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DESIGN FOR SUSTAINABILITY - ANTICIPATING THE CHALLENGE

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Abstract

In its report 'Our Common Future', the Brundtland commission defined sustainable development as 'meeting the needs of the present without compromising the abilities of future generations to meet their needs'. However, quite often sustainability is narrowed down to include only the economy and ecology, thus neglecting the social component of the definition. This paper presented a number of thoughts on the role of the designer in the social product development process. First, the question is raised whether design or supply chain management would be the crucial phase in product development. Though no answer can be given at this moment, a number of criteria are presented as a basis. Second, two ways of developing a social sustainability measurement system are presented. A first option is based on a genuine LCA approach. A second option is closely related to social corporate responsibility programmes.

Keywords: Sustainable design, Life cycle, Design for X

1. Introduction

In its report 'Our Common Future', the Brundtland commission defined sustainable development as 'meeting the needs of the present without compromising the abilities of future generations to meet their needs' [1]. One of the main virtues of this definition consists of the coupling of the important socio-political themes economic growth, ecological conservation and social wellbeing. However, quite often sustainability is narrowed down to include only the first two aspects, thus neglecting the latter. In parallel, the design tools supporting 'sustainable design' are typically merely Design for Environment (DfE) tools. Nevertheless, the growing market share of 'fair trade' products indicates that also social sustainability will become a major issue in the following years. For example, Fair trade labelled sales across the world grew by 21,9% between 2001 and 2002, representing an acceleration of Fair trade's steady growth of the past years [2]. Moreover, a survey by the European Commission concludes that over one third of European citizens would be prepared to pay 10% more for fair trade products [3]. Apart from ethical considerations, the economic benefit of growing market share could consequently attract companies to increase their attention for social justice throughout their supply chains.

With respect to the environmental dimension of sustainability, the importance of design as a crucial and determining opportunity for improving a product's environmental profile has been widely recognised (e.g. [4], [5]). A visible proof of this recognition is the recent efforts of the European Commission to legally enforce the application of ecodesign for end user equipment entering the European market ([6]). This paper investigates if the design process can play a similar, crucial role with respect to the social dimension of sustainability, and, if so, how a genuine design for sustainability (DfS) programme could look like.

2. The role of the designer

The first question is at once the most difficult one: is the designer the optimal person to ensure the social sustainability of the product. The current state-of-the-art regarding the integration of sustainability into business does not allow providing a sound answer yet. One would, though, easily claim that the purchase department has higher potential, since one intuitively has the impression that social sustainability is - much more than ecological impact - dependant on the supplier rather than on the design of the product.

This intuition is, however, contestable. In many Design for Environment programmes, environmental impact of products is calculated using average "environmental indicator scores" for material types, disregarding potential differences between individual suppliers (e.g. [7], [8]). For example, within the Eco-Indicator'99 ecodesign method, virgin aluminium has an eco-score of 780 millipoints per kg, regardless of the supplier [7]. However, taking into account that e.g. global warming potential of 1 kWh of electricity differs with a factor 40 between Switzerland and Greece, it is obvious that the environmental impact of electricity-intensive materials (such as virgin aluminium) and production steps will be largely dependent on the geographical location of the supplier. Consequently, the sole argument of supplier dependency is either insufficient for eliminating DfS, either sufficient for eliminating current DfE practices too...

A crucial element in this discussion is - for both DfE and DfS - the comparison between, on the one hand, the difference of performance between suppliers of the same material, and, on the other hand, the difference of performance between different materials (Figure 1).

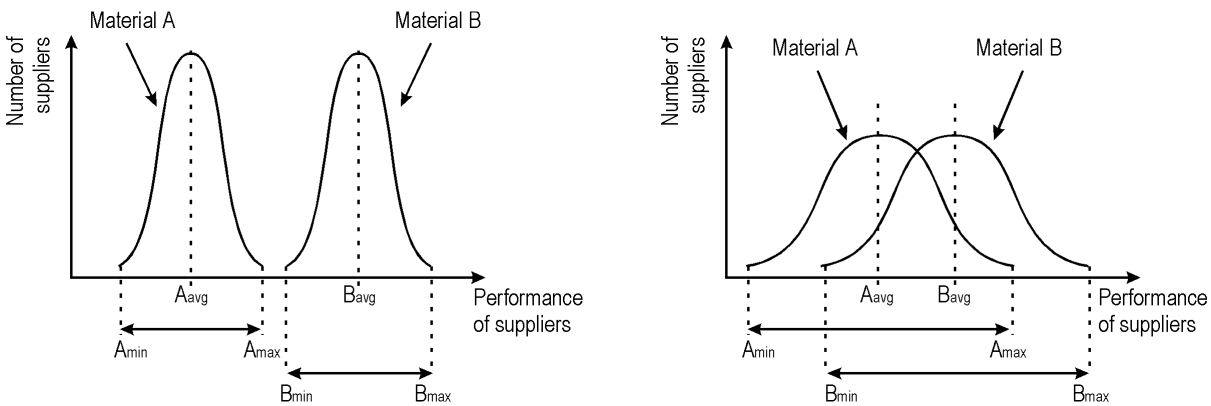

Figure 1. Number of suppliers reaching varying levels of (environmental or social) performance. A_{min} , A_{avg} , and A_{max} represent the performance levels reached by respectively the worst, the average, and the best supplier of material A. On the left hand side, the difference of performance between suppliers of the same material A (A_{max} - A_{min}) or B (B_{max} - B_{min}) is smaller than the difference between the averages for both materials (B_{avg} - A_{avg}). On the right hand side, the opposite applies.

It makes sense to both sustain the use of sector-wide averages in current DfE practice and to extend this approach to DfS in three cases:

1. if the difference of performance between suppliers of the same material (= A_{max} - A_{min} or B_{max} - B_{min}) is smaller than the difference of performance between different materials (= B_{avg} - A_{avg});

2. if the actual performance of 1kg of material bought from a particular supplier cannot be traced. This argument has been the major argument of many an industry sector to provide only sector average environmental cradle-to-gate data and to refrain from publishing site specific data (e.g. [9]);
3. in case of scarcity, implying that market conditions are such that buying 1 kg of material from supplier X instead of supplier Y only implies that another customer will need to shift from supplier Y to supplier X. This argument needs to be situated in current research discussions on the distinction between average and marginal LCI data collection (see e.g. [10]).

In case one of these conditions applies, it could be useful to build up a DfS programme. A starting point for building such programme is the parallel between DfS on the one hand and DfE and DfQ (Design for Quality) on the other hand: all three paradigms aim at optimising a virtue of the product over its full product life cycle. Consequently, the widely studied prerequisites for and elements of DfE and DfQ programmes (e.g. [11], [12]) can be extended to DfS. Important aspects of such programme include the integration of sustainability in the overall company policy, the availability of a measurement system, the existence of DfS procedures, and the availability of tools.

3. Measuring system

It is clear that the development of a measurement system is a first and major challenge for DfS. As for the environmental aspect, social aspects have traditionally been approached from an organisational side: social legislation - just like its environmental counterpart - has set minimum performance levels for enterprises, without taking into account processes up the supply chain. No product life cycle thinking is included.

This paper presents different options to cope the challenge of translating the organisation or nation oriented social performance levels and indicators developed by e.g. the Global Reporting Initiative [13], the Social Standard SA8000 [14], the UN Commission on Sustainable Development [15], or the International Labour Organisation (ILO) [16] into indicators suitable for assessing a product life cycle from a social justice point of view.

3.1 Activity based classification

The first way of measuring product life cycle-related social performance is by mirroring the environmentally oriented Life Cycle Assessment methodology to the social dimension, as also proposed by Hermann et al. [17]. Life Cycle Assessment (LCA) is defined by the ISO 14040 standard as a technique for assessing the environmental aspects and potential impacts associated with a product by:

- compiling an inventory of relevant inputs (such as raw materials and energy carriers) and outputs (such as emissions and waste) of a product system;
- evaluating the potential environmental impacts associated with those inputs and outputs;
- interpreting the results of the inventory analysis and impact assessment phases in relation to the objectives of the study.

LCA studies the environmental aspects and potential impacts throughout a product’s life (i.e. cradle-to-grave) from raw material acquisition through production and use to disposal. The general categories of environmental impacts needing consideration include resource use, human health and ecological consequences [18]. Though a thorough discussion on the subtleties of LCA is outside the scope of this paper, the following paragraph provides a short introduction into a common framework for LCA.

A widely accepted methodological framework was first proposed by the Society of Environmental Toxicology and Chemistry (SETAC) in its famous "Code of Practise" [19]. This framework was further refined and standardised in the ISO 1404x series of standards, as a part of ISO's work on standardisation in the field of Environmental Management (Figure 2).

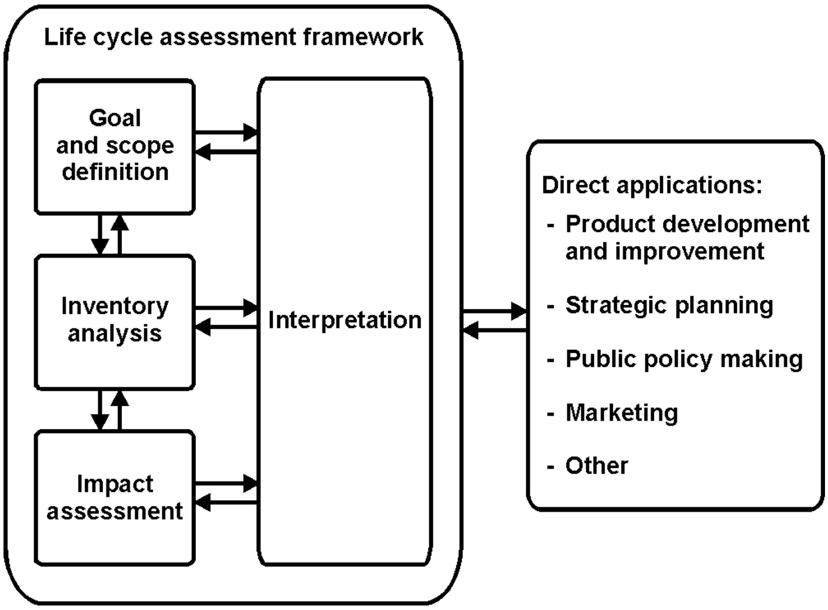

Figure 2. Methodological Framework for LCA according to ISO 14040 [18].

Core of the framework is a life cycle wide inventarisation of emissions, waste, and resource consumption, which is then used to calculate the product's contribution to the major problems for the environment, for human health, and for resource depletion. These problems (called impact categories) include e.g. global warming, stratospheric ozone depletion, acidification, and land use. As a scoring system, an indicator is selected for each impact category. For example, the indicator "GWP" (Global Warming Potential) is commonly used for the impact category "global warming". An optional weighting step can then be used to aggregate the scores of the individual impact category indicators into one single score. This weighting step is, however, typically based on a subjective basis using e.g. panel discussions.

A system similar to LCA could be worked out for sustainability assessment. Three questions are crucial:

1. how to "measure" the life cycle inventory,
2. which are suitable social impact categories, and
3. which are suitable social impact category indicators.

The first three questions probably need to be answered together. Social impact categories have been identified by the supranational organisations as explained above. They include e.g. forced labour, child labour, and discrimination. A translation of organisation-oriented social indicators to product life cycle oriented indicators is, however, often possible based on a time basis. Social impact category indicator scores for the production of a product could then be expressed in e.g. minutes of child labour, minutes of forced labour, etc.

However, extensive research will be necessary before this, theoretically most promising, option could be implemented in industrial practice. Problems inherited from the basic LCA approach include data availability, system boundaries, allocation, weighting, etc. Moreover, some social indicators, such as ratio of male/female wage - are hard to translate towards individual products. An option could be to use once more a time basis, by calculating the time worked by underpaid women. In that case, the expression "underpaid" needs to be defined by some minimum performance level.

3.2 Company classification

The last example links to a second option which is probably theoretically less concise than the LCA approach, but more practically oriented. It makes use of a binary classification of work into Class A 'meeting all minimum target levels' and Class B 'not meeting all minimum target levels'. Both the indicators and the target levels used for this classification are again derived from e.g. ILO conventions. The single social indicator to be used during the design process could then, for example, be 'the overall Class B time worked on the product'. The advantages of working with such binary classification are multiple:

1. no extra mutual weighting of social indicators is needed within the design process;
2. the original, organisation-oriented, indicators can be used to classify the organisations into the two classes. The 'time worked on the product in a Class B organisation' could then be used as an approximation for the above-mentioned indicator.
3. the proposed DfS system can be seamlessly integrated into a social responsibility management system based on e.g. SA8000 or another ISO standard still to be developed. In that case, no time studies would need to be done for work performed in a complying company. Moreover, SA8000 implies that companies complying to the standard need to make sure their full supply chain complies. In other words: all work performed by either the company itself or its supply chain resorts under Class A and can thus be disregarded. Of course, third-party certification, currently not provided for SA8000, would be appropriate.

An assessment algorithm based on the above proposal is presented in Figure 3.

One problem with the proposed system is, however, the rather unstable situation when a company is - for at least one aspect - working on the very edge of the minimum requirements. This problem could be tackled by creating more classes than merely 'applying' and 'not applying'. In that case, however, the necessity to introduce weighting between e.g. 'not applying', 'applying', and 'very well applying' returns.

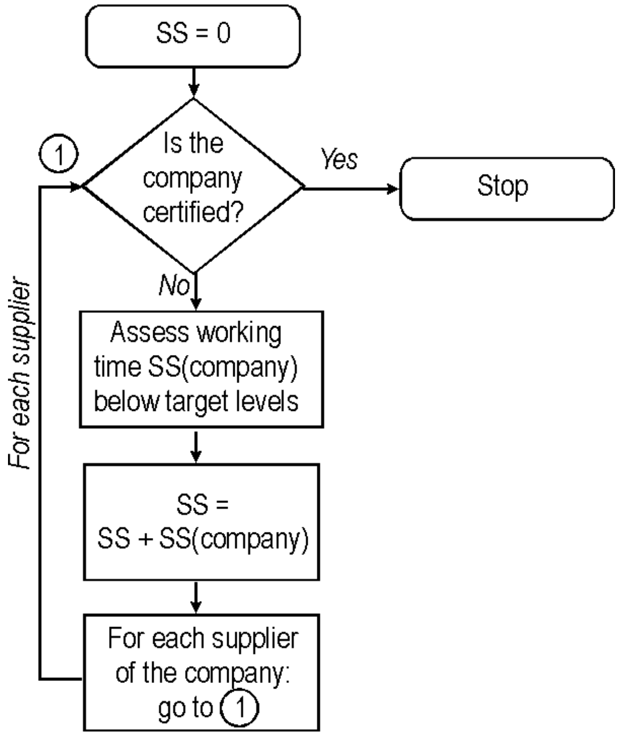

Figure 3. Social sustainability assessment algorithm for products throughout their supply chain.

A pertinent question is, why such system would be advisable for a Design for Sustainability system, while obviously not being used in a Design for Environment situation. The answer on that question has two parts:

1. First, the measuring units for respectively social assessment and environmental assessment have a differing meaning. In the social assessment case, the measuring unit "time" is only important in case a company does not meet the required standards. Working time delivered under acceptable conditions does not result in adverse effects (or is even beneficial in view of unemployment). Consequently, this "time" need not be measured. On the other hand, a less is better approach is always applying for environmental emissions, waste, material consumption and energy consumption. As a result, even process steps resorting under "best available technique" need to be included and assessed;
2. A second, though related, reason is that the ISO 14001 standard on environmental management systems does not set any environmental targets: every company is allowed to set its own targets, and is certified based on the fact of having targets, of having a strategy and the means to aim for the targets, and of the promise to regularly update the targets. Consequently, ISO 14001 certification does not tell anything about actual environmental performance. In contrast, a social standard such as SA8000 explicitly requests the organisation to comply with social minimum standards of the International Labour Organisation Conventions (which is a part of the United Nations).

While the LCA based system presented in Section 3.1 is probably theoretically more concise, the system presented in this section is more practically oriented and can be implemented on a rather short term.

4. Final remarks

This paper presented a number of thoughts on the role of the designer in the social product development process. First, the question was raised whether design or supply chain management would be the crucial phase in product development. A number of criteria were presented as a first way to finding an answer. A crucial element in this discussion is the comparison between, on the one hand, the difference of performance between suppliers of the same material, and, on the other hand, the difference of performance between different materials.

In case design would turn out to be a crucial phase, a DfS programme would include the integration of sustainability in the overall company policy, the availability of a measurement system, the existence of DfS procedures, and the availability of tools. The paper presented two ways of developing a social sustainability measurement system. A first option is based on a genuine LCA approach. A second option is closely related to social corporate responsibility programmes. While the former option is theoretically more concise, the latter option is more practically oriented and can be implemented on a rather short term.

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