Profiles of Tools and Tactics for Environmental Mainstreaming

No. 10

INDICATORS

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INDICATORS

What are indicators for?

Policy development	√	To promote joined-up approach, & raise awareness of concerns
Planning	√	Guides good decisions
Field work		For data collection
Investment	√	For project approval
Assessment	√	Main focus
Monitoring	√	Indicates what to monitor
Campaigning	√	Can be – to highlight problems

What issues do indicators focus on?

Environmental	√
Social	√
Economic	√
Institutional	√ (can do)

Note: Indicators also play an important role in accountability and in verification related to market transactions (eg. in carbon markets, broadly covered under the measurement, reporting and verification (MRV) aspects of the climate regime). Indicators are also used to prove impacts associated with standards (e.g. organic standards in agriculture).

Purpose

Indicators should be readily interpretable measures that tell us what is happening with regard to a particular issue. They can be divided roughly into two groups - those that express the state of affairs with regard to the issue, and those which portray trends with specific spatial scales and time horizons. Indicators can also be useful at the organizational level where they can help track and assess performance.

(i) Environmental indicators. Since the environment is very complex, indicators provide a more practical and economical way to track the state of the environment than attempting to record every possible environmental variable. For example, the health of amphibian populations is often monitored as they are very sensitive to changes in their habitats and may provide early warning of ecological impacts from climate change, loss of stratospheric ozone, habitat alterations, or the presence of pesticides.

Environmental indicators can include physical, biological and chemical measures (known as ecological indicators), eg atmospheric temperature, the concentration of ozone in the stratosphere, or the number of breeding bird pairs in an area. They can also measure human activities or anthropogenic pressures [1], such as greenhouse gas emissions, or the societal responses used to address environmental issues, such as the number of people serviced by sewage treatment.

Environmental indicators are tools that can serve different purposes. They can be used to see if environmental objectives are being met, to communicate the state of the environment to the general public and decision-makers, and as a diagnostic tool through detecting trends in the environment. Indicators are also useful to assess the potential implications of various policy options in the context of scenarios. In addition, there are other, more instrumental applications, e.g., using indicators to inform budgeting (ie 'outcome based budgeting', where budget allocations are associated with specific, time-bound targets as measured by indicators).

Environmental indicators can be measured and reported at different scales. For example, a town may track air quality along with water quality and count the number of species of birds whose populations are declining to estimate the health of the environment in the area. Others have attempted to monitor

[1] These also have their own indicators. It seems the EU's *Beyond GDP* initiative will return to the earlier idea of pressure indicators and maybe the environmental pressure index.

and assess the state of the planet using indicators. In other cases, indicators are developed for specific ecosystems, such as the Great-Lakes in North America.

(ii) Sustainable development indicators (SDI) usually comprise a mix of environmental, social and economic measures (reflecting the pillars of sustainability). However, sometimes other categories are included, eg cultural and governance/institutional indicators as now included in the BellagioSTAMP (SusTainability Assessment and Measurement Principles) [2]. They have the potential to turn the abstract concept of sustainability into action. But this potential is far from being achieved and it has proved difficult to agree a standardized set of indicators. This is partly because the conditions for sustainability are not easily defined (it is easier to measure unsustainability and try to reduce it), and also because it requires different actions in each environmental situation and developmental context. But probably of more importance is the fact that the currently dominant indicators (and the underlying goals, symbolized by the GDP) - and the way they are used - are not compatible with the notion of sustainability. Developing alternative indicators is, therefore, only a first step; having them accepted in decision-making is just as important, if not more so, and there is a lot of momentum in the existing mainstream system. Several sectors and private corporations are creating their own sustainable development indicators suitable for their purposes while international institutions are still trying to develop a composite indicator or set of indicators for measuring and monitoring sustainable development.

The last 10 years have seen a major expansion of interest in SDI [3] systems to help measure progress towards sustainable development, both in industrialized and, albeit to a lesser extent, in developing countries. SDIs are seen as useful in a wide range of settings, by a wide range of actors: international and intergovernmental bodies; national governments and government departments; economic sector institutions; administrators of geographic or ecological regions; communities; nongovernmental organizations; and the private sector.

SDI processes are underpinned and driven by the increasing need for improved quality and regularly produced information with better spatial and temporal resolution, and the need for strengthened governance and accountability. In addition, there is a need, partly created by the information revolution, to better differentiate between information that matters in a given policy context versus information of secondary importance or irrelevant.

Audiences

The type of indicators selected or developed should be partially based on the information needs of those who will be using them:

(a) *Technical experts and science advisors* – likely to be interested in detailed and complex indicators. These should have scientific validity, sensitivity, responsiveness and have data available on past conditions.

(b) *Policy-makers, decision-makers and resource managers* – mainly concerned with using indicators that are directly related to evaluating policies and objectives. They have similar needs to (a) but also look for indicators that are cost-effective, have meaning for public awareness and are responsive to policy-making.

(c) The *audit community* - interested in indicators both from the perspective of their measurement of actual performance, and also at a meta-level to show whether audited organizations have the interest and ability to track their own performance.

(d) *The public and media* - respond to indicators that have clear and simple messages and are meaningful to them, such as the UV index and air quality.

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[2] Developed by a group of international experts meeting in Bellagio, Italy, organized by IISD and the OECD's Measuring the Progress of Societies initiative (http://www.oecd.org/pages/0,3417,en_40033426_40033828_1_1_1_1_1,00.htm).

[3] A wide range of terms are in use that refer to something very similar (quality of life, wellbeing, sustainability etc.), but the indicators selected are often the same.

Indicator systems

Individual indicators are designed to translate complex information in a concise and easily understood manner in order to represent a particular phenomenon (e.g. ambient air qualty). In contrast, indicator systems (or collections of indicators), when seen as a whole, are meant to provide an assessment of a much larger domain (e.g. sustainable development, the progress of a society, economy, environment).

There are numerous existing ***indicator frameworks*** and sets, varying in their sophistication and coverage. Some set hard and quantitative targets, while others use more general goals or simply portray trends over time without any goal. Some of the more commonly used frameworks are:

- *pressure-state-response* (PSR), sometimes limited to environmental issues, although pressures are often also in the economic domain and related to production and consumption. This framework has evolved into the DPSIR (Driving Forces-Pressures-State-Impacts-Responses) framework which is now probably used even more widely (e.g. by UNEP) which also includes impacts on human well-being;

- linked human/ecosystem *well-being frameworks* (eg Figures 1 and 2);

- *issue- or theme-based frameworks*; and

- *capital-accounting based frameworks*, centred on the economic and environmental pillars of SD.

Examples of international indicator sets and initiatives include the UN Commsission on Sustainable Development (CSD) Sustainable Development Indicators (SDI) initiative, the Millennium Development Goals (MDG) indicators, and the UN System of Integrated Environmental and Economic Accounts.

There has been a large, and still growing, number of attempts to create aggregate measures of various aspects of sustainability. This has generated a stable of indices that provide a more nuanced perspective on development than economic aggregates such as GDP. Some of the most prominent of these include the Human Development Index (HDI) of the United Nations Development Programme (see www.undp.org/hdro/anatool.htm); the Environmental Sustainability Indices (ESI) (see: www.yale.edu/esi/) and the Environmental Performance Index (EPI) reported at the World Economic Forum (WEF) (see http://epi.yale.edu/Home); or the Genuine Progress Index (GPI) calculated at the national or sub-national level (see http://www.gpiatlantic.org/gpi.htm). Parallel to these initiatives is political interest in producing a green GDP that would take at least the cost of pollution and natural capital depletion into account. However, implementation has been impeded because of the difficulties in overcoming conceptual and technical challenges. The position taken by the Commission on the Measurement of Economic Performance and Social Progress (commissioned by French President Sarkozy) (http://www.stiglitz-sen-fitoussi.fr/en/index.htm), is that we need to complement the GDP with other metrics and also make the components of the GDP clearer. This is compatible with the emphasis on 'key national' or headline indicators - a distinct approach.

An alternative approach is illustrated by the Ecological Footprint (http://www.globalfootprint.org/) which converts resource consumption and environmental impact per capita into the common unit of land area. There are methodological debates about the way to do this, and also concerns that the EF method, in its current form, is of limited use for actual policy-making. Nevertheless, EF has two great advantages: it is easily understood by everyone (like the footprint in its name), and it can be calculated for everything from an individual or family to a community, business or nation. It also illustrates another characteristic of good indicators: the precision of the calculation is less important than the consistent application of the methodology. The real value of such indicators comes from their comparison in space (say between countries) and in time (it is getting better or worse).

While sustainability indicators, indices and reporting systems gain growing popularity in both the public and private sectors, their effectiveness in influencing actual policy and practices has taken time to develop. An increasing number of countries are now reporting regularly on the state of their environment and sustainability at the national level using indicators, and with rising concern for climate change, indicators of greenhouse gas emissions are suddenly becoming major policy drivers. The interconnections between environmental conditions, human well-being and economic

Figure 1: Group Barometer of Sustainability, showing the well-being of North and Central America.

The Human Well-being Index (HWI) is in the yolk of the egg; the Ecosystem Well-being Index (EWI), in the white. (El Salvador's HWI is 36 and EWI 46.) The Well-being Index (WI) is the position of the egg—the point on the Barometer where the HWI and EWI intersect. Sustainability is the square in the top right corner. Note that the Barometer clearly shows the relationship between human and ecosystem well-being, the wide spread of performance among countries, and the distance to sustainability. Belize was assessed on fewer indicators than the other countries: a fuller assessment might move its position to between Costa Rica and El Salvador.

Source: Prescott-Allen (2001a).

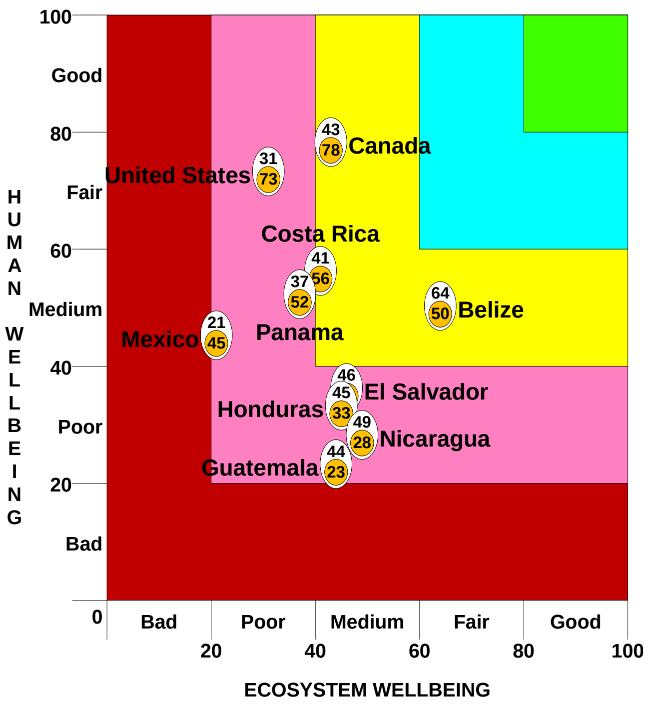
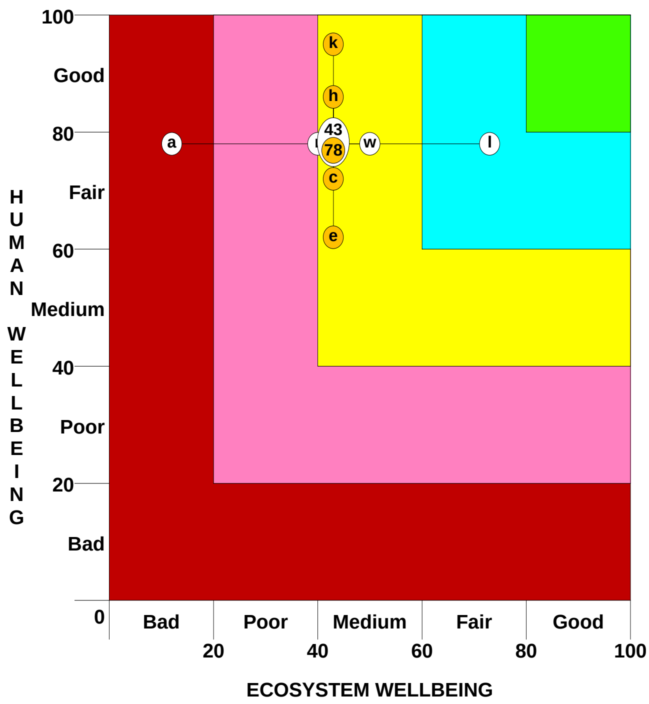


Figure 2: Individual Barometer of Sustainability, showing the well-being of Canada.

Grey circles (vertical axis) are the points on the scale of the human dimensions (major components of the HWI): c = community; e = equity; h = health and population; k = knowledge; w = wealth. White circles (horizontal axis) are the points of the ecosystem dimensions (major components of the EWI): a = air; l = land; r = resource use; s = species and genes; w = water. Some dimensions are hidden by the egg (wealth, species and genes, resource use). The dimensions that need most attention are air (reduce carbon emissions), resource use (reduce energy consumption), and species and genes (expand habitat protection for wild species, and conserve agricultural diversity).

Source: Prescott-Allen (2001a).



performance, including costs are becoming clearer, and these cannot be well understood without suitable metrics.

Interpreting ***indicator systems*** can be difficult as they often include hundreds of indicators and require a certain level of knowledge and expertise in various disciplines to fully grasp. And at a more sophisticated level, the analysis may also require linking indicators to an actual model. As a result, a number of methods have emerged to distil this information and allow for rapid consumption by those who do not have the time or the expertise to analyse the full set of indicators. In general these methods can be categorized as:

- ***Numerical aggregation*** (e.g. indices). When indicators are combined transparently into indices, they can provide a clear picture of the entire system, reveal key relationships between subsystems and between major components, and facilitate analysis of critical strengths and weaknesses. No information is lost, because the constituent indicators and underlying data are always there to be queried. However, if indicators measured in different units need to be weighted together, the choice of components and their weighting can be controversial. If not transparent, indices may also hide problems since good and bad performance may cancel each other out.

- ***Short selections of indicators*** (e.g. core set or headline indicators). For example, the current (2005) UK Government Sustainable Development Strategy "Securing the Future" contains 68 indicators - 20 UK Framework indicators (Table 1) and a further 48 indicators to monitor progress.

- ***Short visual assessments*** (e.g. arrows, traffic signals).

- ***Compelling presentations*** - that show the spatial aspects of indicators (eg maps) - every indicator has some explicit or implicit spatial dimension. Partly because of technology, more and more indicators take on a spatial dimension. An example of good presentation is dashboard of sustainability (Figure 3).

- ***Animations*** (eg. The Gapminder software - see: www.gapminder.org)

Use of indicators for assessment

Indicators are often used in environmental and other assessments. Systematic procedures for choosing indicators make clear the issues covered and the values involved, and make the construction of indicator-based assessment more transparent than that of narrative or composite indicator assessments (ie those that construct raw data and convert them to a common unit such as money, area, or energy).

By employing the same set of indicators over time, later indicator-based assessments ((assuming no change in monitoring and calculation methods) can be compared with previous ones, providing more consistent coverage from one assessment/reporting period to another [4]. Comprehensive and consistent coverage, together with systematic organization of issues and their indicators, enable priority issues and strengths and weaknesses of performance to be clearly identified. Common metadata are an important element of consistency.

Increasingly, SD indicators are being used at local level, too. For example, in 2000, the UK Audit Commission issued a handbook offering ideas for measuring sustainable development and quality of life in local communities (available at www.sustainable-development.gov.uk/indicators/local/). It provides a menu of 29 indicators, from which local authorities may wish to consider using a selection for reporting on their Local Agendas 21 and Community Strategies. In the USA, a Community Indicators Consortium has been established, and in Canada the Canadian Sustainability Indicators Network (CSIN) has over 1,000 members (most involved in community scale work)

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[4] It is important to have an underlying database to make sure data collection does not need to start from scratch every time a new assessment cycle is started. With improved web technologies, assessments could increasingly be linked to databases that have live links to monitoring systems and are updated on a continuous basis

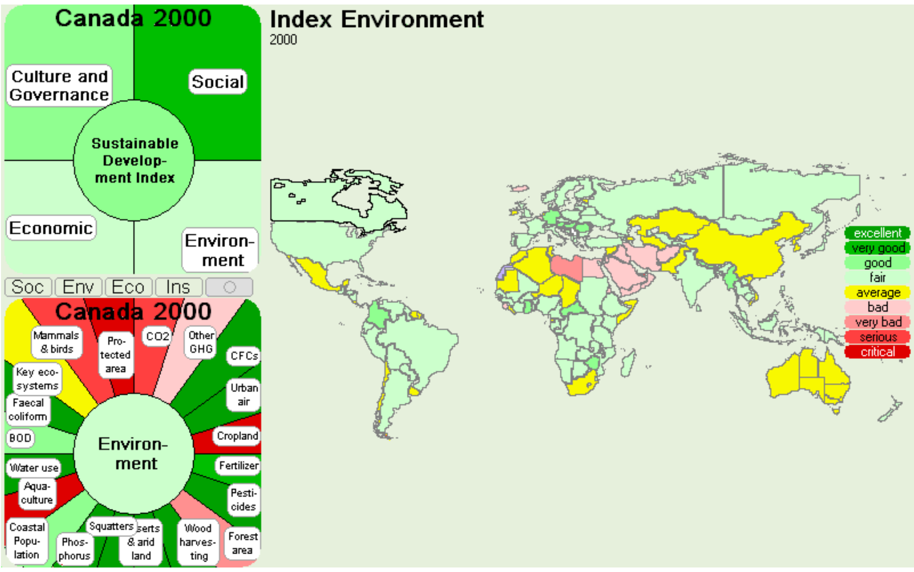
Table 1: UK SD Strategy framework indicators

Indicator		Change since		Direction in latest year
		1990	**1999**	
Greenhouse gas emissions		√	≈	≈
Resource use		√	≈	**X**
Waste		□	≈	≈
Birdlife populations	Farmland	**X**	≈	≈
	Woodland	≈	≈	≈
	Coastal	≈	≈	≈
Fish stocks		□	□	□
Ecological impacts of air pollution	Acidity	□	√	≈
	Nitrogen	□	**X**	≈
River quality	Biological	√	√	≈
	Chemical	√	√	≈
Economic growth		√	√	√
Active community participation		□	√	≈
Crime	Vehicle	√	√	√
	Burglary	√	√	√
	Robbery	**X**	**X**	**X**
Employment		≈	√	≈
Workless households		√	√	≈
Childhood poverty		√	√	√
Pensioner poverty		√	√	√
Education		√	√	≈
Health inequality	Infant mortality	**X**	**X**	√
	Life expectancy	**X**	≈	**X**
Mobility	Walking/cycling	**X**	**X**	≈
	Public transport	**X**	≈	≈
Social justice		□	□	□
Environmental equality		□	□	□
Wellbeing		□	□	□

Key
√ = Clear improvement
≈ = Little or no change
X = Clear deterioration
□ = Insufficient or no comparable data

Figure 3: The Dashboard of Sustainability

The ***Dashboard of Sustainability*** is a free, non-commercial software (http://esl.jrc.it/envind/dashbrds.htm) designed to be understood by experts, the media, policy-makers and the general public. It takes the form of a car instrument panel, displaying country-specific assessments of economic, environmental, social and institutional performance toward (or away from) sustainability. An example of Canada is shown below.



Notes:
The overall SD index for Canada is indicated in the upper left corner (with best scores for Social Development), and the disaggregated picture for "Environment" in the lower left corner. The twenty indicators demonstrate the complexity of environmental policy: Is it correct to assign the same weight to CO_2 emissions (red) and CFCs (green)? And why is Canada deep in the red for "Protected area"? The Dashboard software would reveal that 10% protection is far lower than the 38% of Saudi Arabia. While the judgment is based on objective data, a politically and scientifically sound analysis might come to the conclusion that protecting a desert is not as important for preserving biodiversity as the data suggest.

Steps in developing an indicator framework

Based on experience in Central America, the International Center for Tropical Agriculture (CIAT) has produced a useful booklet (available at http://www.ciat.cgiar.org/indicators/toolkit.htm) with lessons on developing indicators. It covers topics ranging from the development of a conceptual framework to case studies, and suggests seven key steps:

1. ***Develop a conceptual framework*** (clear and flexible), allowing for different approaches to analysing the development process:
    - Sustainable development components (environmental, social, economic);
    - Sustainability issues (eg land use, economic and social dynamics, and natural events);
    - Categories of indicators (pressure, state, impact, and response).

   The framework should also allow for analyses at different levels (regional, national, local).

2. ***Select indicators and explore means for analysis***. Use a set of clear selection criteria (eg data reliability, relevance, causality, measurability and scale). Include different means for analysis:
    - *Indices* to visualise scenarios at aggregated levels (eg regional or national);

- *Core indicators* to analyse the information obtained from the indices in order to identify causal links, dynamics and impacts;
- *Complementary indicators* to further refine the analysis for decision-making – often country, area or project specific.

3. ***Establish a consultative network*** – build a network of partners and facilitate a consultative process, eg workshops, visits, capacity-building and training:
    - Discuss and harmonise the framework, issues to monitor, indices and indicators, and work plans;
    - Identify capacities, needs, processes, mandates, responsibilities, uses and interests;
    - Exchange information and data.

4. ***Search data and develop databases***. Survey and improve the production, availability, and use of data and information. This includes use of both existing data and information and identifying when the needed information is missing. Avoid being unrealistic – look at what data exists, [judge its reliability], and use it creatively when developing indices and indicators.

5. ***Develop tools for causal link analyses and visualisation.***
    - Develop capacities to analyse and visualise available information;
    - Use tools such as land use models and geographical information systems to fill crucial information gaps;
    - Enable causal link analyses through the use of different types and sources of information; and
    - Visualise the results in a user-friendly manner (maps, tables, figures, animation, time series, and model scenarios).

6. ***Apply the approach in case studies*** – to identify strengths and weaknesses in the proposed framework and indicator sets, and test their usefulness:
    - Identify new or different needs, gaps in or incorrect information and capacity needs for wider dissemination and use;
    - Case studies provide examples of how the information generated can be used at different levels (regional, national, local or sectoral) and for different dimensions (political, administrative, or ecological).

7. ***Dissemination tools, information and results***. Communicate and disseminate information to achieve effective results and sustainability. Means of information dissemination to be used include: websites, publications, training sessions, visits, and CR-ROM (with user-friendly interfaces).

It is important to think about the audience for the indicators before beginning and the uses to which they will be put.

Key sources of further information and useful web-links

The International Institute for Sustainable Development (IISD) maintains an online directory of "sustainable development indicators initiatives" at national and international levels by governments, non-governmental organizations (NGOs) and individuals ((http://www.iisd.org/measure/compendium/)

Hak, Tomas, Bedrich Moldan and Arthur Lyon Dahl (eds). 2007. *Sustainability Indicators: A Scientific Assessment.* SCOPE Vol. 67. Washington, D.C., Island Press, 413 p.

Meadows D. (1998) *Indicators and Information Systems for Sustainable Development Strategies*. A report to the Balaton Group, The Sustainability Institute, Hartland, Vermont, USA

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