sustainability of a product category, which consists of the group of products capable of performing an equivalent function.

This preliminary assessment is summarized in Figure 1.

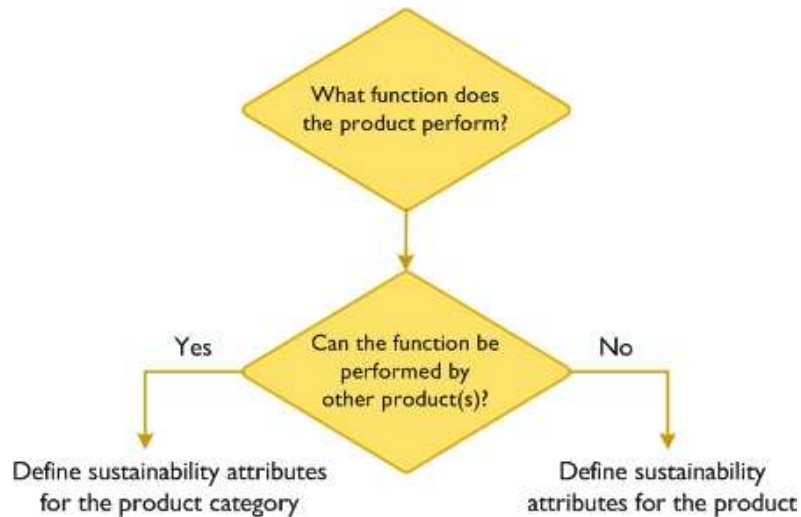


Figure 1. Preliminary assessment of product sustainability.

The degree of complexity in the evaluation of product sustainability can certainly be reduced by reaching a consensus between stakeholders of the product or product category on the definition of which attributes characterize their sustainability. These attributes describe environmental, social and economic aspects of the product throughout its life cycle. Moreover, transparent, measurable and specific indicators need to be selected to provide meaningful information that can monitor the attributes in time. For the sake of comparability among products pertaining to a product category, it is also convenient to agree on a set of values for the indicators that represent a minimum acceptable level of sustainability for the product category. Bear in mind that since a product category could include services and goods, the sustainability attributes and their respective indicators may not necessarily apply to both cases.

### 3. Product system

Having defined if a product or a set of equivalent products are going to be evaluated, it is then necessary to establish the product life cycle, and based on this, determine the product system and its boundaries. According to ISO 14044:2006 (ISO, 2006a), the product system consists of the processes that model the life cycle of the product. Figure 2 depicts a typical product life cycle, showing subsequent stages of raw materials extraction or generation, transformation, use and final disposal.



Figure 2. Product life cycle. T stands for transport of materials.

For sustainability evaluation purposes, the concept of product system can be extended to include the direct stakeholders who bear responsibilities in carrying out the processes in the system. The present work focuses on consumer stakeholders. Strictly, consumer stakeholders can be understood as the end users of a given product. Consumer behaviour and preferences influence the manufacture stage. The retail stage is characterized by a symbiotic and active participation of both consumers and retailers. At the consumption and final disposal stages, though, consumers are the key stakeholders. In the same way, indirect stakeholders to the product system can be included based either on their degree of influence or control over the processes in the system, or on how they are affected by the processes of the system.

### 4. Evaluation of the environmental dimension of product sustainability

At a global scale, environmental regulation requires organizations to prevent, reduce or mitigate the environmental impacts arising from their activities and products. The implementation of environmental management systems, which can be certified through schemes such as ISO 14000 series (ISO, 2004) or EMAS (Eco-Management and Audit Scheme) (EC, 2001), entails a cycle of continuous improvement of the system which can be achieved through the use of the technique of life cycle assessment (LCA). The methodology to carry out an LCA has been standardized as the norm ISO 14044:2006 (ISO, 2006a).

LCA is the appropriate and systematic tool to assess the environmental dimension of a product's sustainability, for it can assist in the identification of hot-spots in the environmental performance of the product throughout its life cycle and provide relevant quantitative indicators with a sound scientific basis. Benchmarks for the indicators can be set, so that the product's environmental performance can be gauged over time or compared to that of equivalent products. Type I environmental labels, specified by ISO 14024:2001 (ISO, 2001a), are awarded to products that meet a set of pre-determined requirements.

The way in which the LCA results are communicated will depend on the goals initially set for executing the LCA and the indented audience of the study. Due to their technical nature, the communication of the results to consumers has to be done in a careful and transparent way, avoiding potential misleading or confusing interpretations. Type III environmental declarations, as specified by ISO 14025:2006 (ISO, 2006b), enable the comparison of the environmental performance of products performing equivalent functions and are based on independently verified LCA results.

If, on the other hand, an environmental aspect of the product is to be communicated, it is possible to use self-declared environmental claims corresponding to Type II environmental labelling and specified by ISO 14021:2001 (ISO, 2001b). This is the case of the carbon footprint of a product. It focuses on the environmental aspect of life cycle greenhouse gas (GHG) emissions, which contribute to global warming and climate change. PAS 2050:2008 is a publicly available specification developed by the British Standards Institute (BSI, 2008) that sets a consistent methodology for the assessment of the GHG emissions associated to a product throughout its life cycle. In the UK, the carbon footprint can be certified and awarded a Carbon Reduction Label by the Carbon Trust (Carbon Trust, 2009) for a period of 2 years. The producer

commits at the same time to reduce the carbon footprint or lose the label in the absence of any improvement.

Information regarding the environmental performance of products and in compliance with standardized methodologies (SETAC, 1991; ISO, 1997) has been available for at least 20 years. Therefore, the implementation of a program that evaluates the environmental dimension of product sustainability will have to take account of this background information as well as the impact it has had so far in shaping or changing consumer understanding of the environmental impact of a product, consumer attitudes and actual consumer behaviour.

PAS 2050:2008 has been introduced fairly recently (2008), and so far only a number of products (mainly food products) have been certified with the Carbon Reduction Label. This situation offers unique opportunities to plan a project aimed at evaluating the effectiveness of carbon footprints and Carbon Reduction labels as indicators of the environmental dimension of product sustainability. The opportunities are presented in the following ways:

- a) For products and/or product categories for which a Carbon Reduction Label has been already awarded: An ex-post type of evaluation, considering that the time boundary for this intervention was the date the product and/or product category were labelled.
- b) For products and/or product categories for which a Carbon Reduction Label has not been awarded yet: An ex-ante type of evaluation, considering that the time boundary for this intervention will be the date the product and/or product category will be labelled. In this case, it will be necessary to collaborate closely with an organization which actually intends to label its products in the near future. Once the products have been labelled, then it will be possible after a reasonable period (1-2 years) to evaluate the impact labelling has had on product sustainability.

## 5. Consumer stakeholders and the evaluation of product sustainability

The purpose of this work is to identify key areas where consumer stakeholders are involved and what would this imply in the preparation of the aforementioned evaluation project. The scope of the participation of consumer stakeholders ranges from the preliminary activities leading to the award of a Carbon Reduction Label to the consumption of labelled products as well as the planning and execution stages of the evaluation project.

The next sections will elaborate on the following issues:

- a) Identification of consumer stakeholders.
- b) Involvement of consumer stakeholders on the characterization of product consumption.
- c) Logical framework of the project aimed at evaluating the environmental dimension of product sustainability.

### 5.1 Identification of consumer stakeholders

Actually, the group of stakeholders generally referred to as consumer stakeholders can be further classified in terms of what is being consumed and how they interact with the product. Table 2 details how stakeholders of concern to a program for the evaluation of product sustainability can be identified. Consumers may pertain to more than one category.

For each product or product category, a list of consumer stakeholders can be prepared based on the criteria shown in Table 1. Moreover, the consumer stakeholders can be mapped on to the stages of stakeholder engagement of the project aimed to obtain the Carbon Reduction Label for a product and the project aimed to evaluate the product's sustainability.

Table 2. Identification of consumer stakeholders.

Criterion	Identification of consumer according to:
Object of consumption	<ul style="list-style-type: none"> <li>a) Material consumption of the product: Consumers who purchase the product and are the end users, or consumers who just use the product.</li> <li>b) Conceptual consumption of the product. Consumers who receive and/or look for information regarding the product's sustainability</li> </ul>
Interaction with the product	<ul style="list-style-type: none"> <li>a) Material interaction with the product: Consumers who use the product.</li> <li>b) Economic interaction with the product: Consumers who purchase the product and/or take responsibility for the economic implications of the use of the product.</li> <li>c) Rational interaction with the product: Consumers who take decisions in relation to the consumption of the product.</li> <li>d) Advocacy interaction with the product: Consumers and consumer organizations advocating in favour or against the consumption of the product.</li> <li>e) Potential interaction with the product: Members of the public who are not yet consumers of the product or who consume alternative products meeting an equivalent function.</li> </ul>

## 5.2 Involvement of consumer stakeholders in the characterization of product consumption

Product category rules (PCR) are defined in ISO 14025:2006 (ISO, 2006b) as a set of specific rules, requirements and guidelines used to develop environmental declarations containing quantified environmental data for product categories. PCR should be clear and generic enough to allow for comparability among products within a product category. Organizations that chose to conduct a voluntary program of environmental declarations determine the procedures and operating rules for the development of the program's PCR in line with ISO 14025:2006 requirements.

The procedure to define a new PCR consists of the following steps:

- a) Definition of product categories. Product categories shall be defined in a transparent and open consultation process where interested parties are invited to participate.
- b) Preparation of first version of the PCR. The document shall indicate the life cycle stages of the product that will be considered, which parameters will be covered, the way in which data will be collected and how the environmental information will be reported. In the same way, it has to be outlined the goal and scope of the associated LCA study which will provide the relevant environmental information.
- c) Open consultation of the PCR. Interested parties and stakeholders affected by the development and use of the PCR are invited to review and comment upon it and all the associated documentation.
- d) Approval of the PCR. Once the consultation process is over, the reviews and comments have been addressed and responded, and reasonable efforts have been made to achieve consensus, the PCR is approved by the PCR review panel.

Consumers in general and organizations advocating consumer interests are considered stakeholders in the PCR development process. Their participation is contemplated in the stages of definition of product categories and the open consultation of the preliminary version of the PCR.

The final version of the PCR will determine what data needs to be collected by any organization that implements the PCR in order to assess the environmental impacts associated to the product or product category. Data reflecting consumption patterns and particular consumer behaviour can be obtained through the tools and techniques of market research and market intelligence as well as ethnographic and anthropological studies. Representative samples of consumers provide a direct input of both qualitative and quantitative data.

PCR are generic enough so as to be used at a global scale. However, it would be incorrect to assume that consumption patterns of a product or product category collected at a local or regional scale can be generalized to represent the situation at a global scale. Cultural factors definitively influence consumer perceptions, attitudes and behaviour in every country. Therefore, as a methodological consideration and for consistency sake, when assessing the sustainability of any product, data pertaining to the consumption and final disposal stages (material and energy flows as well as consumption patterns) should be bounded to a specific geographical scope. When the results of a product's carbon footprint, Carbon Reduction Label or sustainability assessment are communicated, the fact that the results are applicable to a single country or region should be clearly communicated to avoid misleading not only the consumers but the public in general.

5.3 Logical framework of the project aimed at evaluating the environmental dimension of product sustainability.

The logical framework upon which the evaluation of indicators for the environmental dimension of product sustainability will stand is developed at the planning stage of the respective evaluation project. One of the first issues to address is that of the definition of the evaluation questions trying to be answered through the evaluation project. For this purpose, it is worthwhile and informative to revise the main objectives guiding the development of programs for environmental labelling. Table 3 details the objectives of the three accepted types of environmental declarations and labels [ISO 14021:2001, ISO14024:2001 (ISO, 2001b), ISO 14025:2006].

Table 3. Objectives of environmental declarations and labelling programs

<b>Environmental declaration and label</b>	<b>Objectives</b>
Environmental declarations and labels in general	To communicate verifiable, accurate and not misleading information about environmental aspects of products to encourage demand for and supply of products that cause less stress on the environment; thereby the potential for market-driven continuous environmental improvement is stimulated.
Type I (ISO 14024:2001)	To assist in the reduction of the environmental impact associated to a product through the identification of products that meet specific Type I program's criteria for overall environmental preferability.
Type II (ISO 14021:2001)	To provide self-declared claims containing information about environmental aspects or environmental improvements of a product.
Type III (ISO 14025:2006)	To provide environmental information (LCA-based) of products. To assist purchasers and users to make informed comparisons between products. To encourage improvement of environmental performance.

From Table 3 it is possible to infer the rationale behind the development of environmental declarations and labelling programs and subsequently draw evaluation questions highly relevant to consumer stakeholders. The following assumptions underpin the rationale:

- Consumers are rational decision makers.
- Consumers make informed choices.
- Consumers are aware of the environmental impacts caused by economic activities (production and consumption of products).
- Consumers take responsibility for the environmental aspects of their consumption decisions.
- Consumers use environmental information to choose the products they wish to purchase and use.
- Consumers prefer to purchase and use products that have a reduced environmental impact.
- Environmental information about a product is useful to consumers.
- A demand exists for environmental information about products.

- Environmental information can influence consumer decision making and consumer behaviour.
- Environmental information can be trustworthy, reliable, verifiable and accurate, for it is obtained following scientifically sound methodologies.
- Environmental information does not mislead consumers.
- Environmental information can be tailored to be understood by consumers who have different levels of awareness about environmental issues.
- Consumers chose to purchase and use products for which environmental information is available (environmental declarations or labels).
- Producers offer voluntarily environmental information about their products.
- Overall environmental improvement is attainable through market transactions.
- Self-declared environmental claims (for example carbon footprints and Carbon Reduction Labels) may be made by anyone likely to benefit from them (ISO, 2001a).

Almost every assumption listed above can be selected as a hypothesis to be addressed in the evaluation project. Actually, some of the assumptions touch upon fields beyond the sustainability of a given product or product category. For example, consumer behaviour, green decision making and economic policy making are fields where all products and consumers are involved, irrespectively of time, geographic or product system boundaries. Therefore, the scope and feasibility of the evaluation project depends on a sound choice of the evaluation question.

Based on the assumptions of the logical framework, Table 4 proposes a primary chain of effects that can be used in the design of the evaluation project: Notice the reliance of environmental labelling and declarations programs on the response of consumers or lack thereof for their success.

Table 4. Proposed chain of effects of environmental declarations and labelling programs.

<b>Inputs</b>	Standards and methodology for the preparation of environmental labels and declarations. (ISO 14021:2001, ISO 14024:2001, ISO 14025:2006, PAS 2050:2008)
<b>Intervention</b>	Preparation of LCA studies. Calculation of carbon footprints of products. Award of environmental labels/Carbon Reduction Labels
<b>Outputs</b>	Results of LCA studies/carbon footprint calculations. Environmental labels/Carbon reduction Labels carried by products. Environmental declarations, carbon footprints and explanatory statements required to understand them are communicated to the public through various channels: company websites, advertising, publicity, product literature, technical bulletins, brochures, point of sale panels, etc.
<b>Outcomes</b>	Increased awareness in consumers and public in general about the environmental performance, environmental impacts and carbon footprint of products throughout their life cycle. Brand recognition of environmental labels/Carbon Reduction Labels. Consumption of environmentally preferable products. Reduced consumption of products with high environmental impact. Changes in consumer behaviour. Use of environmental information about products as criterion in decision making processes.
<b>Impacts</b>	Increased demand for environmentally preferable products. Increased supply of environmentally preferable products. Product innovation. Producers of competitor and alternative products follow suit and also prepare carbon footprints and environmental declarations and are awarded environmental labels/Carbon reduction Labels for their products. Reduced carbon footprint of households. Overall reduction in GHG emissions at national, international level. Reduced environmental stress arising from the product category (ISO, 2001a). Change of nature of environmental labelling programs from voluntary to compulsory. Introduction of personal or household carbon allowances.

As previously mentioned, the carbon footprint and the Carbon Reduction Label may be used to assess the environmental dimension of a product. However, these are tools recently added to the environmental management toolkit. At the design stage, the developers of the evaluation project have to be aware of and take into consideration the body of knowledge in this field – academic research, LCA studies, alternative environmental labels and declarations, carbon footprint calculators – produced by various sources (academia, government, regulatory agencies, industry, interest groups, environmental organizations, NGOs, media) which is already available and in the public domain. This knowledge is produced responding to particular perspectives, satisfying certain objectives, and following methodologies not necessarily comparable, transparent or scientifically rigorous. Nevertheless, it undoubtedly influences and shapes the perception, attitudes and level of awareness of consumers toward environmental issues.

It would be methodologically incorrect to assume that the chain of effects previously proposed takes place in isolation. Concurrent chains of effects should be put forward, using as input the available information (related to the product or product category under study or others), suggesting alternative intervention mechanisms and considering similar as well as different outputs and impacts (positive and negative, intended and unintended).

An additional chain of effects should focus on the consumer's experience of purchasing and using products awarded with environmental labels or Carbon Reduction Labels. The consumer stakeholders identified according to the criteria in Table 2 will experience different consumption outcomes and reach various conclusions about the product. Inputs in the chain of effects would be the environmental information about the product coming from a variety of sources. Outputs and outcomes of interest in this chain are behavioural changes, trust of consumers in labels, trust of consumer in the sources of information, degree of satisfaction with the product, transfer of trust and satisfaction across product categories, increased/decreased consumption of the product, increased/decreased consumption of product alternatives, product boycotts, indifference, confusion, information overload, disappointment, and alienation from the product, the producer or the label. Let's take an example from the Carbon Reduction Label: as previously mentioned, it is awarded to products for a 2-year period, during which the producer agrees to reduce the carbon footprint of the product; as a result, after a new certification process, the product is allowed to carry the label again for the next 2 years. Consumer satisfaction with the product can be reinforced when the product is awarded the Carbon Reduction Label once again; however, consumer's trust in the producer and the product can receive a serious blow if the label is taken away because targets for the reduction of the product's carbon footprint were missed. This is a calculated risk taken by producers who voluntarily decide to calculate the carbon footprint of their products and apply for a Carbon Reduction Label.

Subsequently, interactions and linkages between the chains of effects ought to be mapped. Although the complexity of the logical framework and the data collection exercise will increase this way, a better understanding of the effectiveness of environmental labelling and declarations programs can be gained indeed.

Assuming that the evaluation project will follow a theory-driven approach, the following data collected from the various consumer stakeholders would assist in the validation of the proposed chains of effects:

- Decision making processes of consumers.
- Criteria used in decision making.
- Circumstances under which the products are purchased and used.
- Consumer awareness and understanding level of the product life cycle, environmental impacts of the product, environmental issues in general, carbon reduction strategies at consumer level, Carbon Reduction Label, carbon footprint of a household, sources of GHG emissions, the role and responsibilities consumers have in the life cycle of the product and its associated environmental impact.
- Consumer preferences in relation to the function performed by the product or product category.
- Consumer attitudes toward the product, the producers, environmental issues, climate change, sustainable development, willingness to change their consumption patterns and behaviour.

- Spending habits of consumers in relation to labelled and non-labelled products in the same product category.
- Environmentally preferable products actually purchased and used by the consumers.
- Use and disposal patterns of products (environmentally labelled or not).
- Motivation for changes in consumer behaviour and permanence of those changes.

Certainly, the perspective of the logical framework will be influenced by the agent commissioning the evaluation project and the purpose of the evaluation - for accountability or for improvement. Whether it is a governmental department, a business association, a consumer's organization, an academic research group, an environmental group, or any organization certifying the award of the environmental labels, the information obtained through the evaluation project will be used as valuable input in the formulation and implementation of policies and programs fostering, promoting and embedding sustainability throughout the life cycle of a product.

## 6. Conclusions

Carbon footprints and the Carbon Reduction Label can be used as indicators of the environmental dimension the sustainability of a product or product category. When the effectiveness of these indicators is evaluated, either ex-ante or ex-post a Carbon Reduction Label has been awarded or a carbon footprint has been calculated and communicated, some challenges arise in relation to the engagement of consumer stakeholders.

The present work shows that it is possible to overcome these challenges by defining methodological guidelines at the evaluation project design stage. In first instance, consumer stakeholders have to be identified clearly as well as how they interact with the product and the environmental information associated to it. Secondly, it is of great consequence to know how consumer stakeholders or their representatives participate in the characterization of product consumption, for this lays down an agreed representation of consumption that will be subsequently validated through data collection for the carbon footprint calculation and the evaluation project. If consumer input is not considered when product consumption is characterized, consumers cannot be expected to relate to and acknowledge the results of a product carbon footprint and moreover, consumers most likely will not take responsibility for the environmental impacts arising from the consumption of the product. Finally, it is necessary to understand how the rationale of carbon footprints and Carbon Reduction Labels revolves around consumers. This topic was addressed when the general principles and procedures for environmental declarations and labels and the respective international standards were prepared. The assumptions set out in these standards provide not only hypothesis to be used when the logical framework supporting the evaluation project is structured, but also indicate what information ought to be collected from consumer stakeholders during the execution of the evaluation project. Certainly, the evaluation methodology can build on the environmental management standards and the evaluators can learn from environmental assessment practices how to address and resolve methodological issues that may arise when products are assessed and evaluated.

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