

## Measuring Sustainable Development

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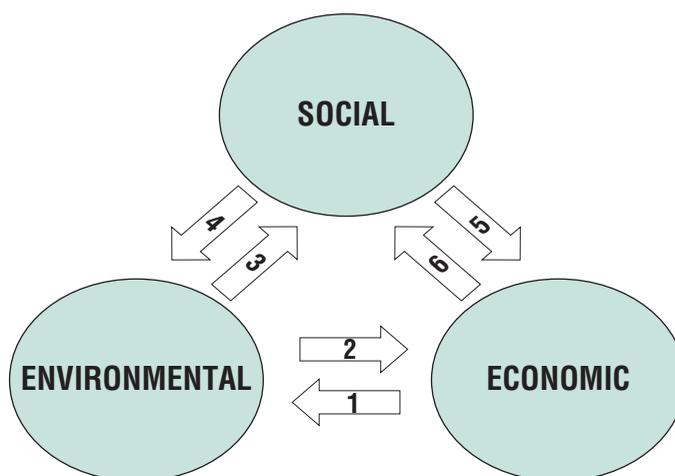
Making the concept of sustainable development operational for public policies raises important challenges in terms of measurement. Without indicators or a quantitative framework, sustainable development policies lack a solid foundation on which to advance.

The concept of sustainable development encompasses three dimensions of welfare — economic, environmental and social - and involves complex synergies and trade-offs among them (Chart 1). This Statistics Brief presents an update on progress in the development of indicators of sustainable development and describes some of the challenges that lie ahead.

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Chart 1. Key dimensions of sustainable development



1. Effects of economic activity on the environment (e.g., resource use, pollutant discharges, waste).
2. Environmental services to the economy (e.g., natural resources, sink functions, contributions to economic efficiency and employment).
3. Environmental services to society (e.g., access to resources and amenities, contributions to health, living and working conditions).
4. Effects of social variables on the environment (e.g., demographic changes, consumption patterns, environmental education and information, institutional and legal frameworks).
5. Effects of social variables on the economy (e.g., labour force, population and household structure, education and training; consumption levels, institutional and legal frameworks).
6. Effects of economic activity on society (e.g., income levels, equity, employment).

## Sustainable development: what is the measurement challenge?

Progressing towards sustainable development implies that the objectives of increasing economic efficiency and material wealth must take into account social and environmental objectives. Explicit in the concept is a focus on inter-generational equity, implying that future generations should have opportunities similar to those now available. Sustainable development also puts emphasis on equity that applies both across and within countries.

In 1987, the World Commission on Environment and Development (WCED) published a report entitled “Our Common Future”. Known as the Brundtland Report, it presented guiding principles for sustainable development. Among other precepts, the report implied the need to develop indicators for monitoring long-term progress towards “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs”.

Later, Agenda 21 (the 1992 Rio Declaration on Environment and Development) urged countries to “develop indicators of sustainable development” in a way that would “contribute to a self-regulating sustainability of integrated environment and development systems”.

Indicators are needed to illustrate to policy makers and the public the linkages and trade-offs between economic, environmental and social values; to evaluate the longer-term implications of current decisions and behaviours; and to monitor progress towards sustainable development goals by establishing baseline conditions and trends. But simple and easily-understood measures that do not compromise the underlying complexity of sustainable development have been difficult to formulate.

The sustainable development agenda is a broad one, covering virtually all aspects of life at national and international levels and of government policies. The fact that countries have different perspectives on sustainable development makes matters more complex. Demands for information are multiple, change over time and originate from many sources – public and private. At the same time, there is a need to maintain balance between short and long-term information needs and continuing efforts and investments to improve information quality.

### Why are conceptual frameworks needed?

Frameworks are important to structure work on indicators and on underlying statistics. Because sustainable development encompasses three different policy

dimensions and their interactions, there is a vast range of relevant indicators in need of an organising principle. Such frameworks should be simple and understandable so as to link the indicators to policy questions and make them useful to decision-makers and the public.

OECD countries have adopted different types of frameworks. For example, Sweden has structured its indicators based on the Brundtland Report’s definition of sustainable development, involving four integrated themes: efficiency, contribution and equality, adaptability, and values and resources for coming generations.

Some countries use their national strategies for sustainable development (NSSD) as the organising framework for indicators. For example, Austria uses 48 indicators to monitor progress on the 20 key objectives of its sustainability strategy. Similarly, the European Commission has developed a pyramid of indicators based on the themes and sub-themes of the European Union sustainable development strategy.

Countries such as Canada and Norway use a “capital” approach where the focus of measurement is on the stocks and flows of different national assets: natural capital, financial capital, produced assets, human capital, etc. Thus, in Norway, natural capital is measured in terms of ecosystems and renewable resources, while financial capital is captured in terms of net national income per capita and petroleum adjusted savings. Here, the question of sustainability is framed as whether the country is managing its resource base – as embodied in different types of national wealth – in a way that secures its maintenance over time.

Measuring sustainable development requires both simple measures that inform decision-makers about major trends and issues as well as more detailed measures to support in-depth analysis. Attention should be given to the “supply side” – how statistics and related indicators can best be constructed – as well as to the “demand side” – how these indicators can be interpreted and used most appropriately. And frameworks are needed to assess sustainability at different levels – local, national, regional and global.

### Are some indicators better than others for measuring sustainable development?

A popular measurement approach to sustainable development is to select and enumerate a number of indicators for each of the three dimensions – economic, environmental and social. The UN Commission on Sustainable Development (UNCSD), the European

Commission (EC) and the OECD are among those bodies which have compiled a list of indicators for tracking sustainable development trends.

In addition to international organisations, many countries and groups have elaborated sets of indicators for monitoring sustainable development. A review of sustainable development indicators assembled by OECD countries, however, shows great diversity in the measures selected under each of the categories and themes proposed by the UNCSD (OECD, 2002c).

A related approach is to develop reduced sets of “core” or “headline” indicators, which are more accessible and easily understood than longer shopping lists. In an earlier publication, the OECD, for example, proposed a limited set of headline indicators to quickly measure whether we are maintaining current assets as well as satisfying current needs in sustainable development terms (Box 1) (OECD, 2001b).

Developing reduced sets of sustainable development indicators has both benefits and constraints. The combined presentation of indicators from various disciplines allows key aspects of sustainable development to be communicated in a simple way. However, these indicator sets are not designed to provide a full picture of economic-social-environmental relationships, but rather to capture key trends and draw attention to selected issues.

### How are these indicators used in policy analysis?

Core sets of sustainable development indicators are particularly useful in comparing countries and conducting peer reviews of performance and policies. In the OECD, environmental performance reviews of countries are based on indicators describing economy-environment relationships in terms of decoupling (described in the following section). These indicators have been developed and agreed over a number of years (OECD, 2003).

#### Box 1. OECD core set of sustainable development indicators

Theme	Indicators
	<b>Resource indicators: Are we maintaining our asset base?</b>
<b>Environmental assets</b>	
Air quality	Greenhouse gases (GHG) emission index and CO <sub>2</sub> emissions NOx emissions
Water resources	Intensity of water use (abstractions / renewable resources)
Energy resources	Consumption of energy resources
Biodiversity	Size of protected areas as a share of total area
<b>Economic assets</b>	
Produced assets	Volume of net capital stock
R&D assets	Multi-factor productivity growth rate
Financial assets	Net foreign assets and current account balance
<b>Human capital</b>	
Stock of human capital	Proportion of the population with upper secondary/tertiary qualifications
Investment in human capital	Education expenditure
Depreciation of human capital	Rate and level of unemployment
	<b>Outcome indicators: Are we satisfying current needs?</b>
Consumption	Household final consumption expenditure Municipal waste generation intensities
Income distribution	Gini coefficients <sup>1</sup>
Health	Life expectancy at birth Urban air quality
Work status / Employment	Employment to population ratio
Education	Education participation rates

1. The Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.

Source: OECD (2001), Sustainable Development: Critical Issues.

In addition, for a three-year period, the OECD economic surveys included sustainable development reviews of countries based on indicators structured according to the following menu of issues (OECD, 2004c):

- a) Reducing emissions of greenhouse gases
- b) Reducing air pollution
- c) Reducing water pollution
- d) Sustainable use of renewable and non-renewable natural resources
- e) Reducing and improving management of waste
- f) Ensuring sustainable retirement income policies
- g) Improving living standards in developing countries.

Each country review focused on three topics (from a total of seven) selected for their relevance to the country being examined. A number of indicators were used to assess performance under each of the seven themes. For example, reducing emissions of greenhouse gases was measured according to total GHG emission intensity and that of carbon dioxide emissions in certain sectors (electricity, transport, manufacturing, residential) as well as growth rates in emission intensity. In this way, countries were compared on the basis of selected indicators relating to sustainable development and were able to see their relative performance.

The selection of indicators for monitoring sustainable development tends to vary by country depending on their natural attributes, industrial structure, and political and social variables. In practice, it has been difficult for countries to agree on a common core set of sustainable development indicators to be applied to all nations. One approach is to develop different core indicator sets for groups of countries based on selected variables (e.g., level of development, natural resource base).

While countries may use a broad range of indicators to monitor their national performance in sustainable development terms, some common indicator sets may be needed for cross-country comparisons and peer reviews.

## What are decoupling indicators?

Decoupling indicators are useful in helping policy makers understand the interface between developments in two different spheres. In most cases, they compare the relative growth rates of environmental variables and economic variables. For example, the decoupling of damage to the environment from economic growth is advanced when the growth rate of environmental degradation is lower than the expansion of gross domestic product (GDP) over a given time period.

Decoupling indicators are attractive in their simplicity and in their ability to highlight the contribution of technology and structural factors to environmental pressures. They can be used to compare physical trends to policy targets and indicate the scope for progress. However, the simplicity of decoupling indicators is sometimes deceptive. Most environmental pressures are generated by multiple driving forces, which require complex modelling tools to understand.

Another weakness of decoupling indicators is that there are numerous environmental variables where the externalities are not linear. Thus, continual pressure on a resource or species can occur with no apparent effect for a long time until a threshold is crossed and negative effects rise sharply. Many ecological systems are still poorly understood, underlining the need to address scientific gaps in order to develop better indicators.

The OECD has developed a range of decoupling indicators for environmental peer reviews: a number relate to decoupling economic activity from climate change, air pollution, water quality, waste disposal, materials use and natural resources, while others focus on environmental pressures in sectors such as energy, transport, agriculture and manufacturing. These measures show that weak decoupling (in relative terms) has been occurring across the OECD countries since the early 1980s, but that strong decoupling of environmental damage from economic activity is a distant goal (OECD, 2002b).

## Would accounting frameworks help?

Although indicators are important for measuring progress towards sustainable development, they do not provide much insight into the interrelations among the various measures. Accounting approaches are useful in structuring statistics and examining dynamic rather than static pictures as well as in constructing broader frameworks for sustainable development measurement. They can provide both a representation of the relationships among variables and a common scale by which to compare them (OECD, 2004a).

In the environmental field, for example, stock and flow accounts have been developed for natural resources and pollution as well as materials. These accounting approaches help derive indicators on the intensity and sustainability of current patterns of the use of inputs to production.

In 2004, the OECD Council Recommendation on Materials Flows and Resource Productivity encouraged the development of indicators of material resource use within

and among countries and also tools to measure resource productivity. The development of material flow accounts in the OECD will eventually provide the basis for evaluating the resource efficiency of economies.

OECD work is based on developing accounts in physical units (usually tonnes) comprising the extraction, production, transformation, consumption, recycling and disposal of different types of materials. Priority is being given to accounting for high volume flows (metals, wood, fish) and toxic flows (chemicals, pollutants). The aim is to develop a common accounting framework within which countries can collect data and fashion indicators on materials flows (OECD, 2004b).

Other initiatives have aimed at supplementing and expanding traditional national accounts with information on resource and environmental conditions. For example, the Netherlands developed methods for grouping economic and environment-related variables in the National Accounts Matrix including Environmental Accounts (NAMEA) system.

A major contribution to the development of such satellite accounts is the System of Integrated Environmental and Economic Accounting (SEEA) formulated jointly by several international organisations including the OECD (UN, OECD, *et.al.*, 2003). The SEEA complements standard economic accounts (*i.e.* the System of National Accounts, 1993, produced by the UN, OECD, Eurostat, IMF and World Bank) by providing a common framework for examining interactions between the economy and the environment.

The SEEA contains physical flow accounts for four types of resources: natural resources, ecosystem inputs, products and residuals. Hybrid flow accounts then compare these physical quantities to matching economic flows. In linking resource use to economic activity, the SEEA accounting framework leads to better understanding of policies for decoupling environmental degradation from development and growth.

However, these accounts involve large sets of numbers and it is a demanding task to extract easily understandable and politically relevant information. At present, accounting approaches provide data more suitable as a basis for detailed analysis in certain areas.

In addition, these approaches are limited to juxtaposing accounting schemes for two dimensions – environmental and economic. There has been less progress in the social field, despite attempts by groups such as the European Leadership Group on Social Accounting Matrices to link

social variables such as labour force participation and income distribution to various measures of economic activity.

Accounting frameworks to bring the three dimensions of sustainable development together simultaneously are still lacking. Approaches based on the integration (and not just the juxtaposition) of the three types of accounts is needed. This will partly depend on deriving better measures of social capital and determining how various assets (natural, environmental, financial) are distributed among populations and countries. Over time, core indicator sets could increasingly be based on satellite accounts such as the SEEA and more developed accounting approaches.

## How can the social dimension be measured?

Much of the effort to derive sustainable development indicators stems from dissatisfaction with measurement approaches based on purely economic concepts of well-being. These tend to neglect the environmental and social aspects of sustainability. However, the social dimension of sustainable development has proved especially difficult to measure.

There are large differences across OECD countries in how they interpret social sustainability: from concerns about poverty in the developing world, to the health consequences of environmental change, to issues relating to ethnic minorities and gender balance, to broader considerations about the quality of life and social relations (poverty, crime, education, etc.). The diversity of concerns and lack of a common focus is one of the hurdles to identifying suitable measures for the social side.

It has been difficult to derive indicators of “social capital” – comparable to economic and environmental capital – which can be measured in terms of aggregate stock. Many social concerns relate to access to opportunities, *e.g.*, whether some individuals or groups lack opportunities for education and training, adequate health care or affordable housing. Devising statistical measures of the social dimension of sustainable development requires data on how economic, environmental and social resources are distributed in society.

Social capital also reflects the shared norms and values in society which bring benefits to individuals and groups by facilitating co-operation and reducing opportunistic behaviour. This has led to attempts to develop indicators of social cohesion in countries, regions and cities, but these tend to be very subjective.

Another dimension is the sustainability of institutions over time, in particular the social protection system. Measurement involves assessing the pressures on social institutions generated by the evolution of factors such as ageing of the population and lower fertility rates, labour market trends such as work polarisation, diversity and fragility of family ties and distribution of economic resources. Indicators are needed to assess these pressures, government policy responses, and the outcomes delivered by various institutions.

The range of social indicators is very broad and includes many measures that the OECD has developed over the years. Social indicators provide objective measures of the conditions in which people live, the factors shaping these conditions and the actions taken by governments to preserve and improve them. OECD social indicators are grouped under four broad policy objectives: enhancing the self-sufficiency of individuals, promoting equity in social outcomes, improving the health of populations, and securing social cohesion (OECD, 2005b).

Devising suitable measures for the social dimension of sustainable development confronts a range of practical and conceptual hurdles. As in the economic and environmental fields, the selection of indicators relating to the social dimension is a political act. Through this selection, governments convey a sense of their priorities, make commitments to take action, and indicate that they are ready to respond to their electorates for failures to make progress.

## Are global effects taken into account?

Nationally-based attempts to measure sustainable development offer only limited insights into trans-boundary effects or the impacts of countries on global sustainability. Country-level indicators need to be complemented by measures of economic, environmental and social externalities imposed beyond national borders.

Various data sets have been proposed relating to cross-border flows and impacts (OECD, 2005c). In the environmental sphere, for example, indicators of embedded carbon flows measure the import of products with significant carbon content, e.g. steel and chemicals. These data show the impact of countries on the stratosphere through their consumption (imports) as well as production of carbon dioxide. Strict emission standards at the national level may be undermined by large imports of goods produced under less restrictive rules. While national indicators show a decoupling of harmful emissions and growth, international indicators may disprove such a trend.

In the social sphere, indicators have been developed to examine trans-boundary financial flows through combining related, and sometimes off-setting, measures, e.g., development aid and debt repayment. For many developing countries, outflows in terms of loan principal and interest are more than half of new inflows of assistance. In effect, countries are borrowing to repay earlier loans.

More sophisticated measures of global flows of capital, human and natural resources are essential for arriving at true indicators of sustainable development.

## What are composite indicators?

Composite indicators are synthetic indices of groups of individual indicators which are used to compare and rank countries in areas such as environmental performance and sustainable development. Composite indicators are valued for their ability to integrate large amounts of information into easily understood formats for a general audience. They limit the number of statistics to be presented and allow for quick comparisons of country performance. In this, the use of composite indicators as a communication and analytical tool is growing.

Examples include the Environmental Sustainability Index, which compares countries based on over 100 indicators divided into five groups (environmental systems, environmental stresses, human vulnerability, societal adaptability and global stewardship); the Ecological Footprint which uses a range of indicators to measure the amount of renewable and non-renewable land area required to support given resource demands; and the Dashboard of Sustainability, which links 100 economic, environmental and social indicators and examines their interactions on a country basis.

However, there are serious questions regarding the accuracy and reliability of composites, particularly in ranking country performance (OECD, 2002a). Because their construction is not straightforward, they can provide misleading information, be manipulated to produce desired outcomes or lead to simplistic policy conclusions. Methodological issues include the sometimes lack of a theoretical framework, the ad hoc nature of their construction, the sensitivity of results to different weighting and aggregation techniques, and continuing problems of missing and weak data.

Conflicting views on the merits of composite indicators are increasing at the same pace as their use. Yet, they can be a useful starting point for policy discussions and can assist the public in understanding complex issues. The

OECD and the EC Joint Research Centre have developed a handbook to assist both the users and builders of composites (OECD/JRC, 2005).

The aim of the handbook is not to resolve the debate about composite indicators, but to contribute to a better understanding of their complexity and to an improvement of the techniques currently used to build them. Through this guide, users are acquainted with the advantages and disadvantages of the application of composite indicators and means for assessing their soundness. For constructors, the methodological steps are explained and a toolbox presents different construction alternatives. Methods for testing the robustness of composites and assuring their overall quality are also included.

## Conclusion

Understanding sustainable development linkages and achieving the required policy trade-offs across the environmental, economic and social spheres requires novel methodologies based on new types of statistical approaches. The challenge in measuring sustainable development lies in developing new indicators and combining these through accounting frameworks, decoupling methods, global approaches and composite indices. Solid analysis and measurement provide the basis for implementing sustainable development policies which accurately reflect the complexities of real world choices. ■

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