

Measuring Sustainability: A Developing Economic Definition

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Submitted to the 41st Annual
Mountain Plains Management Conference
National University
La Jolla, CA
October 14-16, 1999

Abstract: This paper examines the changing definition of and reporting on measures of environmental sustainability by the World Bank and the United Nations Development Program. The paper also reports some correlates on income and sustainability.

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Introduction

Sustainability, sustainable development, and environmental sustainability are widely used terms in current economic development literature. Two of the major sources of statistical information related to this topic are the *World Development Report* published annually by the World Bank, and the *Human Development Report*, also an annual publication issued by the United Nations Development Program (UNDP).

The terms and statistical measures used by these two organizations to define and quantify sustainability are evolving over time. The goals of this paper are to:

- ▶ show the changing language of sustainability as used by these international agencies over time
- ▶ track the changing statistical measures used in quantifying sustainability and
- ▶ assess changes in global sustainability using UNDP and World Bank indicators.

Changing language and measures of sustainability

The World Bank's World Development Report

The *World Development Report* has been produced by the World Bank since 1978. Each report consists of a development "theme" that is explored in depth and a voluminous statistical appendix of development-relevant data. The data tables in this appendix are categorized into major sub-headings, such as "people," "environment," "economy," and so on, and these major categories have changed over time both in content and name. The 1992 report explored the theme of "development and the environment." But as shown in table 1, in its annual statistical tables, the World Bank first used the term "sustainable" only in its 1994 report. It then changed this category to "environmental sustainability" in 1996, and finally dropped the use of sustainable/sustainability with the 1998-99 edition, replacing it simply with "environment." Prior to the 1994 report, sustainability measures were included and reported within the "human and natural resources" category of

statistical tables.

Table 1 also shows the changes in statistical tables included within the sustainability category. Urbanization is the one common table from 1990 to 1997. Health and nutrition statistics were moved in the 1996 report from the "environmental sustainability" category back to the "human and natural resources" category. Tables on forests, protected areas, deforestation, and water resources were added in 1991 and have remained part of the World Bank's sustainability measures since then.

Two of the more interesting changes in the World Bank's reporting of sustainability are the addition of energy use in 1996 and emissions in 1998. One of the most critical areas of sustainability, energy consumption, was reported as part of "production" category for the first half of this decade. Emissions are not included in reports prior to 1998.

Table 1: World Development Report Sustainability Reporting, by year

<i>Year</i>	<i>Categories</i>	<i>Statistical Tables</i>
1990	Human resources	Health and nutrition; urbanization
1991	Human and natural resources	Health and nutrition; urbanization; forests, protected areas, and water
1992	Human and natural resources	Health and nutrition; urbanization; forests, protected areas, and water
1993	same as 1992	same as 1992
1994	Environmentally sustainable development	Urbanization; infrastructure; natural resources (health and nutrition moved to "Human resources development")
1995	same as 1994	same as 1994
1996	Environmental sustainability	Commercial energy use; land use and urbanization; forest and water resources
1997	same as 1996	same as 1996
1998-99	Environment	Land use and agricultural productivity; water use, deforestation, and protected areas; energy use and emissions

UNDP's Human Development Report

Defining human development "as the process of enlarging people's choices," the United Nations Development Program's *Human Development Report* was first published in 1990. Like the World Bank, UNDP's report also consists of a theme explored in depth, followed by a series of statistical data tables. The 1998 report for instance "examines consumption from the perspective of human development. It concludes that despite a dramatic surge in consumption in many countries, all is not well: more than a billion people lack the opportunity to consume in ways that would allow them to meet their most basic needs. Other consumers ... are consuming in ways that cannot be long sustained environmentally or socially and are quite often inimical to our own well-being" (*Human Development Report 1998*, p. iii).

While the *Human Development Report* includes the UNDP's well-known "human development index" — a summary measure of life expectancy, literacy, and education— it does not directly define or measure sustainability. Instead, as table 2 shows, the UNDP report also provides evolving categories and measures of environmental impact and degradation.

The changing categories used in the UNDP annual reports are indicative of the process of developing a sustainable definition of environmental sustainability. Initially, in 1990, environmental issues are only included in statistics for developing countries. The next year, natural resource measures are included for developing and industrialized countries, and a new category "profile in human distress" is added to the report. A greenhouse emissions index is added in 1991. In 1992, "energy balances" is added as a table to the developing countries' natural resource category and commercial energy to that for industrialized countries. Basic energy consumption statistics are added, and a "share of world energy consumption" measure reflecting energy gluttony by industrialized countries was added to the report.

1993 was the first time the UNDP report includes a category of "environment and pollution," reporting waste production statistics. The following year, the environment and pollution category is expanded to include emission percentage and pesticide use statistics. Probably reflecting the World Earth Summit, the 1995 report added CO₂ emissions, and the next year protected areas was added to environmental statistics. No changes were made in the statistical categories and data tables for the 1997 Report, but in 1998 the environmental category was expanded by splitting it into two sub categories "profile of environmental degradation" and "managing the environment," incorporating what was previously reported in natural resource, and environment and pollution statistics.

Table 2: UNDP's Environmental Sustainability-Related Reporting, by year

<i>Year</i>	<i>Categories</i>	<i>Statistical Tables</i>
1990	Natural resources balance sheet (developing countries)	Deforestation; internal renewable water resources
1991	Natural resources balance sheet (developing countries)	Same as 1990, with Greenhouse index added
	Profile in human distress (industrialized countries)	Greenhouse index
	Natural resources balance sheet (industrialized countries)	Same as developing countries, with spent nuclear fuel inventories; hazardous and special waste generation; emissions of traditional air pollutants; major cities with days of high sulfur emissions added
1992	Natural resources and energy balances (developing countries)	Same as 1991 with commercial energy per capita, and change in energy consumption added
	Natural resources (industrialized countries)	Same as 1991 for industrialized countries
	Commercial energy (industrialized countries)	New category in 1992, share of world energy consumption
1993	Same as 1992 with a new category added Environment and pollution	Municipal waste; industrial waste; waste paper recycled added.
1994	Same as 1993	Global emissions % share; pesticide consumption added.
1995	Same as 1994	CO2 emissions by category added.
1996	Same as 1995	Major protected areas added.
1997	Same as 1996	Same as 1996
1998	Changed into two categories: Profile of Environmental Degradation and Managing the Environment	Trees defoliated added.

Over the past decade the language and reporting of sustainability-related measures has changed dramatically. While the UNDP reports do not use the sustainability word, they have significantly expanded the reporting of environmental statistics, and most recently begun labeling a category as "environmental degradation." In the 1990s both reports recognized the importance of energy use in environmental management and expanded their reporting of emissions, recycling, and wastes. In general, both reports reflect the evolution of environmental concerns over the past decade.

Correlates of sustainability

It is sometimes suggested that countries' attention paid to sustainable economic development and growth is income elastic, i.e., that the most developed countries are better able to afford a clean, sustainable environment than poorer countries and that the larger is the gain in a country' income (GDP or GNP), the larger will be its expenditures on and resulting improvement of measures of sustainability. In this section, we report on a handful of correlates of sustainability.

First, we report how the World Bank's preferred overall measure of development, per capita GNP correlates with various sustainability measures and then report on the UNDP's preferred overall measure, its human development index, in like fashion.

The World Bank (*World Development Report 1998/99*) classifies countries into four income (GNP) groups: low, lower middle, upper middle, and high-income. The groups and associated per capita incomes are as follows: high-income countries range from Switzerland (\$44,320) to Slovenia (\$9,680); upper-middle income countries from Malta (\$8,630) to Turkey (\$3,130); lower-middle income countries from Panama (\$3,080) to Sri Lanka (\$800); and low income countries from Albania (\$750) to Mozambique (\$90).

In table 3, column A shows that the average annual deforestation between 1990 and 1995 is highest in the poorest countries to lowest in the richest countries. Indeed, for the richest countries, the statistics indicate *re*forestation instead of *de*forestation. A similar pattern emerges for nationally protected areas, column B. As a percentage of the total land area, this is lowest of the poorest and largest for the richest countries.

The growth of commercial energy use, column C, is most pronounced among the poorest and least pronounced among the richest countries. Columns D and E show GDP produced per unit of energy use for 1980 and for 1995. Remarkably, only the high-income countries managed to squeeze more GDP out of each unit of energy whereas all other country groups either stagnated or even became *less* energy efficient. Finally, columns F and G reveal that per capita carbon dioxide emissions

grew between 1980 and 1995 most drastically among the poor countries, i.e., by 75 percent for low-income countries (from 0.4 to 0.7), by 118 percent for lower-middle income countries (from 1.6 to 3.5), and by 4.7 percent for upper-middle income countries (from 4.3 to 4.5). In contrast, the high-income countries showed the lowest per capita carbon dioxide emissions growth of only 4.2 percent (from 12.0 to 12.5). What is of concern is that the *absolute* amount of these emissions (in millions of metric tons) grew from 13,586 to 22,700 tons, with three quarters of the increase of 9,114 tons accounted for by the poor countries (i.e., non high-income countries).

Table 3: Correlates of income and sustainability

	A	B	C	D	E	F	G
Low	0.7	4.9	6.2	2.4	1.9	0.4	0.7
LM	0.2	5.2	7.5	0.8	0.8	1.6	3.5
UM	0.5	5.3	2.1	1.7	1.5	4.3	4.5
High	-0.2	11.9	1.7	2.9	3.3	12.0	12.5

Column A: Annual deforestation, 1990-95, avg. annual % change

Column B: Nationally protected areas, 1994, as % of total land area

Column C: Commercial energy use, avg. annual % growth, 1980-95

Column D: GDP per unit of energy use, 1987\$ per kg, 1980

Column E: GDP per unit of energy use, 1987\$ per kg, 1995

Column F: Carbon dioxide emissions per capita, metric tons, 1980

Column G: Carbon dioxide emissions per capita, metric tons, 1995

Source: World Development Report, 1998/99.

One cannot avoid the conclusion that, on these measures, rich is better and sustainability is served by the power riches afford. Among the rich countries we see reforestation, nationally protected areas more than twice as large as among the poor countries, highly efficient energy use, and the smallest increase in per capita carbon dioxide emissions. Of course, some will want to argue that the rich can afford these outcomes because they have managed to shove the brunt of environmental damage to the poor countries. From a short-run perspective, this may be true as much traditional, "old-style", heavy-industrial activities are indeed carried out in middle-income countries in particular whilst the high-income countries have shifted to high-value added service activities. But from a long-run perspective, it is fairly clear that the shift, via educational attainment, to a service

economy permits to pay for environmental sustainable economic advancement. Those who in industrial countries lament the opportunity cost of foregone economic growth when costly environmentally justified restrictions are placed on industrial, commercial, and domestic activity need to bear in mind that the only relevant category of economic growth is long-run, sustainable, growth not short-run growth spurts that hallow out a country's environmental carrying capacity.

As regards the UNDP, one must question its country groupings and therefore the summary statistics that emerge. For instance, in its 1998 *Human Development Report*, UNDP places Georgia, Kyrgyzstan, Azerbaijan, Moldova, Tajikistan, and other former USSR nations among the "industrialized countries," while Cyprus, the Bahamas, Hong Kong, Singapore, and South Korea are placed among the "developing countries". This makes the UNDP summary statistics useless.

Moreover, the decision to strictly segregate "developing" from "industrial" countries and to collect diverging statistics for each is unfortunate. For example, data are collected for "deforestation" and "reforestation" (spotty data) for developing countries, but only for "deforestation" for industrial countries. Similarly, data on hazardous waste production and spent nuclear fuel is collected and reported for industrial countries in a rubric called "managing the environment," but a similar rubric is altogether missing for developing countries even as many of them also use nuclear power to generate electricity and as all of them produce some amount of hazardous waste.

While one must congratulate UNDP for putting forward the notion that pertinent data need be collected and reported, in our assessment a good job that would permit reasonable comparisons among countries over time has not been done.

What measures need reporting?

If sustainability involves preservation of natural resources among generations, say from today's to tomorrow's generation, then it is self-evident that today's generation must leave tomorrow's a sufficient set of resources with which to provide for its livelihood. Apart from accurate reporting on population levels and population growth rates, this will involve reporting on renewable and non-renewable natural and human resources. Among human resources, the most important is educational attainment. This is usually well reported, although we note with concern that the World Bank recently changed its reporting procedure making it now impossible to track primary, secondary, and tertiary school enrollment among countries over time.

Among the natural renewable resources one must also distinguish between levels and rates. In particular, one must know the relevant rate of renewal (positive or negative). For instance, fish and live stocks are, in principle, a renewable resource. Oceanic fish stocks are depleted but the rate of depletion is not reported by the World Bank or UNDP. Similarly, live stock is renewable but, in turn,

consumes agricultural products (feed stock) whose production may not be sustainable. The reporting on de/reforestation and freshwater resources is in principle correct but, at this time, still fairly uninformative for comparative purposes across countries and over time.

Among the non-renewable natural resources one must establish what the rate of depletion is and what the rate of use and rate of growth of use of alternative, substitute resources is. For example, energy use is reported but it is not reported what percentage of energy use stems from non-renewable fossil fuels and to what degree substitutions are taking place from fossil fuels to, say, hydro, wind, and solar power generation.

In a word, while congratulating the World Bank and UNDP for collecting and reporting on *some* measures of environmental sustainability of economic activity, we lament that the data that are reported exist in a theoretical vacuum whose presence would permit us to more appropriately assess the state of environmentally sustainable economic activity and development. We therefore urge the World Bank, UNDP, and similar organizations that publish high-profile annual compendia of statistical tables to think about a theoretically useful set of data tables and then go on to collect appropriate data and publish them on a consistent, comparable, annual basis.

List of References

World Bank. *World Development Report*. New York: Oxford University Press (various issues, 1990 to 1998/99).

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