Oliver Parodi, Ignacio Ayestaran and Gerhard Banse (dir.)

Sustainable Development
Relationships to Culture, Knowledge and Ethics

KIT Scientific Publishing

Sustainability, Uncertainty, and Environmental Ethics

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Éditeur : KIT Scientific Publishing
Lieu d'édition : KIT Scientific Publishing
Année d'édition : 2011
Date de mise en ligne : 13 septembre 2019
Collection : KIT Scientific Publishing
ISBN électronique : 9791036538230

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Teresa Kwiatkowska, Wojciech Szatzschneider

> "Most people […] take refuge in theory and think they are being philosophers and will become good this way, behaving like patients who listen attentively to their doctors, but do none of the things they are ordered to do. As the latter will not be made well in body by such a course of treatment, the former will not be made well in soul by such a course of philosophy."
>
> *(Aristotle 2002, 1105b, 15)*

1 Remarks about Sustainability

If we scan our horizon these days we detect a huge labyrinth of ecological, climatic, economic, and social challenges that drives us into disoriented changes at unprecedented speed. This myriad of swingings often without simple cause or solution has brought on the evolution of new concepts, including that of sustainable development as a basis for overcoming the environmental and economic challenges (cf. Mebratu 1998).

The publication of the UN-sponsored report *Our Common Future* (1987) opened the door to this ambiguous concept that became highly instrumental in developing a "global view" of our planet's future. Indeed, some of the local successful outcomes paved the way to discussions about global policies that are thought to cope with the vast environmental challenges worldwide. This catch phrase has become part of many policy documents, ending in a wide variety of definitions and interpretations. As Sharachchandra M. Lele fittingly affirmed: "[Sustainable development] is a 'metafix' that will unite everybody from the profit minded industrialist and risk minimizing subsistence farmer to the equity seeking social worker, the pollution concerned or wildlife loving First Worlder, the growth maximizing policy maker, the goal-oriented bureaucrat and, therefore the vote-counting politician" (Lele 1991, p. 607). The flexibility of the uses of this concept raises questions about its diverse meanings hidden behind widespread green rhetoric.

Although the historical and conceptual antecedents of the concept of sustainability are well known, many practical questions have been arising. Herman Daly, challeng-

ing the trendy and fluid nature of sustainability concept, pointed out that "this term – touted by many and even institutionalized in some places – is still dangerously vague" (Daly 1996, p. 1). Many politicians believe that their decisions concerning global environment rely on robust and secure scientific knowledge, a voice of the natural world. However, there are good reasons to question our optimism about scientific knowledge mainly when it is applied to complex climate and environmental problems. Therefore, the false impression that we have a clear scientific elucidation of "sustainability" carries on countless unexpected ecological, social, and economic consequences.

Without doubt, all the definitions go around the severe environmental crisis we are facing and point out the necessity of clean and fair economic growth. Therefore, the sustainability concept has to be woven out of the rich fabric of theory and practice. Each of different formulations of "sustainability" makes a distinct and noteworthy contribution to our understanding of this notion, but also suggest that we are not really in position to comprehend and apply this "science" until we have recognized all differences among various perspectives. Some authors assume that sustainable human society with "good quality of life for all" can be achieved by changing consumers' habits and promoting "green" development programmes with appropriate technologies (cf. Sinha/Greenway 2004). At the same time, we face countless problems of extensive floods or droughts, rising food prices followed by social unrest, deepening poverty, and spreading diseases over many places of our Earth community. Hence, if the science of sustainability pretends to be more than a mere theoretical fanfare, it should avoid a partial view of one aspect of the world in highly abstract and reduced terms (cf. Holdrege 2008, p. 326).

The contemporary environmental debate is mostly associated with growing pollution, dwindling natural resources and biodiversity loss. With a good reason, for history gives us mounting evidence that numerous ancient societies may have collapsed because of environmental degradation. Back then, however, many of the perilous changes have been to slow to be noticed during the individual human life. In contrast, in the course of the last two centuries, the economic growth and globalization have inevitably led us to point of various critical environmental thresholds.

As the German poet Johann Wolfgang von Goethe pointed out: "If we want to achieve a living understanding of nature, we must follow her example and become as mobile and flexible as nature herself" (Goethe 1977, p. 48). Shall we adjust social and economic structures to natural systems, re-conceptualize the whole theory of development, or develop an environmental "way of thinking" at the community level to meet basic needs of local populations? "The Romans", wrote Martin Heidegger, "called a matter for discourse *res* […] *Res publica* means, not the state, but that which, known to everyone, contains everybody and is deliberated in public" (Heidegger 1971, p. 175).

Expert knowledge, based upon theories of science of Earth systems and space, will in due course generate regulatory practices of governance and the concepts of

sustainability that suit uniform ideals of law, justice, and society of a central state. The practice of dwelling within the region with its *res publica* characterized by a long tradition rooted in customs and convention, will, on the other hand, tend to create an ideal of policy that emphasizes local idiosyncrasy, diversity, and look after local community interests. One can morally act only on policies that could be truly universalized in the sense of being freely adopted by all who could be affected by them.

2 Private Morality and Public Policy

We have to begin by explaining the concept of morality. How can we morally condemn certain acts of injury to plants, animals, or ecosystems unless we are clear on what constitutes morality? Here we also note that moral rules exceed legal norms. Countless human actions may be rejected or encouraged but they cannot be part of any legal system. A moral rule such as Aldo Leopold's famous pronouncement ("A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.", Leopold 1949, p. 262) is a recommendation to act in a certain way, a recommendation established by experience (science comes in handy), which has been shown to promote personal, social, and natural well-being better than others. And "well-being" can only imply something empirical like self-development, happiness, a more pleasant life, an aesthetically pleasing environment, spiritual enjoyment, a sympathetic connection with other living things, and so on. Morality, as Aristotle indicates, is strictly a personal affair. It is a matter of each person's independent judgments.

Ludwig Wittgenstein once said: "Only from the consciousness of the uniqueness of my life arise religion, science, and art" (Wittgensten 1979, p. 79e). We can equally apply his thought to morality. The way we act depends on what life we would like to live. This is a territory where environmental ethics can play a leading role in shaping our values and our moral fiber into a way of understanding that preservation of nature is a necessary condition for developing human possibilities. But, as Aristotle rightly noted in *Nicomachean Ethics*: "[…] if arguments were in themselves enough to make man good, they would […] have won very great rewards […]; but as things are, […] they are not able to encourage the many to nobility and goodness" (Aristotle 2002, 1179a, 1-5). So here lurk difficulties grounded in our lives as social beings. Our values and their origins are embedded in inherited human cultural contexts. Private choices operate within social codes or customs. Given the fact that environmental values are rooted more in ethical discourse than in social or political practice, the protection and conservation of vulnerable biological riches requires a collective form of response that involves regulatory and legislative principles, and political decisions. It is through the government that we have to mediate human-nature relationships. It was

again Aristotle who pointed out that it is politics that uses the rest of sciences, and it legislates as to what we are to do and what we are to abstain from.

By making decisions that directly affect the anonymous public, our acts acquire another character. We cannot disregard this when we make a decision concerning the environment beyond our own back yard; we act as social or political agents, regardless of our deepest ethical or religious intentions. If one designs and decrees a certain natural area as a national park or biosphere reserve, he or she acts as a political agent, not as moral one. Most environmental decisions and initiatives are in large sense " political" since they consist in advice as to what should be done. However, policy though usually based on how people behave, can also be proscriptive and normative. Environmental values (frugality, care, intergenerational justice, compassion, and respect for nature) like all the other qualities can be thought and learned. Together with the experience and comprehension of the non-human world they might instill a new moral disposition and change old habits, and thereby traditional features of social ethics and political decision-making. The new quality of culture that reflects and promotes the goodness of character can, in time, convert the quality of the environment into the political priority. However, it is worth to remember the words of Aristotle that "most people obey necessity rather than argument, and punishments rather than the sense of what is noble" (Aristotle 2002, 1179b, 35).

At the same time, one of the most disquieting features of the more radical solutions to ecological and social problems is their tendency to become authoritarian in the face of the pre-supposed total environmental (climatic) destruction. Such concern leads to proposals for "ecological guardians" to advise the sustainable society on the "just" or moral use of natural resources. We should not fail to remember that there are ways in which the coercive protection of wildlife and ecosystems ostensibly for public good and the intangible benefits of conservation can actually damage the environment and reinforce the political power of the state. The dangers of the state that thinks it knows what is good for us are not alien to our history, and we should be wary of this in environmental affairs. We must guard against telling others what their morally good decision ought to be, or what their "interests" are, as opposed to the interests they think they have. Paternalism is a vice in environmental policy.

Various critics of contemporary policies offer visions of a free and ecological society that can transform our relationship with each other and with the world. There are parallels more recently in the longing for eco-socialism or eco-communism that seemingly connects the good of the humanity with the Earth Democracy. In our quest for the better future we should be searching for a viable alternative to the present development models, but not for a new utopia. For whilst utopia is only a vision of a world without suffering, without conflict, without poverty and with justice for all, while it is just an intellectual or philosophical exercise, it is inoffensive and painless. When it becomes an instrument to convert our wishful thinking into practice, it sacrifices everything and everybody on its way to reach its goal. Wherever we look for the Earth

Democracy that reunites the human being with the environment, and offers the likelihood for dignified life for everyone, it can not be found in projects that unleashed human and environmental horrors before, for they can unleash them again.

3 What Uncertainty Are We Talking About?

> "I have praised folly, but not altogether foolishly."
>
> *(Erasmus 2008, p. 7)*

At the present time most physicists are indifferent to humanistic discourse on the subject of Heisenberg's concept. Paradoxically, philosophers, literary theorists, anthropologists and many others from the social sciences have enthusiastically appropriated the attractive and slippery expression of *uncertainty*, only to confuse its real meaning with whatever sort of arranged fictitious connotation they found fitting. Science, they assumed, no different than the arts and humanities, offers us models, images, and metaphors of the world, and there is no reason why the layman should not make use of these models in his or her dealings with the world, without having to become a nuclear physicist to do so. In a majority of cases this kind of elucidation is, generally speaking, plain nonsense from the scientific point of view. While there is understanding of probabilities and uncertainty in the hard sciences, particularly in mathematics or physics, there is little understanding of such concepts in the social sciences in spite of the appearance of "experts". If we were dealing with a deterministic world, the universe stripped of randomness, the pattern of the series would reveal predictive information. But we live in a world that is not well charted, and time gone by teaches us to avoid the brand of naïve empiricism that consists of learning from casual historical facts. The sad truth is that quite often in soft sciences people confuse science and scientists, who are biased as we all are.

Recently, an entire industry of "risk measurers" has emerged, specializing in assessing risks in different scenarios. These ideas go back to the concept of Knightian uncertainty. In his seminal work that deals explicitly with decision-making under conditions of uncertainty, *Risk, Uncertainty, and Profit,* economist Frank Knight wrote: "Uncertainty must be taken in a sense radically distinct from the familiar notion of risk, from which it has never been properly separated. […] The essential fact is that 'risk' means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomena depending on which of the two is really present and operating […] It will appear that a *measurable* uncertainty, or 'risk'

proper […] is so far different from an *unmeasurable* one that it is not in effect an uncertainty at all" (Knight 2002, p. 19).

Much has been made of Knight's famous distinction between "risk" and "uncertainty". In his interpretation, "risk" refers to situations where the decision-maker can assign mathematical probabilities to the randomness which he is faced with. In contrast, "uncertainty" refers to situations when this randomness cannot be expressed in terms of specific mathematical probabilities. (Knight's uncertainty arises from the difficulty of predicting the future.)

Knight's distinction between uncertainty and risk is quite well preserved in classical decision theory (cf. Luce/Raiffa 1989). A decision is made under risk when the probability of each end result is known, and under uncertainty if the outcomes of the alternatives are known, but the probabilities of these outcomes are "completely unknown or are not even meaningful" (Knight 2002, p. 13). Many economists argue that Knightian risk and uncertainty is one and the same thing. In particular, the distinction is challenged by Bayesian decision theory. Central in this theory is the idea that a subjective probability, or degree of belief, can be assigned to any state of affairs. The Bayesian approach enters as a massive avalanche into environmental studies (cf. Beven 2009). However, to take full advantage of modern Bayesian statistics, these studies should consider losses or gains as outcomes of human actions that hardly could be assessed. Others assume that there are actually no probabilities out there to be "known" since probabilities are just individual expressions of our beliefs and have no connection to the blurry randomness of the "real world". If one cannot construct a well-defined stochastic model, the correct quantitative parameterization is even more difficult. In some situation one can adjust the model to present situation but any forecast of future events (in climate change, natural catastrophes, political and social change etc.) is clearly more elusive. "There has been a tremendous improvement in the three-dimensional numerical models of climate over the last two to three decades in terms of resolution, processes included and accuracy of simulation of present-day climate and variability. However, the uncertainties in the prediction of climate change have changed little in that time, even excluding the additional uncertainties arising from modelling chemical and biological processes" (Mitchell 2004, p. 2355).

All decisions about environmental impacts generally fall into the category of decisions under high risk. The solutions depend on science, engineering, logistics, and economic and moral assumptions about what is good and bad for humans or other life forms. In spite of the growing interest of the general public in nature and wildlife, it may be that the arguments of conservationists must be ultimately framed in cost-benefit terms since governments will always determine their policies against the background of money they have to spend, and, sometimes, the priorities accepted by their electorates.

Recently, some have suggested that all kinds of non-market benefits (preserving a species, aesthetic appreciation of forests, and scientific values of biodiversity, recrea-

tional or spiritual pleasures) be included in cost-benefit analysis. The idea of this more extended kind of analysis in the environmental context is to compare the benefits (immediate and diffuse, monetary and non-monetary) of a decision (such as preserving wilderness, alleviating poverty and equity) to the costs (direct or potential). It has to be stated that a lot of policy-related research develops increasingly complex models that generate a never-ending debate about their applicability. We do not refer only to famous Schrödinger's phrase that "nature resists imitations through models" (Schrödinger 1980, p. 323), but to the fact that models entries can hardly be observed or estimated. The use of statistics is hampered by the lack of specified knowledge about the ways the ecosystem works and its spatial and temporal changes. This combined with scarce information about the social factors that contribute to the degradation of ecosystems make sound decision-making particularly difficult.

Randomness does not exclude regularities in the hierarchical pattern of special and/or temporal variations in natural systems (cf. Kwiatkowska 2001). Stochastic models with time factor involved – even the most symmetric – exhibit the possibility of large excursions from the actual state. The simplest, most popular, and for probability people most beautiful, continuous time and continuous paths stochastic model is Brownian motion that although symmetric and recurrent, can produce very large displacements, positive or negative. Roughly speaking Brownian motion is characterized by Gaussian symmetric distribution and independent increments of past history. In environmental topics there is large unstructured uncertainty generated by external factors. In addition, things are complicated because the stochastic mechanism behind them is not autonomous, meaning that models must depend intrinsically on time factor. Any serious analysis and subsequently predictions must be given in terms of probability of occurrence of specific results; hence, if the model or its parameters are practically unknown, these predictions are fuzzy and dimmer with increasing time horizon.

4 A Step towards Realistic Answer

> "Act so that you use humanity, whether in your own person or in the person of any other, always at the same time as an end, never merely as a means."
>
> *(Kant 2002, p. 429)*

> "When politicians, industrialists, and environmentalists run out of practical advice, they often take refuge in appeals for a new vision, new values, a new commitment, and a new ethic. Such calls often ring hollow and rhetorical. This is the crux of the problem of sustainable development, and perhaps the main reason why there has been acceptance in principle, but less concrete actions to put into practice."
>
> *(Selvam 2007, p. 6)*

Until now, various recommendations to bring together ecologically sound ways of living with the call for renewing growth to alleviate poverty in the developing world have scarcely brought the required results. The conjecture that once the site was designated as a "nature reserve", its biodiversity was preserved proved short-sighted. The shelter of its legal status did not resolve the problems of land tenures and speculation, or stopped the harmful agricultural activities. Furthermore, none of the proposals including the Kyoto Protocol with its Clean Development Mechanism and permits to pollute is aimed at stopping deforestation.

Environmentalists thought that a strong case can be made for conservation based on the local, regional, and global values of forests to be incorporated into decisions on "sustainable" management of this important resource. The idea was to help forest dwellers and rural settlers profit from the wilderness without destroying it. However, in many developing countries, it did not stop the destruction; selective timber harvesting proved costly and inefficient. Ecologically friendly activities such as collecting wild fruits, rubber, nuts (non-timber products), including pharmaceutically active substances are either money-loosing propositions or push some plant species to the brink of extinction. Many of well meant "sustainable" programmes lost touch with the development necessities of the communities. They focused exclusively on the alternative activities like industrial reforestation or intensive, multi-crop land use that may appeal to the healthy self-interest of the local people by providing trees and harvests of value to them. But they missed the real connection between the complex community problems, external market pressures and biodiversity loss. As Arturo Gómez-Pompa and Andrea Kaus rightly observed: "All the terracing, green mulching, selective harvesting, field rotation, crop diversity, and reforesting in the world cannot help if the external consumption of natural resources continues to outpace local sustainable practices and to offer economic incentives that out-compete long-term conservation benefits" (Gómez-Pompa/Kaus 1999, p. 5984).

The overwhelming majority of proposals to conciliate economic progress and quality of life with the necessities of biological conservation have financial incentives attached to them. Until now disbursement of the funds public or private has often been insufficient or sporadic, and frequently derailed. On the one hand, the governmental subsidies (local and national) frequently have been bringing more harm than benefit. On the other hand, the international fund-lending institutions tend to promote unrestrained development directly threatening biological, ecological, and cultural diversity. The aid has also been used by power groups without changing local ideas and uses of the environment. Many conservation proposals have only succeeded in enormous squander of money. The subsidizing agencies never visualized the complex interactions between protection of biodiversity, requirements of development and the community life. Nor have they analyzed the direct connections between the local activities and the possible reduction of deforestation or other environmental pressures. As Alexander N. James, Kevin J. Gaston and Andrew Balmford pointed out: "Gov-

ernments could safeguard the world's biodiversity with a small fraction of the money they spend on environmentally harmful subsidies" (James et al. 1999, p. 323).

All agree with Aldo Leopold that "system of conservation based solely on economic self-interest is hopelessly lopsided" (Leopold 1949, p. 214), yet the question of financial incentives that can alleviate the poverty, and indicate the alternative to the environmentally damaging practices, has to be addressed promptly. According to some views expressed at the European Conference on the Biodiversity (2004) one of the main reasons of continuing biodiversity loss has been a market failure to play a fundamental role in halting deforestation and overall environmental degradation. Benefits associated with conserving biodiversity are mainly of use for the society as a whole and most of the time not covered by the market. Many ecosystem functions and services defy monetarization as their contribution to our well-being, present and future, is unknown or difficult to asses. Most of the non-material life support functions represent "collective goods". Intrinsic values by definition have no price, and many other values, as for instance unpredictable preferences of future generation, escape monetary evaluation. "Freely functioning markets are based on narrow self-interest. The upstream polluter has no incentive to account for the cost he imposes on a downstream user of the river. The non-consideration of such 'externalities' – the third party costs – may lead to decisions that are 'wise' for the individual now, but 'unwise' for the society as a whole (and that may also be harmful to the individual). This is a market failure" (Jooston/Clark 2002, p. 138).

Conceivably, the monetary valuation can play a supportive role in environmental policy in spite of many objections, but its multiple practical and normative problems have to be considered when using such a method. However, the comprehensive approach to conservation of the entire biological diversity requires a strategy that goes beyond economic cost-benefit valuation. A number of proposals like permits to pollute or transferable development rights are essentially market approaches that set limits on environmentally harmful activities. However, as observed by Allen Blackman and Winston Harrington in reference to developing countries "tradable permits are generally not practical" (Blackman/Harrington 2000, p. 5).

It is important to stress that we do not pretend to price environment by endowing it with market value. What we propose is the direct market out of *environmental improvements*, always when high reliability measurement of actual state could be ensured: for example the number of wind turbines. The "conditional carrot" approach using "Principal-Agent" methodology (cf. Laffont/Martimort 2002) might be the only way to deal with the most serious environmental crisis. In fact, this approach has been already under way in combating pollution, like opening of high-occupancy vehicle lines or promoting hybrids. However, it poses different optimization problems because initial customer's decision remains stable over time.

On the whole, the Principal-Agent method (Nature being the Principal *represented by a financial institution*) aims at creating new investment opportunities that will

stimulate economic development of the region, benefit local communities, and the wildlife. Agent could be anyone who buys the certificate or, in situations involving reforestation, these certificates could be given free of charge to the inhabitants of a community. In another words, agents are people, some of them with null participation. Participation means the ownership of corresponding certificates. It also offers transparency in handling conservation funds that will be created from taxes, or voluntary contributions, offsetting (compulsorily or voluntarily) environmentally harmful actions. It can be taken for granted that the main problem of any environmental decision is not how to impose additional taxes, but how to use the collected money wisely. The fund creation offers more efficient ways to improve and protect the environment than spending millions of dollars in organizing panels of experts who conclude (with fuzzy estimation of probabilities) that degradation is caused by human activities.

A different approach with the use of Principal-Agent method has been considered by Laurent Franckx and Alessio D'Amato. They wrote: "We have considered there the regulation of a (private or public) agent by an EPA (Environmental Protection Agency). This EPA is constrained to basing its incentive scheme (both rewards and punishments) on environmental performance, and allocate funds to alternative projects with environmental benefits. The private agent can allocate its effort either to environmental protection or to its core task" (Franckx/Amato 2003, p. 15). While we consider only environmental improvements, we go further in co-operation topics. At the same time, our approach does not need precise specification of parameters, as the quoted above study requires.

It is also known that rural communities in undeveloped countries mostly have a hierarchical structure controlled by powerful individuals. Some authors see it as a main reason of their failure to stop deforestation of the regions in question. According to our strategy their inhabitants could act positively if sufficiently rewarded. "Good" environmental certificates[1] would recompense planting trees or decreasing pollutant levels. We would like to stress that our method is not aiming at valuation of environmental goods nor would the proposed market lead toward this direction.

The precise optimality of such certificates – *Principal optimization problem* – depends on the given models. After using this method for a while, we can consider more exact models to get precise optimality stemming from the strict application of the Principal-Agent method. It is worth to bear in mind that modern finance applications often anticipate theories, models, and theorems. Usual cost-benefits analysis compares Nash competitive equilibria with collusive ones. Well-known mismatch between these two (depending heavily on parameters chosen) does not have an easy

1 Good certificate is meant to stimulate and encourage positive environmental actions like reforestation, restoration, conservation of biodiversity, or reduction of pollutants. These certificates can be freely bought by all interested agents.

solution, and is linked to coalition creation and eventual renegotiation through the theory of repeated games (cf. Ray 2001).

Our approach is qualitatively different. With the use of certificates of improvements that could any temporal mean of some convex function of pollutants (for example square function) we are able to create the co-operation using the concept of fusion.

Let us explain the difference between collusive and fusion. In a collusive approach a certificate that pays more for smaller pollution levels embraces, let us say, two "domains", for example countries, states, or local communities; each agent can make improvements in his or her own domain only. In the fusion case an agent can make improvements in the other agent's land. This could result in the transfer of technologies or any other form of real co-operation. (In fact, recent conferences on climate change stress the transfer of technologies as one of the most significant parts of the future political agenda.) Mathematical analysis of certificates of improvement is non trivial (cf. Kwiatkowska/Szatzschneider 2009). The good news is that our project can start with the issue of ANY good environmental certificate. Instead of diffuse promises of cutting pollution that could put poor countries (if compromised) back to dark ages, we should consider bona fide co-operation, which can be accomplished by properly using Principal-Agent methodology.

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