

**A Participatory Approach Seeking Consensus in a Context of Uncertainty**  
*A Sustainable Development Perspective of Life Cycle Analysis*

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**Abstract**

The lack of an existing decisional framework in a context of uncertainty for developing sustainable solutions imply that there is a gap in decision making processes for stakeholders. To move towards sustainability, it is recommended that stakeholders adopt decision making processes that are precautionary. A commitment to precaution encourages a global perspective and the search for alternatives. Therefore governance involvement through a participatory approach becomes fundamental for the establishment and evaluation of social indicators using life cycle thinking, so that the decision making process during conception will result in a justified course of action in cases of uncertainty and potential harm.

According to Agenda 21, in a context of sustainable development, the consideration of governance as a collective decision making process will not impose a situation of authority or coercion; it is a social technique meant to resolve collective problems and to allow the citizens a sense of responsibility. No single actor has all the information and authority to develop a strategy that considers the long term. This strategy cannot therefore emerge unless there is cooperation between institutions and other interested parties where each would fully exercise their responsibilities and competencies. Therefore this strategy will be based on the 4th pillar of sustainable development – governance, which is over and above the other three pillars of economy, environment and society.

Because of the inherent uncertainties of long-term strategies, the precautionary principle can be integrated into the decision making process during the conception of products and services, as a complement to Life Cycle Analysis (LCA). 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. It is a sophisticated tool that highlights the issues and helps in the decision making process; but the decision ultimately rests on the decision maker based on his interpretation of the data, which is a function of his point of view. Furthermore, in cases of lack of knowledge or indeterminism, it is not obvious how to define an appropriate course of action because the LCA process is not

equipped to handle such decisions, unless the decision maker makes an estimated guess; decisions cannot be easily rationalized because of this inherent lack of data. LCA therefore presents an obstacle when decisions are taken in spite of uncertainties concerning the consequences of an eventual action. In addition, there are no tools that lean specifically towards the creation and evaluation of social impacts using a global point of view.

It is therefore necessary to set up structures and processes that will allow such stakeholders a venue where a particular referential paradigm will be used as a basis for their discussions; where their individual value systems will 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. The objective is a sharing of visions and values through 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.

### **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 (Des Jardins, 1995). The world's environment continues to be devastated by the impacts of development. 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. (Des Jardins, 1995; Adam, 2004; Princen, 2005; Korten, 2006; Van de Ryn & Cowan, 2007). 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 (Princen, 2003). 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 (Droz & Lavigne, 2006). 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 (Sclove, 1995).

Even if it may seem tempting to resort to science and technology, the problem is that environmental problems are not inherently technical or scientific. In essence then, ethical questions emerge as a result of this crisis (Droz & Lavigne, 2006). 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 (Whiteside, 2006). 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 (Dupuy & Grinbaum, 2005). 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 (Sclove, 1995). An attitude of sufficiency is necessary for arriving at sustainable solutions, since efficiency is clearly inadequate on its own in a context of sustainability (Princen, 2003).

### **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 (Fletcher & Goggin, 2001). 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 (Marchand, De Coninck & Walker, 2005). 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* (Madge, 1997). 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' (Consoli, et al., 1993). 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.

Table 1: Various industrial approaches to design that consider one or more of: environmental, social, cultural, and ethical criteria (Madge, 1997; Dewberry, 1995; Janin, 2000).

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.

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.

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

The idea of an epistemological obstacle was first introduced by Bachelard (1938). 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 this author, 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 (Kuhn, 1970).

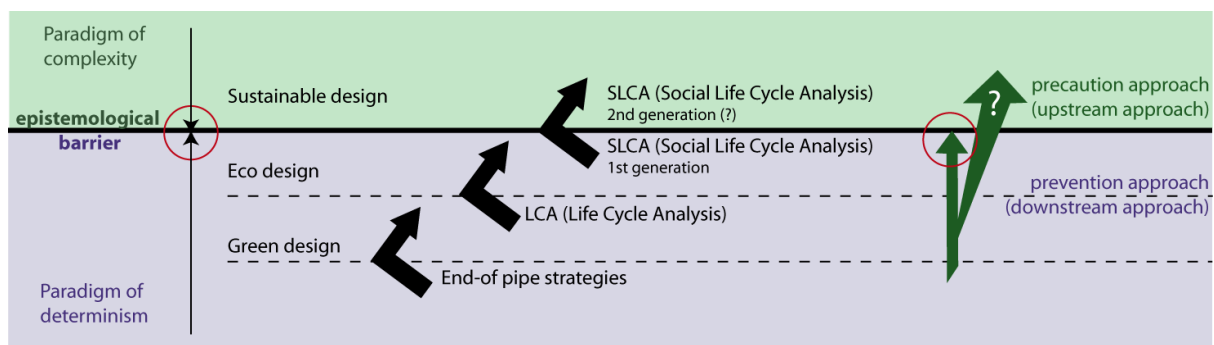


Figure 1: Towards a global and systemic approach in the establishment of social indicators: a theoretical result of adopting a precautionary approach to decision making. © Cucuzzella, De Coninck, 2007.

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 (Droz & Lavigne, 2006); 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.

### **Prevention and Precaution as Complementary Approaches for Sustainable Design**

The definition of the precautionary principle in a general context can be defined as a principle that tries to guide development in the absence of certitude and in the presence of potential risks, and therefore allows the establishment of a responsible, anticipative action. This is why sustainable design is more appropriately adapted to a precautionary approach since it allows for a more global and long-term perspective; a perspective that also considers the common-good. A precautionary approach can be seen as a model for upstream thinking. In fact, a precautionary approach entails the cooperation of experts as well as non-experts because of the inherent uncertainty of harm in many current contentious situations. This approach must therefore allow a consideration of the values of those affected by the situation so that a decision based on the common-good can be reached. However, the precautionary principle has largely been ignored in decision support tools as it is not evident how it can be operationalized; it is based on fundamental uncertainties and therefore inherently rests on an ethical framework.

Some questions that arise in this approach are: Through which debates 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. This ethic takes into account the opinions of each seriously. 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 innovative solutions towards sustainability.

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. 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. Yet, the attraction of using deterministic quantitative methods is that they have predictive powers where decisions based on computable data are simpler to rationalize. Humans are very comfortable with this type of support for decision making (Janicaud, 1985; Dupuy & Grinbaum, 2005). There is a difficulty in moving beyond a deterministic approach; instead there is a greater tendency to rely on statistical probabilities to support decision making in cases of uncertainty (Janicaud, 1985; Dupuy & Grinbaum, 2005). However, this research is seeking to operationalize sustainable design using a precautionary framework for decision making, and therefore will move beyond a deterministic approach to decision making towards a complex approach.

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 inverts 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.

### **Conclusion**

A point of departure for this research was that it is no longer possible to rely on scientific certainty for defining actions, and that the consequences of not taking anticipative measures early enough could be irreversible. Such early and precautionary measures are the reason why the 1992 Rio Earth Summit adopted the *Rio Declaration on Environment and Development* containing Principle 15, the precautionary principle. The reflection based on the exploration of this principle revealed that it is a promising approach for innovation and decision making in a context of sustainable design for addressing the problematic of over-consumption.

This research also seeks to address the recommendation for change proposed by the Stern Review (2007) indicating that the benefits of immediate action will considerably outweigh the costs of no action regarding the current environmental and social crisis. This is because it seeks to explore new methods of decision making that may have a positive contribution towards sustainability. The main focus of inquiry of this research addresses the imperative imposed by Stern since it is seeking to transform current modes of consumption through design using a perspective of prudence.

Existing eco-design tools, although very useful in assessing and helping to reduce environmental impacts for a product or service system, are no longer sufficient on their own, because they limit the point of view of the problem to the product or service in question and therefore evade the more global perspective of the impacts. This is because the long-term, global, invisible effects of technological innovations on society and the environment require global consideration and cooperation. Therefore, nature and society cannot be analyzed only through a cause-effect perspective because of the existence of emerging phenomenon in technological, social, political, or environmental innovations (which means that uncertainties in discoveries can no longer be ignored). In fact, in the context of sustainable development, an acceptance of uncertainty and diversity of values is inescapable. Deterministic, rational methods (such as LCA) are often advantageous in economic and risk analysis and provide justifications for final decisions since they provide measures to make preventive decisions. This type of operational reasoning is embedded in the certitude of knowledge. These tools depend on existing norms and conventions as a basis for guiding decision making processes and seek to optimize situations through the logic of efficiency (or more specifically, eco-efficiency). As a consequence of a decision taken, a transfer of

new problems may result, perhaps to other levels of society or the environment. Therefore prudent approaches and not only preventive measurable approaches are essential for sustainable design. In fact, an attitude of prudence in decision making calls for an ethical framework that allows an understanding of the complementary nature of both precautionary and preventive approaches to decision making.

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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