

# Measuring Environmentally Sustainable Development

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**A** *BROADER understanding of development requires broader measures of development that encapsulate social, equity, and environmental concerns. Care must be taken that aggregate measures of progress do not conceal more than they reveal. But promising work is underway to “green” the national accounts.*

*“The gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages; the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to our country; it measures everything, in short, except that which makes life worthwhile.”*

*Robert F. Kennedy, 1968*

Measures of the overall income and output of a nation—the national accounts—give a highly imperfect indication of a nation’s well-being. Besides the well-known gaps in coverage, such as unpaid household work, at least four sets of additional information are required to make any kind of conclusive judgment on trends in human well-being.

**Inequality and poverty.** Aggregate income figures do not necessarily indicate

trends in the incidence of poverty. While the correlation between national income growth and poverty reduction is strong, and earlier notions of income inequity tending to rise at early stages of development (the “Kuznets Curve”) have now generally been debunked (see *World Development Reports 1990, 1991*), household surveys are required to shed light on income and expenditure patterns among the poor. Reasonably good progress has been made in the past decade to standardize survey methodologies, and about 40–50 countries (accounting for 80 percent of the population of developing countries) now undertake household surveys, producing fairly professional poverty assessments. Nonetheless, it is still difficult to compare the incidence of poverty across countries.

**Human resources.** Increased aggregate income does not always buy improved human resource indicators. Recent concerns about declining educational attainment in industrial countries illustrates this point, as does the apparent variation in human development achievements at similar income levels (see, e.g., “The Progress of Nations,” UNICEF, September 1993). Data on key indicators—such as infant mortality, literacy, school enrollment, and access to medical facilities—are available for almost all countries, but the reliability of these data varies greatly, with indices often calculated indirectly from highly partial data and sometimes from extrapolation of earlier estimates. Significant resources are being devoted to strengthening field measurement and to standardizing definitions, but much remains to be done.

**Environment.** If growth in aggregate income significantly damages the environment, it may counteract some (or possibly all) of the welfare gains from income growth and

undermine future growth prospects. Knowledge about environmental conditions is particularly inadequate, due partly to conceptual problems (e.g., how to define soil depletion, loss of natural habitat, and air pollution) and partly to the fact that mechanisms are often simply not in place to measure the raw facts. Increased efforts have been made in the past few years to help countries with environmental monitoring and to compile internationally comparable statistics. For example, the Global Environmental Monitoring System, managed by the UN Environment Program, collates data on air and water pollution in some 150 countries. But in most situations, resources have been inadequate, and the quality of information and comparability across countries remains poor.

**Social, political, and spiritual aspects of welfare.** Measures of “economic” welfare fail to capture the social, political, and spiritual aspects of human well-being, which are often much more important. Many of these aspects cannot be measured in any quantitative sense, of course, which may tend to diminish their importance in the minds of policymakers. Recent years have seen the refinement and growing use of indicators of political and civil liberties, gender and racial bias, the incidence of crime and violence, and the like. At the same time, a growing number of governments and aid agencies have been developing and using the tools of social assessment in investment planning and appraisal. These tools have tended to focus on project-level decisions (e.g., how social and cultural cohesion might be affected by particular investment programs). Much less is known about the social impacts of broader development trends, such as urbanization and market liberalization.

Where does this state of affairs leave policymakers? Clearly, they need better basic facts on the development concerns listed above, but they also need to see these basic facts aggregated into policy-relevant indicators of progress. Both of these steps—measurement and aggregation—pose tough challenges for the noneconomic dimensions of development. This article reviews some of the current issues in the search for development indicators and describes one particularly promising area in which the aggregates are environmentally adjusted.

## Indicators of development

One of the reasons there has been an excessive focus on the economic aspects of development is because it is easier to measure what is transacted in the marketplace than what is not. What to measure and where to measure it are more intuitive, and the “numeraire” (common unit of account) enabling aggregation is straightforward—money.

Such easy calculations are not available for many other aspects of development, especially social concerns and environmental issues. For example, with over 300 different toxic pollutants—many of them highly localized—how can pollution in any aggregate sense be monitored? Or, in view of the many types of soil degradation (e.g., erosion, salinization, loss of moisture or nutrients, and waterlogging), how can the state of a nation’s land resources in any aggregate sense be captured?

Aggregation, of course, requires a numeraire. In this regard, important work is now underway to derive relationships (“dose-response functions”) between various forms of environmental damage and human health,

economic productivity, and human amenity values, which would provide a numeraire, thereby enabling aggregation. Thus, for example, different pollutants would be multiplied by both their health impacts and the affected population. Areas affected by different types of soil damage would be multiplied by estimated impacts on such factors as future yields. However, resources allocated to such work have been modest and research programs often poorly coordinated.

Care needs to be taken in searching for aggregate measures of progress, so that the single indices chosen do not conceal more than they reveal. Housing is an example. Traditionally, simple measures of housing have been the norm: Do people have housing—yes or no? But with the movement away from direct government provision of housing toward “enabling strategies,” and a growing recognition that housing involves much more than bricks and mortar, it became clear that richer measures were needed. This realization led, in 1990, to the creation of a Housing Indicators Program, sponsored jointly by the UN Center on Human Settlements and the World Bank.

Data have now been collected from 53 countries covering 80 percent of the world’s population, drawing on extensive surveys of demand and supply factors and the recognition that there are many dimensions to good housing (e.g., reasonable space and ventilation, access to a footpath, proximity to employment, and affordability). Researchers on this project, while attracted to the possibility of deriving an aggregate measure of housing services, have concluded that in the absence of a mean-

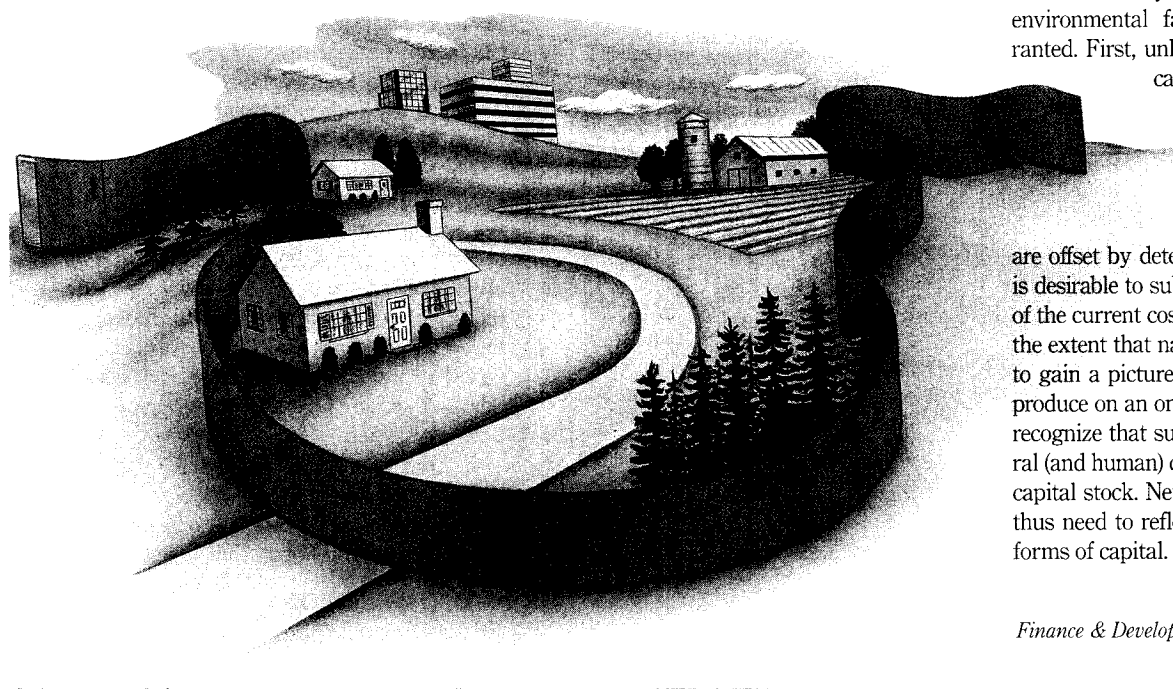
ingful numeraire, any such aggregate index would not help policymakers. The methodology adopted is currently being extended to other areas, including urban environmental issues, water, sanitation, and transportation.

If adding apples and oranges is a problem at the subsectoral level, it is much more so at higher levels. Various proposals have been made over the years for aggregating measures of education, health, nutrition, income, civil liberties, and the like. But in the absence of a substantive numeraire, most of these proposals have involved merely adding together normalized indices. Critics of these indices argue that such aggregations are inevitably arbitrary and thus potentially misleading. Supporters, however, contend that even if the indices are arbitrary, the purpose is to force nonmonetary elements of well-being to the forefront of development policy. The Human Development Index (HDI) of the UN Development Programme, the best known of such indicators, illustrates this point. By aggregating indices of life expectancy, educational attainment, and per capita income—the same indicators used in the World Bank’s “Basic Indicators” table—the HDI has provoked an outpouring of views (many critical) on its methodology and findings, thus serving its purpose well.

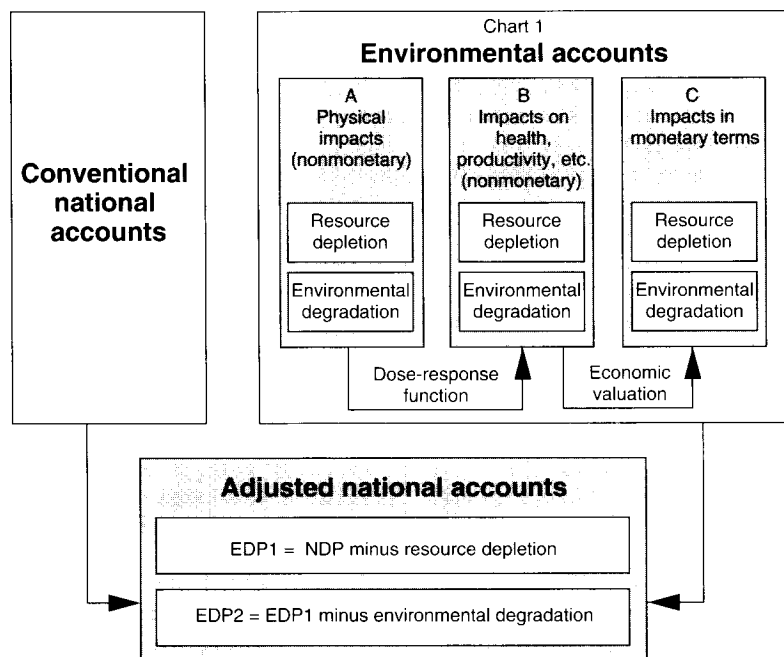
## “Greening” the accounts

Deriving aggregate indices using a common numeraire is conceptually preferable to the ordinal approach of the HDI but is practically much more difficult. Adjusting the national accounts to reflect broader development concerns is one commonly proposed route. No credible approach is available to make adjustments based on social or income distributional concerns, but methods for making environmental adjustments have been available for some time. Adjustments to take into account environmental factors are particularly warranted. First, unlike human development indicators, which are generally positively correlated with income, environmental conditions sometimes worsen with economic growth. If the benefits of increased income

are offset by deteriorating health conditions, it is desirable to subtract from income a measure of the current costs of such damage. Second, to the extent that national accounts data are used to gain a picture of the economy’s capacity to produce on an ongoing basis, it is necessary to recognize that such capacity depends on natural (and human) capital as well as on manmade capital stock. Net capital accumulation figures thus need to reflect the changing stocks of all forms of capital.



## “Greening” the national accounts



**M**aking environmental adjustments to national accounts can occur at three levels of sophistication:

- **Physical accounts.** Nonmonetary accounts can be established, measuring resource depletion and environmental effects of various aspects of national production and income. Thus for any sectoral activity, it is possible to determine its physical impact. These impacts may be added for the economy as a whole.

- **Nonmonetary impacts.** These environmental impacts can be recast in terms of their estimated impacts on various nonmonetary indicators, such as human health, agricultural productivity, global warming, or ozone depletion. These impacts are usually calculated by multiplying physical outcomes (e.g., soil erosion) by impact coefficients or “dose-response” functions (e.g., impact on yields).

- **Monetary valuation.** Environmental impacts can then be expressed in monetary terms through the use of valuation techniques, in turn providing a means of adjusting the national accounts themselves.

Major empirical problems exist at all three levels—on the basic physical impacts, on dose-response functions, and on monetary valuation. But it is the third level, valuation, where particularly tough conceptual and methodological problems occur.

### Illustrative figures for Mexico (1985 estimates)

	In million pesos	Index
Net domestic product (NDP)	42,060	100.0
Minus resource depletion		
Oil	1,470	3.5
Timber	164	0.4
Land use change	764	1.8
Equals EDP1	39,662	94.3
Minus environmental degradation		
Soil erosion	449	1.1
Solid wastes	197	0.5
Ground water use	191	0.5
Water pollution	662	1.6
Air pollution	1,656	3.9
Equals EDP2	36,507	86.7

Source: "Toward Improved Accounting for the Environment," Chapter 6, Jan van Tongeren et al.

At this stage, most efforts at natural resource and environmental accounting have been restricted to creating physical accounts that parallel conventional national accounts rather than to estimating the money values of resource loss and environmental damage, thereby adjusting the “core” accounts themselves (see Chart 1).

Norway, for example, the country with perhaps the longest history of interest in resource accounting, has put its efforts into refining physical stock estimates in key sectors such as oil, minerals, fish, forestry, and hydropower. The Netherlands, another country with a history of concern in this area, has endeavored for over a decade to derive monetary measures of the loss of “environmental functions” (so far unsuccessfully). France is trying the most ambitious system yet—“patrimony accounting”—which is aimed at analyzing and describing the natural environment in its three basic dimensions: economic, social, and ecological. The system is to have seven levels, ranging from specific resource data at level one to aggregate welfare indicators at level seven. However, only limited resources have been available for implementation, which has so far been limited to the physical data at level one. US efforts in this field have been restricted to collecting data on pollution abatement expenditures, although President Clinton recently committed his administration to producing environmentally adjusted accounts during his term in office.

But there is now movement on several fronts. One reason is that in “Agenda 21,” the major policy document of the June 1992 Rio “Earth Summit,” 178 nations committed themselves to “expand existing systems of national accounts in order to integrate environmental and social dimensions in the accounting framework, including at least satellite systems of natural resources in all member States.” Second, in 1993, the UN Statistical Commission adopted a revised System of National Accounts (SNA) after a decade of work, altering the accounting procedures for member countries.

Although countries will not be required to fully integrate environmental concerns into the core accounts, it is suggested that they prepare “satellite” accounts, comprising both physical and monetary units, consistent with the core accounts. For this purpose, in December 1993 the UN Statistical Office issued a handbook on integrated environmental and economic accounting, providing detailed guidance.

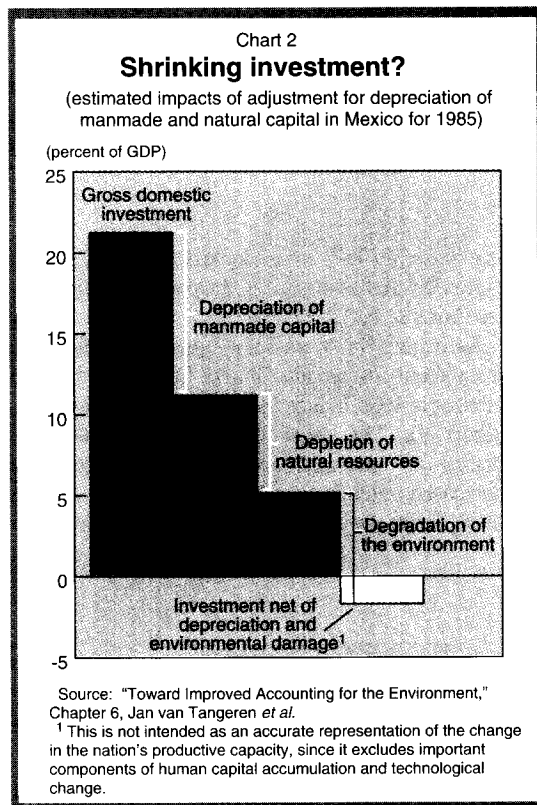
As part of the preparations for the SNA revision, the World Bank collaborated with the UN Statistical Office and country authorities in Mexico and Papua New Guinea to see

how practical the new methodology and handbook would be. The results of the two case studies (backed up by another study in Thailand) proved not only the viability of the approach but also the sensitivity of the findings to assumptions made.

Since most countries' national accounts do not even calculate depreciation of manmade capital to derive net domestic product (NDP), the first task of these studies was to make such estimates. Two sets of "environmentally adjusted net domestic product" (EDP) calculations were made. The first (EDP1) deducted estimates of resource *depletion* (e.g., oil, mineral, and timber extraction) from NDP. The second (EDP2) further deducted estimates of the monetary value of environmental *degradation* (e.g., air and water pollution, waste disposal, soil depletion, and groundwater use).

These calculations are much easier said than done, of course. Numerous judgments were required in choosing methodologies for estimating money values for both depletion and degradation, and in most instances indirect estimates were required. For example, ideally, the impact of pollution on health and future productivity would be estimated and a monetary value placed on such costs (discounted back to the present when damage occurred in future years), which would then be deducted from income and investment. Unfortunately, knowledge is inadequate for such calculations even in the most advanced industrial countries. Instead, an indirect measure—estimating the cost of reducing pollution to "acceptable" levels—was used. A similar approach was employed to calculate the costs of soil erosion, but a host of conceptual challenges and methodological choices remain.

In the case of Mexico—a relatively advanced developing country with severe environmental problems—EDP1 was estimated as 94 percent of NDP for 1985 (the only



year for which data were adequate), and EDP2 was estimated at 87 percent of NDP (see table). In Papua New Guinea—a country at a relatively early stage of development, with a large extractive industry—EDP1 was estimated at 92–99 percent of NDP for the 1986–90 period and NDP2 at 90–98 percent. These figures raise awareness of the need to adjust for environmental costs but in themselves give little guidance to policymakers. Sectoral accounts, however, provide more insight.

"Green" accounting also offers policymakers insights into the long-term productive capacity of a nation—through the investment and capital accounts. Chart 2 shows the estimated impact of resource depletion and environmental damage on Mexico's productive base in 1985. But care must be taken in inter-

preting the findings. A careless interpretation might conclude that with an apparently negative real investment rate after adjusting for national resource depletion and environmental degradation, the productive capacity of the economy had actually declined. But such a conclusion would require that other aspects of the nation's productive capacity also be assessed. Human capital formation and technological progress are particularly important. Broadening our understanding of productive capacity to include these elements should have a high priority.

### A richer measure

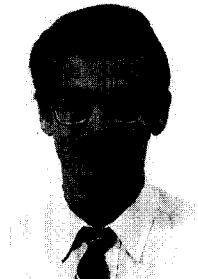
It is clear that a broader understanding of development requires broader measures of development. Heavier investment than in the past is required simultaneously at three levels: basic data collection, research into the relationships between such data and human welfare and economic development, and the derivation of *policy relevant* indicators at different levels of aggregation.

In emphasizing the limitations of overall income as an indicator of development, however, it is important not to "throw the baby out with the bathwater." Income is still the best measure we have of people's command over many of their commodity needs. Appropriately adjusted, real income remains a useful indicator of progress, especially for governments of democratic countries where citizens are better able to voice their preferences on how a nation's wealth and income should be allocated. There is even some indication that rising incomes can help promote such regimes.

However, neither income nor any other single indicator can or should encapsulate development progress. A richer set of indicators is needed, and remedial efforts are urgently required on those components of development that cannot be measured in the marketplace. ■



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For more details, see "Valuing the Environment: Environmental Accounting with an Operational Perspective," by Peter Bartelms, Ernst Lutz, Jan van Tongeren, World Bank Working Paper, September 1993; "Is Poverty Increasing in the Developing World?" by Shaohua Chen, Gaurav Datt, and Martin Ravallion, World Bank Policy Research Department Working Paper, 1993; "Toward Improved Accounting for the Environment," edited by Ernst Lutz, World Bank; and Poverty Comparisons: Fundamentals in Pure and Applied Economics, by Martin Ravallion, Harwood Academic Press, New York, NY, 1993.