

## **Sustainability Indicators**

**Sandrine Simon**

*February 2003*

### **1. Introduction**

Imagine a situation where, after debating for years on what makes you happy, you finally decide that it is about time you start put these ideas into practice and effectively make yourself happy(ier). If you are really determined, you will be keen to stop convincing yourself that you are happy if you are not: you will want to check whether you are really making progress towards achieving your goals. You will have identified different components of your happiness and will assess some of them, progressing cautiously, step by step. You will also be aware of the links between these components, links that determine your overall state of happiness.

In the situation described above, now replace the term 'happiness' by that of 'sustainability' - like concepts such as justice, truth, or happiness indeed, it is a desirable objective, albeit difficult to capture in a concise, shared, definition. The situation you are now looking at describes pretty well the context within which debates on sustainability indicators are now taking place. For decades, we have worked hard at defining, in more and more precise ways, what sustainability means. These debates have been of such a conceptual nature that 'the term sustainability, like any other suddenly fashionable phrases, has been misunderstood and misused with increasing frequency. Even worse, it has been used to misinform so as to gain advantage for narrow and special interests' (Munro, 1995:27). We have sometimes been kidding ourselves that we are not doing that badly in managing the interactions between our human and ecological systems. In other cases, we have sensed that our ways of living are very unsustainable but we haven't been able to change our practices and move towards more sustainable ones.

The development of 'indicators of sustainability', perceived as a first step towards the operationalisation of the concept, has reflected a pro-active initiative to make a change, itself fired up by a real sense of urgency: "sustainability [becomes] meaningless unless we can do it" (Bell and Morse, 1999:5). It all started in 1992, when the Rio Summit established a mandate for the United Nations to formulate a set of indicators that would help gauge progress towards sustainability. Although the construction of indicators is only one way of tackling the operationalisation of the concept amongst others (as described in the ten Bellagio principles established in 1996 - these principles also mention, for instance, broad participation and institutional capacity), it has become a very popular one. Thus, many governments and agencies have devoted substantial resources to indicator development and testing ( Kuik and Verbruggen, 1991, Refs a), b), c)). Although this process was originally very much kept in the official circles of policy-making agencies, it now includes

more stakeholders. Through initiatives such as those taken by the International Sustainability Indicators Network (Ref e), the development of sustainability indicators is now playing an important role in the awakening of new forms of environmental governance.

## **2. What are Sustainability Indicators?**

While the enthusiasm with which the issue of 'indicators of sustainability' is being researched on can give me an indication of their importance, quantified measurements of the impacts that indicators of sustainability have on environmental policies would constitute (if such measures existed) *indicators* of their performance. These indicators would help us understand better research on sustainability indicators by showing where we are, which way we are going and how far we are from where we want to be. It is often said that a good indicator can alert us to a problem before it gets too bad and helps us recognise what needs to be done to fix the problem. This review will give you an overall indication of what sustainability indicators are and what difficulties and controversies their construction is generating.

Debates on the concept of sustainability have highlighted its complexity. Indicators of sustainability provide a simplified understanding of this concept by providing practical information about the numerous issues encompassed in it. These normative, proxy, measures also reflect a trend: they show how far or close we are from being a 'sustainable society' by reflecting the reproducibility of the way a given society utilises its environment.

Numerous 'indicators of sustainability' have been developed simultaneously. They either emphasise various components (ecological, economic, political, social) of the complex concept separately, in numerous 'partial indicators', or they encapsulate all these components at once in indexes, or 'frameworks of indicators'.

Examples of partial indicators

Given the strong emphasis put on the 'natural environment' in the original debates on sustainability, it is not surprising to have witnessed the development of numerous 'environmental indicators' aimed at helping us identify whether we are managing the environment in a more sustainable way. Progressively, social and economic indicators also contributed to the description of our progress towards sustainability. The UK government (DETR, 1996), the World Resources Institute (Hammond et al. 1995), the OECD (1995) and the UN (ref. d), to cite only a few, developed such indicators following the general 'state, control (also referred to as 'pressure'), response' pattern.

*State indicators* describe the state of a variable. The atmospheric concentration of greenhouse gases, for instance, is a state indicator of climate change. The dissolved oxygen in water is a state indicator of human health since it indicates the quality of water, which itself affects human health.

*Control (pressure) indicators* gauge a process that does influence a state indicator. Thus, the emission of CO<sub>2</sub> affects the atmospheric concentration of greenhouse gases. The generation of industrial or other types of wastes is another example of pressure indicator.

*Response indicators* gauge required progress in the responses of governments. The number of protected areas as a percentage of threatened areas is a response indicator linked to the issue of biodiversity.

These state, pressure and response indicators have been classified per 'sustainability dimensions' (social, environmental, economic, institutional).

Other types of sustainability indicators refer to the *geographical scale* of the issues described. It is for instance the case with the construction of indicators for sustainable communities and cities (ref f, Lancashire County Council, 1997, UK Local Government Management Board).

Other partial approaches of sustainability indicators focused on a *specific type of activity*, such as sustainable agriculture, or sustainable trade (Perkins, 1994).

The logic of using such 'partial indicators' in the context of sustainability is that they do help us in understanding something more general and complex about the concept. For instance, species composition reflects ecosystem health and ecosystem health is itself an indicator of sustainability. They can help in grasping the practical consequences of sustainable or unsustainable practices.

But their disadvantage lies in the fact that the *links* between the various dimensions of sustainability (environmental, social, economic, institutional) are not reflected through the indicators. Two main criticisms arise from this remark. First, partial indicators might lead to the formulation of partial policies, focused on one issue while ignoring the other issues it is linked to and hence potentially creating further problems. Thus in river management, for instance, policies related to water treatment should be related to the protection of biodiversity and the monitoring of new developments (farming activities, urban developments, industrial plans...) close to the river. It is now widely recognised that land and water management go hand in hand. From this, one can derive the second main remark on partial indicators: if the links between the various dimensions of sustainability are more meaningful than these dimensions observed separately, then we need another type of more holistic indicators in order to make real progress towards operationalising sustainability.

Examples of holistic single indicators

A first technique, widely researched on and also contested, has focused on developing a single aggregate indicator of sustainability in order to encompass the various dimensions of sustainability. Gauging what in fact is very complex in such a way hasn't been simple.

The easiest way to proceed has been to put more emphasis on one dimension of sustainability. The focus on the natural environmental dimension, in particular, seemed logical since, in its original form, sustainability was closely associated with the maintenance of the quality of the natural environment. The maintenance of *ecosystems' health* has therefore been a focus of interest to demonstrate whether natural resources are being managed sustainably or not. This 'holistic' indicator is linked to the concept of 'carrying capacity': the notion that an ecological system can only sustain a certain density of individuals because each individual utilises resources in that system. The *Maximum Sustainable Yield (MSY)* can be therefore perceived as an indicator of sustainability in that it measures whether the resource is utilised in a sustainable way: if the MSY is exceeded (in case of too big a population increase, for instance), then the ecosystem may collapse.

As debates on sustainability progressed, social considerations started being taken much more into account and were reflected in the construction of sustainability indicators. Just as ecosystem health was reflected in the MSY, sustainability, which is also about people, can be reflected through the *quality of life*: living within the carrying capacity of the community's human, social and built capital. The basic concept and questions are the same: are the different types of capital being used up faster than they are being replenished? The Human Development Index constructed by the UN development programme and various other 'social' indicators focused on education, public safety, health and governance, amongst other themes, and demonstrated that communities that allow their children to be poorly educated and undernourished, the quality of their social interactions to decline through lack of trust, respect, and tolerance, and their facilities (electricity, power, waste processing...) to decay are not sustainable ones. All these phenomena erode the community's capital.

Some authors tried to take social and environmental considerations into account when constructing measures of sustainable economic welfare. The calculation of a 'Green Gross National Product' (green GNP or gGNP) is based on describing sustainable development as requiring that the stock of capital (comprising both natural and manufactured capital) that one generation passes on to the next may be maintained or enhanced. The rationale is that GNP, although very much used to influence policy options, does not reflect all features of societal and environmental developments and should therefore be corrected. Some authors have considered that indicators of sustainable development could show whether there can be substitution between natural capital and manufactured capital in a situation where there is a diminishing stock of natural resources. Thus, the neo-classical or weak sustainability school is 'optimistic' in that it believes that there can be such substitution and that man-made capital can effectively replace decreasing stocks of natural capital; technological progress, in particular, will 'save the day': it can overcome the environmental constraints of the economy. The *elasticity of substitution* between various forms of capital is thus considered by them as an indicator of sustainable development. But this is animating much controversy: clearly, if technology is going to save the day, there is no incentive to protect and conserve resources today.

In reaction to this approach, proponents of strong sustainability devoted their attention to the meaning and desirability of *maintaining the stock of natural capital* as a condition for sustainable development. They argue that the substitution argument is simply not valid: natural capital is needed to make manufactured capital and, beside, natural capital fulfils other economic functions, including basic life support, that manufactured capital cannot fulfil. The creation of an Index of Sustainable Economic Welfare (ISEW) (Daly and Cobb, 1989; New Economic Foundation, 1994) also animated controversies: as Levett stresses, "we are back to subjectivity in deciding which things need to be added to and subtracted from economic indicators, and how they should be measured and weighted".

The controversy surrounding the calculation of single aggregate 'sustainability indicators' based on the adjustment of economic indicators has been heated for years (Faucheux and Froger, 1993; Tinbergen and Hueting, 1992; Neumayer, 1999). They evolved around methodological and ethical

disputes. While some authors concentrated on demonstrating that adjustments of GNP do not tell us very much about our general welfare, others criticised the reductionist and simplistic way in which environmental and social considerations have been measured in order to enter the equations that lead to the calculation of adjusted indicators. The problems generated by using monetary valuation methods in order to do so have, in particular, been criticised at length. So much that other ways of capturing the various dimensions of sustainability all at once in 'indicators' had to be investigated.

#### Framework of indicators

In order to overcome problems created when aggregating measurements, some initiatives have focused on the construction of 'frameworks of indicators' that allow to illustrate the links between different indicators. Thus, for instance, a European System of Environmental Pressure Indices (ESEPI) and a European System of Integration of Economic and Environmental Indices (ESI) have been developed by the Commission of the European Communities (1996). The framework focuses on policy-making themes and illustrates environmental pressures generated per economic sector and expressed in pressure equivalents. A similar presentation is used for environmental protection expenditure.

Some research on environmental accounts concentrated on illustrating the links between economic activities and environmental media, expressed in physical units (e.g. 'satellite accounts' in France or the UK, the national accounting matrix including environmental accounts (NAMEA) in the Netherlands). The idea is to use the illustrative snapshot provided by the accounts as an indicator, a representation of where we are at.

Inspired by Hueting and de Groot (1992), some other authors (Ekins and Simon, 1999, 2001) concentrated on developing a policy framework that shows how economic activities affect ecological functions and services and allows to calculate different 'sustainability gaps' for each of them. In this case, these indicators show the un-sustainability of a situation.

The interpretation of these frameworks as 'indicators of sustainability' might be viewed as being more complex than that of aggregate 'simple' indicators. However, they certainly haven't generated as much controversy. Some (e.g. the NAMEA accounts in the Netherlands) have even proved that they can be effectively used by policy-makers.

### **3. How are sustainability indicators relevant for Ecological Economics?**

As Henderson (1993:147) stresses, "One of the key elements in the transition [to sustainability] is the shift in perception of what is important, what is valuable, the goals to be pursued and the ways to measure collective progress towards these goals".

Ecological economics explores the interrelations between ecological and human systems. This paradigm can help us in conceptualising the way in which we manage these interrelations and constitutes the intellectual underpinning on which to base the construction of policy tools. From understanding how we relate with and depend upon our environment, we need to move onto identifying how we can formulate policies that help us make these interrelations more harmonious and sustainable. The hope is that sustainability indicators can help us in doing so. But can they?

The sometimes virulent disagreements over the definition of sustainability are reflected through the construction of very different sustainability indicators. To give only one example, a sustainability indicator referring to sustainable agriculture will be very different depending on how sustainable agriculture is defined. For those who appear to see no problem in equating sustainability with high-input and high yield conventional farming, "the only sustainable agriculture is profitable agriculture. Short and sweet" (Ainsworth, in Bell, 1999). For those who do not define sustainable agriculture in these terms, on the contrary, "a sustainable agriculture is one that equitably balances concerns of environmental soundness, economic viability, and social justice among all sectors of society" (Allen et al, in Bell 1999). So, definitions of sustainability vary and so do sustainability indicators.

There is no agreement on what the best sustainability indicator should or can be, partly because there are no fixed nor exact definitions of the concept. Realising that some definitions and indicators of sustainability are more respectful of ecological economics principles than others is important. However, what is even more important and in agreement with ecological economics principles, is the realisation that, like the definition of sustainability, the construction of indicators (processes and outcomes) will probably change over time. The variety of stakeholders who take part in defining the concept might also help in identifying what indicators can help capture what we need to know in order to move towards the operationalisation of the concept. This approach, open to uncertainty, flexibility and resilience, is very characteristic of post-normal science and ecological economics. No processes, methodologies, or stakeholders are 'fixed' when it comes to constructing indicators of sustainability; like in defining sustainability or in formulating environmental policies, it is the changes in the construction process that is of particular relevance to ecological economics in the debate on indicators of sustainability.

Also of major relevance is the questioning that the construction of sustainability indicators raises. The difficulties encountered when measuring sustainability show that our way of thinking about the concept, the paradigm within which we envisage environmental policy-making and policy tools, need to be reformed. We cannot start measuring everything in monetary terms when what we are in fact interested in does not belong to the monetary sphere, for instance.

Ecological economics therefore constitutes both a point of departure and a platform within which to reflect during the lengthy exercise of sustainability indicator formulation and use.

#### **4. Conclusion**

The need for indicators of sustainability has been widely recognised and various efforts have been put into constructing such indicators. Both the approaches adopted when doing so and the outcomes have varied considerably: different schools of thought understand sustainability and sustainability indicators differently.

Ecological economics thinking does favour the construction of indicators that will focus on the inter-relations between ecological and human systems - but even that can be done in different ways. The ecological economics paradigm

has also been used to demonstrate the weakness of some types of sustainability indicators.

It is interesting to notice that, despite their apparent obsession with monetary measures, policy-makers have actually favoured the use of environmental indicators and that of satellite accounts expressed in physical units - possibly because of their simplicity. If they are to carry on contributing to research on indicators in a constructive way, ecological economists would benefit from ensuring that people's understanding of inter-relations between ecological and human systems is improved and that it is reflected through the construction of sustainability indicators. Ecological economists should also pursue their work on participatory processes and valuation so that more varied stakeholders contribute both the refinement of the definition of sustainability and to the construction of sustainability indicators. If systems of environmental governance are to widen, and more stakeholders are to implement 'environmental policies', they ought to be involved in identifying what policy tools and indicators could be developed.

## Print and online references

- Ref a) <http://www.sustainable-development.gov.uk/indicators/> The UK Government published a set of 118 preliminary indicators grouped under 21 themes including, amongst others, climate change, land use, water, and wastes.
- Ref b) <http://www.sdi.gov> USA Federal Interagency Working Group on Sustainable Development Indicators
- Ref c) The EU statistical agency, Eurostat, has produced a set of 9 economic, 14 social and 21 environmental Indicators.  
[http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&service=about\\_catalogue](http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&service=about_catalogue)
- Ref d) [www.un.org/esa/sustdev/isd.htm](http://www.un.org/esa/sustdev/isd.htm) 134 Indicators of Sustainable Development were initially developed by the United Nations Commission on Sustainable Development
- Ref e) <http://www.sustainabilityindicators.org> The International Sustainability Indicators Network is a member-driven organisation that provides people working on sustainability indicators with a method of communicating with and learning from each other.
- Ref f) Pastille (Promoting Action for Sustainability Through Indicators at the Local Level in Europe) EU research project 'Indicators into action: A practitioners' guide for improving their use at the local level', 2002.
- Anderson, V. (1991) Alternative economic indicators. Routledge, London.
- Azar, C., J. Holmerg and K. Lindgren (1995) Socio-ecological indicators for sustainability, *Ecological Economics* 18: 89-112
- Bell, S. and S. Morse (1999) Sustainability Indicators. Measuring the immeasurable. Earthscan, London.
- Bellagio Principles: Guidelines for the Practical Assessment of Progress Towards Sustainable Development.  
(<http://iisd1.iisd.ca/measure/bellagio1.htm>)
- Commission of the European Communities (1996) Environmental indicators and green accounting. Com (1994) 670. Commission of the EU, DG XI and XII and Eurostat, Brussels.
- Ekins, P. and Simon, S. (1999) The sustainability gap: a practical indicator of sustainability in the framework of the national accounts, *International Journal of Sustainable Development*, Vol.2, No1, 24-58.

- Ekins, P. and Simon, S. (2001) Estimating sustainability gaps: methods and preliminary applications for the UK and the Netherlands, *Ecological Economics*, Vol 37, No 1, 5-22
- Ekins, P. and Simon, S. (2003) An illustrative application of the CRITINC framework to the UK. *Ecological Economics*.
- Faucheux, S. and G. Froger (1993) Le revenu soutenable peut-il etre un indicateur de soutenabilite? *Cahier du C3ED No 23*, Universite de Paris I, Paris.
- Hammond, Allen and others. *Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development*. Washington, D.C: World Resources Institute, 1995.
- Henderson, H. (1993) *Paradigms in progress*, KnowledgeSystems, Indianapolis.
- Keuning, S. (2002) Indicators and accounts of sustainable development: the Namea approach. In Simon and Proops (eds) (2002).
- Kuik, O. and H. Verbruggen. *In Search of Indicators of Sustainable Development. Environment and Management*. Boston, MA: Kluwer Academic Publishers, 1991. Lancashire County Council, 1997, 'Lancashire Green Audit 2: A Sustainability Report', Lancashire County Council, Preston.
- Levett, R. (1998) Sustainability indicators - integrating quality of life and environmental protection. *J.R.Statist.Soc. A*. 161, part 3.
- Neumayer, E. (1999) The ISEW - Not an Index of Sustainable Economic Welfare. *Social Indicators Research*, Vol. 48, No 1, 77-101.
- OECD (1995) *Environmental indicators*. OECD, Paris.
- Perkins, P. (1994) Exploring sustainable trade: definitions and indicators. Presented at the Paris Conference. Volume II of conference proceeding.
- Rennings, K. and H.Wiggering (1997) Steps towards indicators of sustainable development. Linking economic and ecological concepts, *Ecological Economics* 20: 25-36.
- Simon, S. and Proops, J. (Eds) (2002) *Greening the accounts*. Edward Elgar, Cheltenham.
- Tinbergen, J. and Hueting, R. (1992) GNP and market prices: wrong signals for sustainable economic success that mask environmental destruction.

In Daly, H., R. Goodland and S. El Serafy (eds) Population, technology and life style. Island Press, Washington.

UK Department of the Environment (1996) Indicators of sustainable development. DETR, London.

UNCSD (United Nations Commission on Sustainable Development), 1996, 'Indicators of Sustainable Development Framework and Methodologies', UNCSD, New York / UN Publications Sales no. E.96.II.A.16, available from Agency Publications, The Stationery Office, London, November.

Victor, P.A. (1994) Natural capital, substitution, and indicators of sustainable development. Prepared at the 3<sup>rd</sup> Biennial meeting of the ISEE, Costa Rica., Journal of Public Economics, 86: 341-360.