

# Implementing the Precautionary Principle through Stakeholder Engagement for Product and Service Development

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**Keywords:** sustainable design, precautionary principle, stakeholder engagement, ethical framework

## ABSTRACT

The precautionary principle can be integrated into the decision making process during the conception of products and services in a perspective of sustainable development as a complement to Life Cycle Analysis (LCA). This can assist stakeholders in arriving at just and fair decisions based on the complexity and uncertainty of data. LCA provides powerful insights for addressing the environmental aspects of sustainability. Based on an attitude of prevention, LCA seeks to reduce a product's negative impacts by assessing the various phases of a product's life-cycle and taking appropriate action. However, in cases of uncertainty of harm, it is not obvious how to define an appropriate course of action because the LCA process is not equipped to deal with a fundamental lack of data. Decisions cannot therefore be easily legitimized. By integrating the precautionary principle through stakeholder engagement, in the perspective of an ethic for the future, such decisions could ultimately be justified and can complement the existing LCA process. This approach becomes pertinent, particularly for stakeholders in their practise of product and service development. Methods such as alternative assessment and precautionary deliberation can assist in this shift towards sustainability.

## Introduction

At the start of the 21<sup>st</sup> century, it has become evident that humans face environmental and social challenges that are unprecedented in the history of this planet [1]. The world's environment continues to be devastated by the impacts of development. In some estimates, approximately one hundred species are on the verge of extinction and this number is on the constant rise [2]. Natural resources fundamental for a basic quality of life, such as water, air and soil, are degrading at an alarming rate affecting the quality of life of humans and therefore resulting in the degradation to society as well [1]. In addition, the world population has been on a steady increase; since 1990 world population grew from approximately 5.3 million to 6.5 million. This rise in population has and will continue to have significant negative impacts on natural resources and society at large. However, it is not only the increase in population that is of concern; the way in which humans conduct their lives has considerable consequences as well. This is because the most affluent societies consume the most natural resources, even if they do not constitute the majority of the population. Therefore over-consumption and not only over-population are a major concern in this crisis [3].

There are various perspectives in dealing with this crisis. Pessimists feel that this situation is hopeless and that humanity is doomed. Others revert to science and technology in search for solutions; for example, cleaner energy, more efficient cars, etc [1]. This represents a mode of efficiency that uses optimization methods to reduce impacts. This is a necessary condition, yet insufficient in today's crisis since a major consideration of this crisis is the way in which humans consume and therefore optimizing current products and services alone will not provide long-term solutions [4]. For many, science and technology seems the only way for resolving current problems. One main reason for this is because science is believed to provide objective and factual answers to problems. However, an approach based on science alone with the hope of quick solutions is an attitude destined to fail [5]. These approaches do not consider the impact of individual and collective behaviours as pertinent for solving such problems. In fact, they do not recognize the power of citizens in a decision process [6].

Even if it may seem tempting to resort to science and technology, the problem is that environmental problems are not inherently technical or scientific. They are in fact problems that reveal fundamental questions [1]. Among other questions: What is the place of humans among nature? What type of life can humans expect to continue to lead? Why are resources not shared more equitably? How can the current generation ensure the future of humanity and all life on earth? In essence then, ethical questions emerge as a result of this crisis [5]. Looking solely at science and technology without considering the ethical issues may create as many problems as solutions. Leaving such decisions to the experts of science and technology implies that the decision will be based on the value system of these experts alone.

Problems that are measurable may be addressed using scientific and technological approaches; however the broader social and environmental problems that humans face today cannot be evaluated using such methods alone and therefore require alternate ways for assessment and resolution [7]. In particular, potentially catastrophic problems (problems where there is little certitude of knowledge) must employ a different mode of assessment. This is because in these situations, the consequences or risks are non-observable, long-term or not measurable. Therefore deterministic modes of evaluation are inadequate as they are based in statistical analysis and are considered at best preventive. Potentially catastrophic situations impose a precautionary attitude. In this mode of assessment, other means than statistical analysis are necessary [8]. The views of the community are integral since in these cases, the experts disagree on the risks or consequences. Therefore the values and visions of the experts alone are insufficient. By involving citizens in the decision process, they will develop an increased sense of responsibility towards others and their environment. In addition, they will provide a greater level of insight in the search for a resolution [6]. An attitude of sufficiency is necessary for arriving at sustainable solutions, since efficiency is clearly inadequate on its own in a context of sustainability [4].

### **Evolution of Design Approaches**

Design has become an increasingly significant vehicle for achieving environmental, economic, and social policy goals at a regional, national, and international level [9]. In fact, the role of design has expanded and increased in complexity because the scale of environmental impacts does not depend on population size alone, but also on

consumption choices, production choices, and in general, actions taken. Therefore to move towards sustainability, design has had to deal with the growing concerns that humanity faces. Design strategies and approaches for dealing with the environmental crisis have progressed enormously over the past thirty to forty years. These approaches have evolved from *green design*, to *eco design* and currently to *sustainable design* [10]. Pollution prevention and environmental engineering are strategies mainly used by the *green design* approach; they are considered short term strategies regarding the search for solutions.

Life cycle approaches use analytical tools that can help optimize the eco-efficiency of products and service systems; this is a strategy used by *eco design*. It is a preventive approach to addressing the environmental crisis. These tools have been developed to enable designers and engineers to assess the life cycle of a product or service system from 'cradle to grave' [11]. Eco-design, although a global approach to product design because of its cradle-to-grave perspective, is limited to the scale of the product or service, and therefore is considered as a strategy that seeks essentially medium term solutions. This approach has helped (and continues to help) in the design and production of eco-products as well as the construction of environmental policies. The assessments of negative impacts using such tools are done using objective, available data, with estimated margins of error; a deterministic or probabilistic approach. In fact, these earlier approaches are, on the most part, limited to environmental issues alone. And if they do consider social impacts, these are considered within a confined scale of vision (within a socio-economic scope); and not on the most global scale. Therefore there is a need to consider alternate methods of decision making in design practice if society is to move towards sustainable development.

*Sustainable design* on the other hand is based on the scale of civilization. The main concern in this approach is the satisfaction of the fundamental needs of everyone (present and future) and understanding the limitations and impacts imposed on the environment and society by technology, production and consumption. Therefore the solutions in this approach consider the well-being of humanity on a global scale where very long term solutions are considered. Sustainable design is intrinsically precautionary since it seeks solutions that are long and very long term; in other words, it seeks to avoid catastrophic harm to nature, humans, and their societies by providing solutions that can preserve these.

It becomes evident that the level of complexity and scope of vision increases with the emergence of each new design approach. As the approaches evolve from green to eco and finally to sustainable design, the solutions employed require a greater level of reflection. Therefore for sustainable design, a global and systemic vision that considers social, biophysical, technical, economical, and cultural elements becomes fundamental. Table 1 demonstrates that green design is a production process approach, eco-design is a product approach, and sustainable design is a system approach. This table therefore reflects the spatial and temporal aspect of each of the design approaches. The different approaches, their hierarchical initiatives, the organizational structure required to support such a strategy, and motivations of the organization are described in this table. It elaborates on each of them by presenting them from the simplest to the most elaborate design approach.

Table 1: Various industrial approaches to design that consider one or more of: environmental, social, cultural, and ethical criteria [10] [12] [13].

Name of Design Approach	Scale of Approach	Type of Approach	Organizational Strategy
<b>Green Design</b> An approach that responds to evolving laws; preventive.	micro-level scope	<b>Process Approach</b> Industrial vision with short term solutions	An approach that comprises mostly of end-of-pipe solutions. Work is focused on reducing emissions of pollutants based on the process of fabrication. The motivation here is mostly abiding laws.
<b>Eco-Design</b> Approach to design that considers the environmental impacts based on the life cycle of a product or service; preventive.	meso-level scope	<b>Product Approach</b> Global vision with essentially short and medium term solutions	A strategic approach that considers all the levels of the enterprise. All the potential environmental impacts of a product are taken into consideration and the actions taken are an integral part of the policies of the enterprise. The motivation here is for the enterprise to differentiate itself from other enterprises, as well as to follow expected laws and norms.
<b>Sustainable Design</b> Global approach to design – requires a sense of inter-dependence among the organization, those affected by the activities of the organization, and the environment; preventive and precautionary.	macro-level scope	<b>System Approach</b> More global vision with short, medium, long and very long-term solutions	A global approach that considers environmental, social, cultural, and ethical aspects. In this approach, the organization is no longer considered isolated in its environment, but is considered as a part of the system with the environment and society that surrounds it. The motivation here is a strong commitment to sustainable development.

### Shift in Epistemological Frameworks between Eco Design and Sustainable Design

The idea of an epistemological obstacle was first introduced by Bachelard [14]. He showed that science has progressed against the notion of common-sense and ordinary knowledge; he claims this to be a source of epistemological obstacles to the advancement of science. According to Bachelard [14], scientists use the same form of argumentation and explanation they are accustomed to and therefore are caught in a kind of inertia; this he claims is another source of an epistemological barrier. This refers to the habits of accepting the ways in which things are done, and therefore inhibits new questioning. In some sense, this inhibition of asking questions in innovative ways can be seen as working within a paradigm [15].

The distinction in epistemological stances represents the core discrepancy when describing the differences between prevention and precaution approaches. The epistemological position of sustainable design is coincident with the precautionary principle; just as the epistemology of green and eco design is similar to that of the prevention principle (Figure 1). An awareness of the inequalities of the ‘knowledge producing world’ (or expert knowledge providers) is a point of departure for a precautionary approach. In this approach, a participative forum for decision making allows a pluralistic, non-neutral position [5]; this is in contrast to a preventive approach, which adopts a universal and neutral position of knowledge. A precautionary approach will allow an emergence of various points of view; a way to construct solutions from the diversity of knowledge, values, and concerns. To embrace the complexity of situations from the perspective of precaution requires: (1) a commitment to justice and fairness; (2) a participative method to allow the emergence of the issues of each stakeholder; (3) a commitment to comprehending the value systems of each stakeholder; and (4) a commitment to search for alternative solutions that will not shift the negative impacts, but seek to avoid them altogether.

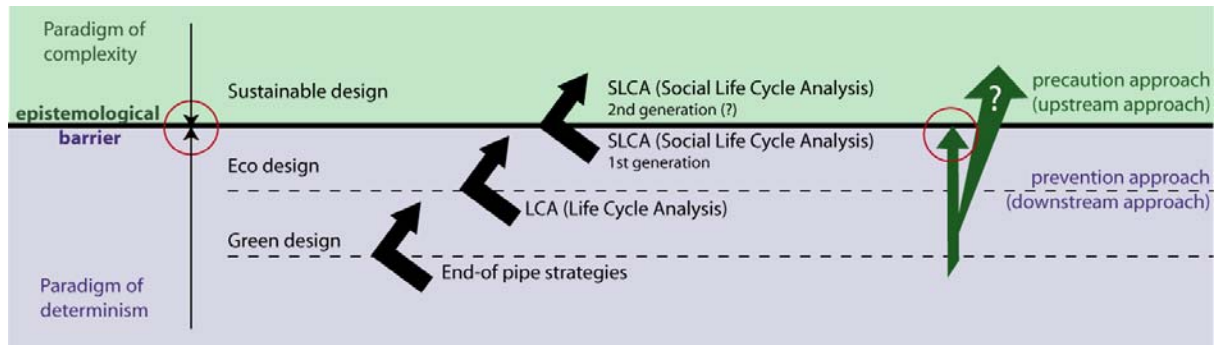


Figure 1: Towards a global and systemic approach in the establishment of social indicators: a theoretical result of adopting a precautionary approach to decision making. © Cucuzzella, De Coninck, 2007

Assessment tools such as Social Life Cycle Assessment (SLCA), that address social impacts and therefore social problems, can aptly be embedded within the systemic paradigm. However, very little research is currently done on SLCA within this paradigm; most research in SLCA is firmly embedded within a deterministic paradigm using quantitative methods<sup>i</sup>. The main problem with using only quantitative methods for assessing social impacts is that much of the data available is not measurable and therefore very difficult to fit into such an approach. In addition in cases of fundamental uncertainties, it becomes very problematic to use such approaches.

The lack of an existing decisional framework in a context of uncertainty of harm, and the lack of an ethical knowledge base for developing sustainable solutions imply that there is a gap in decision making processes in situations where a precautionary approach is warranted. The precautionary principle inverses the traditional logic of proof: one must act even in the face of uncertainty, and seriously consider the consequences even in a hypothetical danger. It is this condition; the uncertainty of harm, the uncertainty of what action to take, and the uncertainty of a desired outcome that puts the precautionary principle in a realm of ethics. All actions contain some level of risk, and therefore humans need to construct innovative ways to deal with such uncertainties. The values and visions of all those affected by such situations can contribute to insightful solutions that consider the common-good. A major question in this approach is that: through which debates (actors and/or issues) can the plurality of such values be revealed? How can this process be defined so that it is effective in including the divergent visions of the world? When taking into account the various actors and their possibly diverse knowledge, values, and opinions, complexity arises from the decision making process since a practical decision must be made that will result in some action. With an ethic that takes into account the opinions of each seriously, which/whose ethic will be used/sacrificed in the process. Therefore methods to go from diversity of opinions to a practical concrete decision are necessary. There is a necessity to discover the value systems, to expose them and to confront them, so that they can contribute to the search for sustainable solutions.

## Conclusion

The complex epistemological framework that characterizes a precautionary approach for sustainable design will encourage multiple points of view in the process of problem resolution. A stakeholder approach to decision making is a promising method, not only for the justification of decisions, but also encourages the creation of a

wide set of possible alternatives. This will have as a result, not only a more insightful final solution, but also the permeation of the manifested knowledge to the stakeholders involved. Such an understanding would encourage stakeholders in an ethic and rhetoric that they are not accustomed to. Therefore this new way of thinking for addressing problems must be learned, used, developed, and adjusted. In this manner, the precautionary principle will allow an adaptive approach to decision making based on several reasons: (1) it adapts to each situation, (2) it allows an adaptation of any previous understanding of controversial situations to current situations without having any of the values imposed. This refers to the general context of prudence; decisions based on prudence seek to use any available (current and/or previous) information to use as a starting point, and adapt to the new situation based on a collective discursive process where the visions and values of each stakeholder are revealed. It therefore becomes an adaptive process; requires the acceptability of criteria which are defined by the stakeholders, where consensual solutions emerge. Stakeholders should be able to rely on a general conceptual framework that would allow them to realize projects, define procedures for participation, and to respond to crucial issues of sustainable development. This will result in a common philosophy, as well as a dialog among stakeholders. This basis of collaboration and exchange among partners will encourage an emergence of co-creation processes of projects and co-formulation processes for solutions and projects. These processes are based on dialogue and will encourage a larger mutual comprehension of new perspectives and an increased level of responsibility among actors.

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## End Notes

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<sup>i</sup> For example GaBi developed by L. Barthel, and J. Pflieger from the University of Stuttgart. This approach was presented at the international conference Society and Materials in Seville, May, 2007.