ALTERNATIVES TO GROSS NATIONAL PRODUCT
A Critical Survey

Richard W. England
Manley Irwin Professor of Economics
Whittemore School of Business and Ecoomics
University of New Hampshire, Durham
Research Associate
Global Development And Environment Institute
Tufts University
Medford, Massachusetts
and
Jonathan M. Harris
Senior Research Associate
Global Development And Environment Institute
Tufts University
Medford, Massachusetts

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Introduction: Issues in GNP Accounting

Efforts to measure a nation's aggregate income date back to the 17th century, when Sir William Petty devised one of the first national income estimates. During the three centuries that followed, the national income concept slowly evolved as economists developed their understanding of how economic systems operate and as the key economic issues faced by society changed. However, the major thrust for the creation of modern national income accounting came with the economic crisis of the Great Depression, the political and military conflict of World War II, and the emergence of Keynesian macroeconomic theory (Carson 1975, Ruggles 1993).

As Robert Eisner (1989:1) has observed, "The national income and product accounts... have been among the major contributions to economic knowledge over the past half century." Since 1945, national income statistics have found a variety of practical uses. For instance, they help to inform the design of government fiscal and monetary policies, influence corporate investment plans, and are commonly used to assess economic development strategies in less developed nations. From their inception, however, the national income and product accounts have also been used to make international comparisons of wellbeing and to track changes in a country's level of welfare.

Simon Kuznets, one of the architects of national accounts, indicated that the connection between production and welfare is implicit in national income accounting: "National income may be defined as the net value of all economic goods produced by the nation... Any claim to significance such a total would have would lie in its presumptive usefulness as an appraisal of the contribution of economic activity to the welfare of the country's inhabitants, present and future." Kuznets makes clear that the construction of national income accounts includes normative judgements: "An investigator can decide intelligently what items to include and how to treat each only by formulating criteria of productivity and the principles of valuation to be applied . . . For those not intimately acquainted with this type of work it is difficult to realize the degree to which estimates of national income have been and must be affected by implicit or explicit value judgements" (1941: 3-4).

Gross national product (GNP) and allied accounting concepts such as gross domestic product (GDP)[1] have been sharply criticized during the past quarter century by a wide array of commentators. Many of those critics have questioned whether national income data adequately measure the state of or changes in economic wellbeing. A typical defense of gross national product and its conceptual siblings has been to deny that they serve as measures of economic welfare.[2] This defense is too facile, however. Leading economic historians and macro-economists readily cite data on real per capita gross domestic product (GDP) as though they can provide insights into standards of living and economic progress. In their influential text on economic growth, for example, Barro and Sala-i-Martin (1995:1, 4) observe that real per capita GDP in the United States grew by a factor of 8.1 from 1870 to 1990. They then conclude, "Even small differences in ... [annual GDP] growth rates, when cumulated over a generation or more, have much greater consequences for standards of living than... short-term business fluctuations...."[3] Because of welfare-tinged interpretations of GDP data by many economists and politicians, the critics of GDP deserve a serious hearing, especially by those who seek to understand the sources of human wellbeing.

This essay critically surveys a number of quantitative measures which have been proposed either as complements to or substitutes for GNP/GDP. These alternatives typically raise some combination of the following issues:

- the need to specify the distinction between intermediate and final output,
- the need to distinguish between "goods" and "bads",
- the need to account for asset depreciation in a comprehensive manner, including both manufactured and natural assets,
- the need to divide net output between consumption and capital accumulation on a reasonable basis,
- the need to take account of non-marketed goods and services, and
- the need to take account of the welfare implications of various forms of social inequality.[4]

In Part I of this essay, we review efforts to develop adjustments or complements to existing GNP accounts. Some of these efforts are clearly relevant to the fundamental question of how GNP/GDP relates to human wellbeing. Other efforts appear more technical, but often have implications both in terms of the choice of what to measure and the formulation of options by policymakers.

In Part II we survey some more comprehensive efforts to develop alternative measures. We have chosen to focus on those which seem to come closest to achieving the objectives either of improving or replacing GNP

accounts; other contributions to the development of this field of analysis are mentioned (and footnoted) but are less fully explicated here.

PART I: COMPLEMENTS & ADJUSTMENTS TO GNP

What Should be Included?
Intermediate versus Final Goods

>From the earliest days of modern national income accounting, deciding what products of human activity belong in GNP has been a contentious issue. Kuznets (1941:6-8) argued for inclusion of goods which are scarce and alienable sources of satisfaction to their users and which are legally exchanged in the marketplace.[5] He acknowledged that this accounting criterion was an arbitrary one and that many sources of human satisfaction would remain undetected and unmeasured by national income accountants if his criterion were officially adopted.[6]

At the same time, Kuznets (1941:36-40) also noted that not all commodities currently produced, exchanged and consumed are a source of final satisfaction to their users. Rather, they are intermediate inputs required to produce other useful goods. Thus, one of the authors of national income accounting reluctantly conceded that work clothing and commuting expenses should probably be treated as intermediate expenses of production and not as final consumption yielding subjective utility to employees.

In his assessment of national income accounting, Juster (1973:72-4) took this argument a step further:

> At present we classify everything purchased by households as final consumption... and most of the things purchased by business enterprise as intermediate products... [However,] most of what we now call final product is really intermediate in the more fundamental sense.

What exactly is the fundamental distinction between intermediate and final output? Juster argued that all products used to maintain the flow of services from existing assets be excluded from final output, and that products be included in final output only to the degree that they increase the flow of services from tangible and intangible assets via net investment. In practical terms, this would mean that all production which goes to support human labor (e.g. food and clothing) should be considered intermediate, rather than final, production. Application of this criterion would sharply reduce empirical measures of a nation's net final output, a consequence that Kuznets anticipated and opposed. .[7] However, Juster (1973:76) was correct when he concluded,

> [W]e can provide a better set of distinctions between intermediate and final product than the ones now embedded in... our existing accounts... Converting some but not all of our present final outputs to intermediate outputs should represent an improvement in what we now measure as net output....

More recently, Christian Leipert has tried to adjust GNP data in order to account more reasonably for intermediate costs of production. He proposes that we measure "defensive expenditures... made to eliminate, mitigate, neutralize, or anticipate and avoid damages and deterioration that industrial society's process of growth has caused to living, working, and environmental conditions" (Leipert 1989:28). These defensive outlays should then be eliminated from measures of aggregate final output.

Leipert identifies six spheres in which major defensive costs occur: the environment, transport, housing, personal security, health, and the workplace. This implies that national income should exclude environmental protection expenses, security services, prisons, and many health costs as well as some legal costs. Outlays for auto repairs and medical treatment resulting from road accidents, for example, should not be treated as final consumption but rather should be seen as unfortunate intermediate costs associated with provision of transportation services. Even outlays on extending metropolitan highway networks do not "increase the quality of life, but rather... can be regarded as a cost factor stemming from a specific type of development in the transport system and regional structure" (Leipert 1989:35-6).

Although one might quibble with the details of his estimates, Leipert has given a plausible demonstration that intermediate expenses for defensive purposes comprise a substantial portion of GNP as currently measured. In his estimates for West Germany, he found that defensive expenditures exceeded ten percent of GNP, "only the tip of the iceberg" in Leipert's view. (See Table 1.) It would seem, then, that GNP figures typically overestimate the aggregate value of final output currently available to satisfy present wants (via consumption) or future wants (via asset accumulation).[8]

40 TABLE 1.
DEFENSIVE EXPENDITURES AS PERCENT OF GNP Federal Republic of Germany, 1985

Environmental Protection Services of Industry and Government	1.33
Environmental Damages	0.80
Costs of Road Accidents	1.1
Costs of Extended Travel Routes	2.2
Higher Housing Costs Due to Urban Agglomeration	0.75
Costs of Personal Security	1.26
Defensive Health Care Costs	2.6
pat8 TOTAL	10.24

Source: Leipert (1989:41)

What Should be Deducted?
Depreciation of Manufactured & Natural Capital Assets

Economists have long accepted that for many purposes the concept of Net National Product (NNP) or Net Domestic Product (NDP) is a better measure of true economic production than the corresponding GNP or GDP figures. Capital goods are produced in any given year, and measured as gross investment in GDP; but capital goods also wear out or depreciate during the same year. We must therefore subtract depreciation from gross investment,

and from GDP, to obtain a true picture of the nations' production during the year. In other words, final output net of asset depreciation is a better measure of society's capacity to service the present and future needs of its members.

In standard national income accounting, however, the depreciation adjustment is applied only to manufactured capital such as buildings and machinery. The depreciation of natural capital such as forests, fisheries, and soils is unaccounted for. In recent years, various adjustments to national income accounts have been proposed so that asset depreciation would be measured more comprehensively, thereby allowing a more realistic estimate of the net output available for current consumption and asset accumulation.

Robert Repetto and his associates at the World Resources Institute have proposed a depreciation adjustment to take account of various forms of natural resource depletion. As they have noted,

> [T]here is a dangerous asymmetry today in the way we measure... the value of natural resources. Man-made assets... are valued as productive capital, and are written off against the value of production as they depreciate... Natural resource assets are not so valued, and their loss entails no debit charge against current income that would account for the decrease in potential future production (Repetto et al. 1989:2).

Particularly in developing nations dependent on natural resource production and exports, this exclusion of resource depletion from their national income accounts results in exaggerated numbers for both net output and also capital formation.

In a widely cited case study of Indonesia, the World Resources Institute (WRI) found that accounting for soil erosion, deforestation and petroleum extraction lowered estimates of Indonesian domestic output quite significantly from its official level. In 1984, for example, the Indonesian government reported the nation's GDP to be 13.5 trillion rupiah (deflated to 1973). After taking into account the market value of net changes in the physical stocks of forest, soil, and petroleum resources, the WRI researchers estimated that the official data ignored 2.3 trillion rupiah of natural resource depletion, a sum equal to 17.3 percent of GDP. During the period from 1971 through 1984, the annual WRI adjustment for these three forms of resource depletion averaged 9 percent of GDP (Repetto et al. 1989:6).

The methodology employed by WRI to derive these estimates has been criticized, however. Salah El Serafy (1993:14) questions the use of annual changes in the market value of proven reserves of natural resources as an adjustment to GDP: "Since the resource stocks are normally much larger than annual extraction, re-estimation of their [physical] size, as well as incorporation of changes in their value... following price fluctuations, can dwarf the adjustment specifically due to extraction."

As El Serafy points out, discovery of new physical reserves in excess of the current extraction rate results in a positive adjustment to GDP.[9] El Serafy considers the resulting measure "erratic and economically meaningless" (El Serafy, 1993: 22). From the perspective of long-run sustainability, discovery of large reserves of an exhaustible resource constitutes questionable progress if previously discovered reserves are currently being consumed at a rapid pace.

In an effort to improve the accounting reform pioneered by Repetto, El Serafy (1993, 1996) has proposed that the user cost of natural resource depletion be used to adjust GDP. User cost is that portion of the receipts from selling a nonrenewable resource, net of extraction costs, which must be reinvested in other assets in order to maintain a flow of future income after the resource stock has been completely depleted. El Serafy demonstrates that user cost as a fraction of net receipts equals $1/(1+r)^{n+1}$, where r is the interest rate for investment purposes and *n* the remaining life of the resource stock at the current extraction rate. In general, this leads to a smaller negative adjustment for resource depletion, since part of the income from sales of natural resources is considered "true" income, to be included in GDP. However, El Serafy's method also greatly reduces the positive adjustments to GDP resulting from discoveries of new resources.[10] (See Table 2 for an application of the user cost approach to the WRI data on Indonesia.)

This user cost methodology suggests that nations whose GDP growth rates depend heavily on natural resource exploitation suffer from a variety of illusions. Net product and net capital formation are overestimated.

Fiscal deficits of central governments that own natural resource enterprises are underestimated. Current account deficits in a nation's balance of payments may be masked by unsustainable sales of natural assets. These statistical distortions encourage a policy of excessive reliance on short-term natural asset depreciation, with serious consequences for future environmental sustainability.[11] Clearly, economic development policies require less narrowly focused accounting measures. This observation also raises other issues in addition to the question of natural capital depreciation -- issues which, as we will see, have not gone unremarked by development economists.

TABLE 2
ADJUSTMENTS BY EL SERAFY FOR NATURAL RESOURCE DEPLETION
Indonesia, 1971-84
Percent of Official GDP

Year	*De-Forestation*	*Soil Erosion*	*Petroleum User Cost*	*Total*
1975	-3.3	-1.1	-5.6	-10.1
1979	-9.3	-0.7	-9.8	-19.8
1971-1984 *(annual average)*	-6.8 (combined deforestation and soil erosion)		-7.8	-14.6

rcf1 Sources:
Repetti, et al. (1989;6), El Serafy (1993:24).
The years 1975 and 1979 are chosen as examples because 1975 represents the smalles total adjustment and 1979 the largest during the period 1971-84.

What Else is Important? Basic Development Indicators

In a effort to provide aggregate data relevant to less developed nations, the World Bank has issued its World Development Report annually since 1978. The intellectual and political thrust of those reports was clearly started in the inaugural issue by the Bank's president, Robert S. McNamara: "The past quarter century has been a period of unprecedented change... in the developing world. And yet despite this impressive record, some 800 million individuals continue to be trapped in... absolute poverty... The twin objectives of development, then, are to accelerate economic growth and to reduce poverty" (World Bank 1978: iii).

The premise that economic growth and poverty reduction are "inextricably linked," although not logically equivalent, led the World Bank to propose a set of basic development indicators, only one of which is gross national product (GNP) per capita.[12] Initially, the Bank's list of basic indicators included energy consumption per head and food production per capita. By the early 1980s, however, the list had evolved to a different set of six variables: a country's population, area, per capita GNP, life expectancy, adult illiteracy rate, and inflation rate.

The notions that economic development is a multidimensional process which cannot be measured by per capita income alone, and that poverty's impact is reflected in literacy and longevity statistics, are very reasonable claims. Furthermore, by publishing a diverse set of basic develop-ment indicators, the World Bank invites us to ask how people in nations with similar average incomes can face highly dissimilar life experiences. As Table 3 shows, the average citizen of India or Nicaragua is more likely to read and write and will probably live longer than his or her counterpart in Mali despite nearly identical levels of per capita GNP. Clearly, there are other dimensions to human welfare than that measured by GNP.

However, we should not overestimate the World Bank's commitment to a multidimensional view of economic development. Although the authors of the 1994 World Development Report warn us (in a technical footnote) that "GNP per capita does not, by itself, constitute or measure welfare or success in development," they also state (in the main text) that "the main criterion used to classify economies and broadly distinguish different stages of economic development is GNP per capita" (World Bank 1994:157, 230). Thus, in the World Bank view, a nation can achieve a higher "level of economic development" simply by increasing its GNP per capita. Fundamentally, then, the World Bank has not yet incorporated the various criticisms of national income accounting into its framework of analysis.[13] While other indicators are acknowledged, GNP remains the Bank's prime measure of development.

TABLE 3.
WORLD BANK INDICATORS:
SELECTED LOW-INCOME NATIONS
Early 1990s

NATION	*GNP per capita ($)**	*LIFE EXPECTANCY (in years)*	*ADULT ILLITERACY RATE (%)*
India	310	61	52
Kenya	310	59	31
Mali	310	48	68
Nicaragua	340	67	35
Nigeria	320	52	49

Source: World Bank (1994:162)
*Official exchange rate

While the World Bank, like most of the economics profession, continues to rely primarily on GNP or GDP, other analysts have taken on the task of developing alternative measures. Different approaches to modifying national income analysis have been proposed by scholars including Robert Eisner, Herman Daly, and John Cobb, as well as by national and transnational institutions including the U.S. Commerce Department's Bureau of Economic Analysis, the United Nations' Department for Economic and Social Information and Policy Analysis, and the United Nations Development Programme (UNDP). In Part II, we review four major proposals for new systems of national income accounting. Each of these four emphasizes different basic issues relating to the treatment of social and environmental factors in national income accounting. None has yet gained general acceptance; but each introduces important new perspectives on measuring national production and wellbeing.

PART TWO:
ALTERNATIVE MEASURES OF INCOME AND WELLBEING

The contributions which we have reviewed thus far clearly indicate the shortcomings of standard GNP/GDP analysis in capturing social and environmental factors and suggest various ways of modifying or supplementing standard accounts in response to these problems. They also raise the question of whether a more thoroughgoing revision of national income accounting methodology could create a better measure of production and/or wellbeing. The prospect is tantalizing -- can we arrive at a new measure which is free of the distortions, omissions, and biases inherent in standard GDP? There have been several notable efforts to construct alternative measures or accounting systems. In this section, we will review four of the most comprehensive --though very different -- proposals for GDP alternatives.

Eisner's Total Incomes System of Accounts

For two decades, Robert Eisner (1978, 1985, 1989) has championed major reform of our system of national income accounting. In his view, we need to develop "better measures of economic activity contributing to social welfare [,]... measures which capture as fully and distinctly as possible both the flow of current consumption and the accumulation of capital contributing to future welfare" (Eisner 1989:2, 7).

Eisner's total incomes system of accounts (TISA) aims to extend and revise the official national income accounts in a variety of ways. First, he questions the practice of treating government and household purchases as expenditures on final output, and business purchases on current account as intermediate outlays.[14] He argues that a large portion of government purchases (on roads, police, the military, and the courts) are intermediate in nature and should be excluded from GDP (Eisner 1989:9). Furthermore, work-related spending by households, commuting expenses for instance, are an intermediate cost of production and not a source of consumer satisfaction. Finally, TISA shifts some consumption services provided by businesses to their employees and clients from the intermediate to final output category.

Another area of accounting reform addressed by TISA is the need to acknowledge that some products make a contribution to social wellbeing and deserve to be counted as final output, but are presently excluded from GDP because they are not exchanged in the marketplace. These nonmarket outputs, many of which are produced within the household sector, include meal preparation, house cleaning and painting, care of the young and elderly, and services of household durables.[15] If one makes imputations for these various forms of production within the home, the household sector's share of GNP exceeds one third (Eisner 1989:36).

A third issue raised by TISA is the need to assign net output between current consumption and capital accumulation on a reasonable basis. At present, the national accounts assume that private businesses undertake all of society's investment activity, and that capital accumulation consists of building up business holdings of plant, equipment and inventories. This highly skewed perspective on social investment ignores all acquisitions of tangible assets by government and households, with the exception of new home purchases. It also excludes investments in intangible assets such as new technologies and literacy skills. If one attempts to measure accumulation of both tangible and intangible assets by all sectors of society, not just business investment in physical assets, one arrives at a much larger estimate of social investment. Eisner (1989:49) found, for example, that the Commerce Department's gross private domestic investment figure for 1981 included only 26 percent of his extended estimate of total gross investment in the United States for that year. Hence, claims in the business press that the U.S. invests too little in its economy should be treated with considerable skepticism. Furthermore, indiscriminate cuts in federal spending to eliminate the budget deficit could reduce public investments in transportation, education, new technologies, and the like.

Eisner's TISA proposal is a wide ranging and impressive one. It invites us to shed several misleading fictions embedded in the national income and product accounts. One is that business enterprises exist only to produce and invest on behalf of ultimate consumers. Another is that households are unproductive and exist merely to enjoy commodities purchased from the business sector. Still another is that government property is unproductive and that government purchases make no contribution to the nation's wealth.

Despite these strengths, however, the TISA framework has several limitations, especially if the goal is to trace all of the links between economic activity and social wellbeing. As Ruggles (1991:455-6) has noted, Eisner declines to include the value of leisure time in his estimate of nonmarket output. In addition, TISA ignores issues

associated with employment (both the personal satisfaction of being productive and also dissatisfaction with poor working conditions) and eschews analysis of income distribution issues. Finally, TISA does not address Repetto's concerns about depreciation of natural capital assets, including soil erosion, fossil fuel depletion, and depletion of forests and fisheries.

Integrated Economic and Environmental Satellite Accounts

During recent years both the United Nations and the U.S. Department of Commerce have launched significant revisions of their national income accounting systems. These reforms incorporate some of the earlier suggestions of scholarly critics[16] and focus on linking (1) asset accumulation and depreciation to current income accounts, and (2) economic activity to availability of natural and environmental resources. The proposed revisions do not alter the fundamental structure of standard GNP/GDP accounting. Rather, they provide additional or "satellite" accounts dealing with the impacts of economic activity on natural resources and the environment. Satellite accounts, while separate from standard GNP accounts, are sector-specific and so can readily be integrated with the standard accounts for purposes of analysis. The United Nations has produced a handbook (United Nations, 1993) providing extensive sector-by-sector guidelines for Integrated Environmental and Economic Accounting.[16] National resource and environmental accounting frameworks have also been developed to varying degrees by Norway, France, the Netherlands, and Japan.

In a critique of its own accounting practices, the Commerce Department's Bureau of Economic Analysis (BEA) points to several "points of asymmetry" between its traditional treatments of natural resources and of structures and equipment. In particular, depreciation of business fixed assets has been subtracted from GDP to estimate net domestic product (NDP), but depreciation of government fixed assets and natural resources has not. Also, additions to the stocks of plant, equipment and inventories owned by businesses count as capital formation, whereas new government buildings and equipment or additions to proven mineral reserves do not (BEA 1994:39).[18]

To remedy these problems, the BEA proposes to shift from current practices to a system of Integrated Economic and Environmental Satellite Accounts (IEESA). The proposed IEESA asset and production accounts have two prominent features: (1) treatment of natural and environmental assets as a part of the nation's wealth, and (2) disaggregation of accounting categories to highlight interactions between the economy and its natural environment. As Table 4 details, the asset account tracks opening and closing stocks of various nonfinancial assets and assigns changes in the value of those stocks to (1) depreciation, depletion, and degradation of assets, (2) domestic capital formation, and (3) market revaluations of stocks.[19] This asset account is linked to the current production account (Table 5) by data on gross investment in various forms of assets and on current rates of depreciation, depletion and degradation of those assets.

Table 4. IEESA ASSET ACCOUNT *(billions of dollars*)

		Annual Changes			
Asset Category	**Opening Stocks**	Depreciation, Depletion, & Degradation (-)	Capital Formation (+)	Revaluations (+.-)	**Closing Stocks**
Public & Private Made Assets 1. Structures & Equipment a. Pollution abatement & control b. Other 2. Inventories					
Developed Natural Assets 1. Cultivated Biological Resources 2. Proved Subsoil Assets 3. Developed Land					

5 Nonproduced Environmental Assets 1. Uncultivated Biological Resources 2. Unproved Subsoil Assets 3. Undeveloped Land 4. Air and Water					

Source: BEA (1994:41)
*Categories only are shown. data not yet available.

The IEESA asset table aims to account comprehensively for all of the (nonhuman) assets contributing to the nation's productivity and wellbeing. Made assets include all artifacts produced by human effort, without regard for who owns those assets. For example, business computers, family homes and public airports all fall into this category. Developed natural assets are gifts of nature which have been transformed to some degree by human effort. These include livestock, crop fields and known reserves of petroleum. Nonproduced environmental assets have economic significance but have not (yet) been molded by human activity. These include wildlife, old growth forests, and undiscovered mineral deposits.

Although the BEA does not yet collect data for most of the cells in Table 4, some estimates are available. At the end of 1987, for example, total made assets in the United States exceeded $12.2 trillion. Of that total, assets devoted to pollution abatement and control equalled $277 billion. In the developed natural asset category, the value of agricultural land came to $486 billion. Estimates such as these inform us about the links between the nation's wealth aand the natural context for human activity.

The IEESA production account (Table 5) calls for expanded measurements of gross and net domestic product. On the one hand, capital formation in the form of natural assets (Ic) is now included in gross domestic investment. This includes expansion of livestock herds, restoration of eroded agricultural lands and discovery of natural gas fields.

TABLE 5. IEESA PRODUCTION ACCOUNT *(billions of dollars)*

GOODS & SERVICES	INDUSTRIES			FINAL USES				TOTAL OUTPUT
	Agriculture	Mining	Other	Consumption	Gross Investment	Exports	Imports	
. Pollution Abatement & Control Assets	- - - -	- - - -	- - - -	- - - -	I_a	- - - -	- - - -	Q_a
. Other Mode Assets	- - - -	- - - -	- - - -	- - - -	I_b	- - - -	- - - -	Q_b
. Natural Assets	- - - -	- - - -	- - - -	- - - -	I_c	- - - -	- - - -	Q_c
. Waste Disposal Services	W_1	W_2	W_3	W_4	- - - -	W_5	W_6	W
. Other Nondurable Commodities	N_1	N_2	N_3	N_4	- - - -	N_5	N_6	N
FACTORS OF PRODUCTION								
. Labor Income	L_1	L_2	L_3					
. Property Income	π_1	π_2	π_3					
. Indirect Business Taxes	T_1	T_2	T_3					
. Depreciation of Fixed Made Assets	D_1	D_2	D_3					
. Depletion & Degradation of Natural Assets	Δ_1	Δ_2	Δ_3					
1 Gross Value Added	V_1	V_2	V_3					

Source: BEA (1994:47)

GDP from the perspective of final uses thus equals $(I_a + I_b + I_c) + (W_4 + N_4) + (W_5 + N_5) - (W_6 + N_6)$. Intermediate inputs used to produce this aggregate final output consist of $(W_1 + W_2 + W_3) + (N_1 + N_2 + N_3)$.

Alternatively, one can measure GDP via he value added approach. In any particular industry, intermediate inputs from other industries are used. Taking the example of agriculture, these intermediate inputs are $(W_1 + N_1)$. Capital and labor are put to work within agriculture itself, and they generate a value in addition to that of the raw materials consumed during production. For agriculture, the value added is $V_1 = (L_1 + \pi + T_1 + D_1 + \Delta)$. In contrast with the traditional BEA approach, note that IEESA value added includes depletion and degradation of natural assets.

For the economy as a whole, then, GDP equals $(V_1 + V_2 + V_3)$. Measurement of net domestic product also requires adjustment if one adopts the IEESA scheme. In addition to subtracting $(D_1 + D_{dn6\,2} + D_3)$ from GDP to arrive at NDP, one also needs to deduct $(\Delta_1 + \Delta_2 + \Delta_3)$, the depletion and degradation of natural assets.

Full implementation of the IEESA reforms would provide us with several important kinds of information not currently available. Imports of waste disposal services (W_6), for example, would measure the degree to which the U.S. economy exports its own waste disposal problems to maintain environmental quality at home. (Anecdotal evidence suggests that disposal of U.S. wastes in developing nations is occurring on a significant scale.) Assignment of the use of waste disposal services to specific industries and to consumption activities (W_1, W_2, W_3, and W_4) would provide an indicator of which sectors of the macroeconomy place the greatest stress on the natural environment.

As the BEA (1994:48) has noted, the net impact of its IEESA adjustments on net domestic product is not obvious in advance: "[T]here is an expectation that such accounts will show that U.S. economic growth as currently measured is not sustainable.... This expectation may well stem from focusing on depletion and degradation to the exclusion of additions [to resource stocks].... Because of ... offsetting changes, it is conceivable that... IEESA NDP differs little from traditional NDP."

This claim is misleading, however. Even if new petroleum reserves are discovered within the U.S., thereby reducing national dependence on energy imports for a number of decades, those newly proved reserves have not increased the physical quantity of fossil hydrocarbons underneath the country. On the contrary, that quantity decreases monotonically as domestic production and consumption of oil takes place. The IIESA accounting system is also vulnerable to El Serafy's criticism, discussed above, since it uses total economic value of reserves rather than the user cost method. While providing valuable information, the IEESA framework thus does not offer a complete basis for the analysis of long-term sustainability. Lange and Duchin (1993) have suggested that the main function of this type of accounting is national or sector-specific natural resource and environmental monitoring and policy analysis.

Unfortunately, since the publication of BEA (1994), the U.S. Commerce Department has not proceeded with refinement of the IEESA approach, mainly because of Congressional budget cuts. A review of the IEESA methodology by a study panel of the National Academy of Sciences is planned. It is to be hoped that this important initiative will soon move forward again.

Social Issues and the Human Development Index

The revised and alternative national income accounting measures discussed so far have concentrated on identifying final uses of gross output and on proper measurement of asset depreciation and depletion. Although that discussion is highly relevant to human wellbeing, we have not yet faced the question of who benefits from the use of net output. As we shall see, raising the question of who benefits immediately leads us to issues of poverty and inequity.

An eminent economist who has persistently addressed the issue of social inequality and its implications for human welfare is Amartya Sen (1981, 1992). As Sen (1993:40) has posed the issue,

> Economics is not solely concerned with income and wealth but also with using those resources as means to significant ends, including the promotion and enjoyment of long and worthwhile lives. If... the economic success of a nation is judged only by income..., as it so often is, the important goal of well-being is missed.

Mortality data, which are simple to use and readily accessible, are valuable indicators of how a nation's net output has been used. Sri Lanka, for example, promoted mass literacy early in this century. Its government expanded medical care in the 1940s and also began to distribute rice to the hungry. In 1940 the Sri Lankan death rate was 20.6 per 1,000; by 1960 it had fallen to 8.6 per 1000. Similar changes took place in the Indian state of Kerala. Despite a per capita GNP considerably lower than the Indian average, life expectancy in Kerala now exceeds 70 years (Sen 1993:45). The lesson is clear: society's level of wellbeing depends not only on the level of net income per capita but also on how that income is distributed and utilized.

Several efforts to capture this important lesson in a single numerical index have been undertaken within the past twenty years. Early social indicators included the Physical Quality of Life Index (PQLI) and the International Human Suffering Index (HSI). These can be considered as forerunners to the most intensively researched and best-known social indicator to date, the United Nations Development Programme's Human Development Index (HDI).

Published for the Overseas Development Council, the PQLI combines three basic indicators of wellbeing: infant mortality, life expectancy at age one, and basic literacy. For each indicator, a nation's performance is placed on a scale from 0 (worst possible performance) to 100 (best possible performance.)[20] A simple average of the three scaled values serves as a country's PQLI.

Does the PQLI indicate anything about a nation not already revealed by its per capita GNP? Perhaps not for the higher-income countries.[21] For low- and middle-income nations, however, there is substantial variation in PQLI scores among nations at comparable levels of per capita GNP (Morris 1979:53). For example, during the early 1970s, the PQLI of Sri Lanka, a low-income nation, exceeded the average PQLI of 32 upper middle-income countries, an outstanding accomplishment (Morris 1979: Appendix A). By studying such outliers in detail, we can discover what factors favor human wellbeing even at low income levels.

A more ambitious, but less compelling, effort to measure wellbeing is represented by the Human Suffering Index. Originally published by the Population Crisis Committee in 1987, the HSI uses a set of ten indicators to measure dimensions of social wellbeing. (See Table 6 for a list of these component indicators.) For any nation, each indicator value is scaled from 0 (most favorable) to 10 (least favorable). The ten scaled values are then simply added to obtain the country's HSI.

This deceptively simple procedure masks a host of conceptual problems. First, the ten component indicators were selected without any (reported) theoretical rationale.[22] Clean drinking water, for example, promotes good health whereas high life expectancy is a consequence of good health. Second, the political freedom and civil rights measures utilized to construct the HSI are of dubious quality. Third, the welfare significance of a country's inflation rate is far from obvious. If an unanticipated inflation redistributes real wealth from wealthy lenders to poor peasants, is that redistribution desirable or not? Finally, the scaling of some component indicators is inexplicable and arbitrary. Why does a nation with an inflation rate less than 4% per year receive a perfect score of 0 for that indicator whereas a nation with an annual inflation rate of 4.1% receives a score of 1?[23] The primary lesson that we can learn from the HSI is that moving from GDP to a richer, multidimensional measure of wellbeing requires serious conceptual groundwork.

TABLE 6. COMPONENT INDICATORS OF HUMAN SUFFERING
Life Expectancy (years)
Daily Calorie Supply Per Capita
Access to Clean Drinking Water (%)
Infant Immunization (%)
Secondary School Enrollment (%)
GNP Per Capita ($)
Inflation Rate (% per year)
Telephones Per Capita
Political Freedom (0-10)
Civil Rights (0-10)
Source: Population Crisis Committee (1972)

The Human Development Index (HDI) reflects just such a concern for conceptual foundations. Created by the United Nations Development Programme (UNDP),[24] the HDI builds upon the following premise:

> *People are the real wealth of a nation. The basic objective of development is to create an enabling environment for people to enjoy long, healthy, and creative lives... Human development is a process of enlarging people's choices... [A]t all levels of development, the three essential ones are for people to lead a long and healthy life, to acquire knowledge and to have access to resources needed for a decent standard of living (UN 1990:9-10).*

Thus, the HDI "emphasizes sufficiency rather than satiety" (UN 1994:91) and views the expansion of output and wealth as a means to promoting human development, not an end in itself (UN 1990:10). Human development, in turn, has two sides: "the formation of human capabilities - such as improved health, knowledge and skills - and the use people make of their acquired capabilities - for leisure, productive purposes or being active in cultural, social and political affairs" (ibid.).

Since income is necessary but not sufficient to achieve human development, the UNDP uses real per capita GDP, expressed in purchasing-power-parity dollars, as one component of its Human Development Index.[25] Recognizing that low incomes typically satisfy basic needs whereas high incomes are spent in part on luxuries, the UN transforms per capita GDP to take account of the declining contribution of a higher average income level to human development.[26] The formula used for this transform accords very little weight to increases in GDP above the world median per capita GDP ($5,120 in 1995). The claim implied by this specification is that continued economic growth above the basic needs level contributes little to the human development of its citizens.

If the welfare contribution of extra GDP is subject to rapidly diminishing returns, what other factors encourage "a process of enlarging people's choices"? The HDI focuses on longevity and access to education.[27] For each of the three component indicators of the HDI (transformed income, life expectancy at birth and educational access), a country is given a percentile score ranging from a fixed minimum to a fixed maximum[28] (see Table 7). The Human Development Index is then computed as a weighted average of the three percentile scores.

TABLE 7.
MAXIMUM & MINIMUM VALUE FOR COMPONENT INDICATORS OF HDI

tIndicator	*Maximum Value*	*Minimum Value*
Educational Access		
** Adult Literacy (2/3 weight)*	*100%*	*0%*
** Combined Enrollment Ratio (1/3 weight)*	*100%*	*0%*
Life Expectancy at Birth	*85 years*	*25 years*
Transformed Per Capita GDP	*$5,488*	*$200*

Source: UN(1995:134)

How useful is the HDI as a measure of wellbeing? If one's goal is to detect differences among the developed nations, it is not a discriminating tool, despite the UN (1990:2) claim that it "applies equally to less developed and highly developed countries." As Table 8 demonstrates, the HDI scores of the top ten nations scarcely differ from one another. Further inspection reveals why: All enjoy nearly universal adult literacy, and the transformation procedure for income levels essentially equalizes their adjusted per capita GDP data. Only the combined school enrollment ratios of the top ten countries differ to a significant degree. We doubt, however, that a set of nations including the U.S., Japan, Spain and Sweden is as homogeneous as the HDI scores suggest.[29]

Despite the UNDP claim of universal applicability, we believe that the HDI is best used as a measure of the welfare effects of economic development strategies in the less affluent nations of the world. The stark differences among developing nations are suggested by Table 9.

Brazil, Costa Rica and Turkey are at similar stages of economic development as measured by (unadjusted) per capita GDP. However, Costa Rica receives a substantially higher human development rating because its average citizen will live a decade longer and is far more likely to be literate. Among even poorer nations, similar differences are revealed by the HDI methodology. Sri Lanka, Congo and Pakistan have similar average incomes, but Sri Lanka clearly outranks the other two in longevity and schooling.

Of course, these HDI data provide only fragmentary evidence about the extent and sources of wellbeing within particular nations. They do, however, invite political debate on national development strategy as well as international dialogue on development assistance policy (UN 1994:101).

TABLE 8.
TOP TEN HDI SCORES, 1992

1 **Nation**	**Life Expectancy (Years)**	**Adult Literacy (%)**	**School Enrollment Ratio (%)**	**Transformed Per Capita GDP ($)**	**HDI Score**
rdrt**Canada**	77.4	99	100	5,359	0.950
USA	76.0	99	95	5,374	0.937
Japan	79.5	99	77	5,459	0.937
Netherlands	77.4	99	88	5,343	0.936
Finland	75.7	99	96	5,337	0.0934
Iceland	78.2	99	81	5,343	0.0933
Norway	76.9	99	88	5,345	0.932
France	76.9	99	86	5,347	0.930
Spain	77.6	98	86	5,307	0.930
Sweden	78.2	99	78	5,344	0.929

Source: UN (1995:155)

TABLE 9.
HDI SCORE
SELECTED DEVELOPING NATIONS, 1992

Nation	Life Expectancy (Years)	Adult Literacy (%)	School Enrollment Ratio (%)	Unadjusted Per Capita GDP ($)	HDI Score
brdrb**Costa Rica**	76.3	94.3	66	5,480	0.883
rw15 **Brazil**	66.3	81.9	70	5,240	0.804
Turkey	66.5	80.5	61	5,230	0.792
Sri Lanka	71.9	89.3	66	2,850	0.704
Congo	51.3	70.7	56	2,870	0.538
Pakistan	61.5	35.7	25	2,890	0.483

Source: UN (1995:156-157)

Furthermore, HDI-based research reveals "large disparities within developing countries - between urban and rural areas, between men and women, between rich and poor" (UN 1990:2). These social and economic disparities are concealed within national averages and can depress the wellbeing of a substantial portion of a nation's population. In UN (1992), the UNDP introduced a gender-sensitive version of the HDI. Taking account of gender differences in life expectancy, schooling, wages and labor force participation lowers the HDI ranks of the U.S. and Canada but raises the Scandinavian countries to the top of the list. The 1992 report also introduced the use of Gini coefficients to calculate income distribution-adjusted HDI scores.

The HDI has been the subject of several critical reviews (Kelley 1991, Srinivasan 1994). The critics have questioned whether HDI provides significant information beyond what is already available from separate indicators including GDP per capita. Goulet (1992) has suggested that the use of multiple indicators is essential to capture social, political, cultural, and ecological aspects of development.

Clearly, some important information is lost in the construction of the index. Income above basic needs levels counts for very little; specific health and nutrition data are not reflected except insofar as they affect life expectancy. Issues of political freedom and human rights are not included. Gender issues were not dealt with until 1995, when the Human Development Report offered a Gender-Related Development Index similar to HDI but adjusted for the disparities between men and women.

Despite these shortcomings, we believe that the perspectives on development revealed by the HDI, together with others offered by the ongoing series of Human Development Reports, constitute a useful contribution to the measurement of wellbeing and the identification of its sources. The HDI has stimulated, and will continue to stimulate, a welcome reorientation in development theory away from a narrow focus on GDP growth.

"Green National Product":

The Index of Sustainable Economic Welfare

Our survey of alternatives to GDP has touched uupon a diverse set of issues so far. Various authors have aadvocated taking account of intermediate and defensive costs of production, accumulation and depreciation of both natural and also government capital, and social issues such as poverty and discrimination. Only recently, however, have we witnessed an effort to integrate all of these issues into a single accounting scheme and to measure the welfare effects of macroeconomic activity and social inequality in a comprehensive manner. That ambitious project has been led by Herman Daly and John Cobb (Daly & Cobb 1989, 1994).

This effort involves an interesting partnership between an economist (Daly) and a theologian (Cobb), both of whom care deeply about environmental sustainability and social justice. They acknowledge their intellectual debt to the pioneering work of Nordhaus and Tobin, who first calculated a Measure of Economic Welfare in 1972, taking account of such factors as unpaid household labor and "urban disamenities". Daly and Cobb have named their proposed substitute for GDP the Index of Sustainable Economic Welfare (ISEW). The ISEW was first calculated in 1989 for the United States over the period 1950-1986 (Daly and Cobb 1989). It has since been updated to 1990, and revised by Clifford and John Cobb in response to an extensive collection of critical responses (Cobb & Cobb, 1994).

Daly and Cobb begin the difficult task of constructing an aggregate welfare measure by arguing that it is the current flow of services to humanity from all sources, not the current output of marketable commodities, which is relevant to economic welfare. Hence, Daly and Cobb start with the U.S. Bureau of Economic Analysis' personal consumption expenditure and then perform a lengthy series of adjustments to officially measured consumption in order to estimate the sustainable flow of useful services. (See Table 10.)

The first adjustment, one for income distribution, recognizes "that an additional thousand dollars in income adds more to the welfare of a poor family than it does to a rich family" (Daly and Cobb 1994:445). This is generally consistent with the principle of diminishing marginal utility of income, but differs sharply from the neoclassical practice of accepting unadjusted dollar incomes as proxies for utility or wellbeing.[31] Thus, the greater the degree of income inequality, the lower the flow of economic welfare associated with a particular aggregate flow of consumption services.[32]

After adjusting BEA consumption expenditure for income inequality, Daly and Cobb take account of four service flows currently omitted from that official consumption measure: those derived from household labor, from the existing consumer durable stock, from public streets and highways, and from public spending on health and education. The authors admit, and rightly so, that their imputation for household labor is too low since each hour is valued at the wage rate of paid domestic workers (and hence no value is placed on managerial functions within the home). In our opinion, Daly and Cobb (1994:467) also underestimate the services of government programs since they claim that "government expenditures... are largely defensive in nature... [and do] not so much add to net welfare as prevent the deterioration of well-being by maintaining security, environmental health, and the capacity to continue commerce."

This claim that government programs are largely defensive even extends to public (and, for that matter, private) education. Despite decades of scholarly research on the economics of education, the authors contend that schooling mainly serves to ration job vacancies by making
credentials scarce and hence qualifies as neither consumption nor capital formation. Not surprisingly, Eisner (1994:99) has identified "the almost complete exclusion of human capital" as the most serious defect of the ISEW accounting framework.

Daly and Cobb continue their journey from personal consumption expenditure to sustainable economic welfare by deducting current spending on consumer durables. Since it is the entire stock of consumer durables that provides services, not newly purchased durables, this is an appropriate adjustment. (As Table 10 shows, however, imputed services of the consumer durable stock and spending on new household durables roughly cancel one one another). The authors also try to account for personal spending of a defensive or intermediate, not welfare-producing, nature by deducting household costs of commuting, auto accidents and pollution control. Personal expenditures on education and medical care are also assumed to be in large measure defensive and not a net contributor to human wellbeing.

Table 10. INDEX OF SUSTAINABLE ECONOMIC WELFARE U.S., 1990 (1972 $, billions)	
f1 BEA personal consumption	$1.266
Personal consumption adjusted for income distribution	1,164
+ services for household labor	+ 520
+ services of consumer durables	+ 225
+ services of highways and streets	+18
+ consumption portion of public spending on health and education	+45
8 - spending on consumer durables	-235
- defensive private spending on health and education	-63
- cost of commuting and auto accidents	-67
- cost of personal pollution control	-5
- cost of air, water, and noise pollution	-39
- loss of wetlands and farmland	-58
- depletion of renewable resources	-313
- long-term damage from nuclear wastes, greenhouse gasses, and ozon depletion	-371
+ net capital growth	+29
+/- change in net international investment position	-34
Index of Sustainable Economic Welfare	$818
Source: Daly & Cobb (1994: Table A.1). Note: Total differs from sum of items due to rounding.	

Still another deduction from personal consumption is an estimate of the current cost of air, water and noise pollution. For 1990, this amount equalled $39 billion (in 1972 dollars), a surprisingly low figure. Daly and Cobb (1994:471-7) mention several reasons for believing that their estimate of current pollution damages is too low. One is that their water pollution estimate includes the effects of siltation and point discharges into waterways but not the impact of nonpoint emissions. Another is that their estimate of air pollution cost includes damages to crops, forests and durable equipment but excludes human health effects.[32]

The depletion of natural assets is another set of concerns addressed by Daly and Cobb. Following the example of Repetto et al. (1989), they estimate and then deduct the annual loss of productive services associated with the past and present conversion of wetlands and farmland to urban uses. A marsh area converted to airport

runway, for example, no longer provides present and future benefits of flood protection, groundwater purification and storage, wildlife preservation and scenic vistas. The loss of high-quality farmland to suburban development or soil erosion requires that crops be grown on less fertile fields with heavier doses of chemical fertilizers. Because Daly and Cobb assume that land development is irreversible, that substitutes for the services of wetlands and farmland are not readily available, and that the marginal annual loss of benefits rises with cumulative land conversion, their accounting methodology ensures escalating aggregate costs of land development as time unfolds.[33]

Extraction of nonrenewable energy in the forms of oil, coal, natural gas and nuclear fuel is another category of natural capital depletion incorporated in ISEW. As Daly and Cobb (1994:482) correctly observe, "depletion of nonrenewable resources... [is] a cost borne by future generations that should be subtracted from (debited to) the capital account of the present generation."

But what economic value should be placed on this debit entry in society's ledger? Although the architects of ISEW express qualified appreciation for the user-cost approach of El Serafy (1993), they opt instead for valuing the annual depletion of nonrenewable energy reserves at the hypothetical marginal cost of a renewable substitute, ethanol.[34] Because they assume that the real marginal cost of producing ethanol rises three percent annually, their estimate of the aggregate value of energy depletion escalates rapidly even if the physical flow of nonrenewable energy extraction stagnates. (See Table 11 for their U.S. estimate.)

TABLE 11
IISEW ESTIMATE OF
U.S. NONRENEWABLE ENERGY DEPLETION

Year	Actual U.S. Nonrenewable Energy Output (billions of barrels)	Assumed Marginal Cost of Ethanol ($/barrel)	Estimated Nonrenewable Energy Depletion (billions $)
1950	5.6	$ 8.3	$ 46.8
1970	10.2	$ 15.3	$ 157.8
1990	11.1	$ 28.1	$ 312.6

Note: The BTU content of coal, ethanol, natural gas, and nuclear fuel has been converted to an equivalent number of barrels of petroleum.

Source: Daly and Cobb (1994: 501)

Having deducted various forms of natural capital ddepletion from society's current flow of consumption sservices, Daly and Cobb (1994: 487-91) next try to account for the environmental damages imposed on future generations because of past economic activity. In particular, the ISEW methodology acknowledges that fossil fuel combus-tion, nuclear energy production, and chlorofluorocarbon (CFC) use result in the accumulation of stocks of persistent pollutants within the global environment. These stocks include atmospheric methane and carbon dioxide, stratospheric chlorine, and spent nuclear fuel.

Although Daly and Cobb are correct that transferring expanding stocks of hazardous materials to future generations is inconsistent with sustainable development, their method for estimating these long-term environmental damages is incomplete at best. In the case of greenhouse gases and nuclear wastes, they assume that the long-term environmental damages resulting from nonrenew-able energy use and suffered by U.S. citizens are propor-tional to the cumulative consumption of fossil fuels and nuclear power within the U.S. since 1900.[35]

This methodology has several serious flaws. First, it assumes that there is a fixed proportion between current nonrenewable energy use and current emissions of persistent pollutants even if the mixture of nonrenewable fuels evolves over time.[36] Second, it assumes that energy-related pollu-tants persist indefinitely once emitted into the environment. This premise ignores the finite, though lengthy, half lives of many environmental pollutants. Finally, since greenhouse gases circulate throughout the atmosphere regardless of their country of origin, the long-term damages from fossil fuel consumption suffered by U.S. citizens depend upon past trends in global energy consumption, not just those in the United States.

When they account for the long-term damages to stratospheric ozone resulting from CFC production and use, Daly and Cobb employ a somewhat different methodology: ISEW assigns an environmental cost of $5 per year to each kilogram of cumulative world production of CFC-11 and CFC-12. The use of global output is entirely appropriate since the welfare loss from ozone depletion suffered by U.S. residents is indifferent to the country of origin of CFC molecules. As with fossil fuels and nuclear energy, however, ISEW ignores the eventual depreciation of a persistent pollutant, in this case the stratospheric chlorine associated with CFC use. Furthermore, the ISEW estimate ignores the lengthy time lags from CFC production to CFC discharge into the troposphere to CFC arrival in the stratosphere. These lags are important determinants of the time pattern of damages associated with CFC production.

We mention these criticisms not in an effort to discredit the ISEW methodology but rather in order to alert the reader to a crucial point. Daly and Cobb have transformed BEA consumption into ISEW via a sequence of twenty specific adjustments. In the end, however, most of those adjustments are too small to explain the growing divergence between per capita GNP and per capita ISEW which seems to have occurred since 1970. (See Cobb and Cobb, 1994, Figure C).

As Table 12 shows, personal consumption expenditure in the U.S. grew by $928 billion between 1950 and 1990. During that same period, ISEW grew by only $438 billion. Hence, the total adjustments to BEA consumption shifted in a negative direction by $490 billion between 1950 and 1990, thereby ensuring divergent time paths for the measures of official consumption and sustainable welfare. Over 58 percent of that change in total adjustments to personal consumption -- more than $285 billion -- is accounted for by the estimated long-term damages from nonrenewable energy and CFC use. For various reasons already noted, however, the ISEW estimates oof those damages are highly speculative and very ppreliminary. Hence, the growing gap between GNP and ISEW could be an artifact of the ISEW methodology and not an accurate measure of empirical trends.[37]

Daly and Cobb complete their computation of ISEW by taking account of changes in the domestic and international capital position of the U.S. economy. They argue, quite properly, that the current level of economic well-being can be sustained only if growth in the domestic capital stock matches population growth, thereby equipping workers with the same amount of capital per head in the future as in the past. Their measure of net capital growth is far too narrow, however, since it focuses on business investments in tangible plant and equipment and ignores social investments in human skills, scientific knowledge, and ecological restoration. Their final adjustment, for changes in the net international investment position of a nation's economy, is a compelling one. No country, not even the United States, can indefinitely sustain a particular level of domestic economic welfare by selling its physical assets to foreigners and by accumulating financial liabilities abroad.

Table 12.
COMPONENTS OF THE GAP BETWEEN
OFFICIAL CONSUMPITON & ISEW
(billions of 1972 $)

YEAR	1950	1990	Change 1950-1990
BEA Consumption (1)	337.3	1265.6	+928.3
Total Adjustments to Consumption (2)	+42.9	-447.4	-490.3
ISEW (1) + (2)	380.2	818.2	+438.0
Long-term Environmental Damages	-85.1	-370.6	-285.5
Source: Daly and Cobb (1994:501)			

In sum, Daly and Cobb have successfully synthesized many of the criticisms of national income accounting within a single welfare-oriented framework. The revised version of the ISEW presented by Cobb and Cobb also takes into account criticisms raised by a number of highly qualified commentators (Cobb and Cobb, 1994). As the authors readily admit, however, many of their numerical estimates are still preliminary and based upon highly speculative assumptions. Hence, ISEW should be seen as a springboard for future research on national accounting and not as a completed framework filled with accurate data.

Conclusion

By this point it should be clear that the quest for an alternative -- or alternatives -- to GNP/GDP is far from over. None of the efforts we have cited has managed to solve all of the conceptual and data-gathering problems.

It is of great importance that understanding of human wellbeing, and of the components that go into it, should continue to improve; for this, continued work on a variety of indicators is critical. Among the large, public efforts that have been described here, we feel that continued support is especially merited for the satellite accounts being developed by the United Nations, by the U.S. Department of Commerce, as well as by Norway, France, the Netherlands and Japan. The Human Development Index of the UN Development Programme is the leading international social indicator, and should be widely used and further developed. Among private efforts, we have paid the most attention to the ambitious scope and careful, though unfinished, work of ISEW. It continues to be refined through the work of the organizations Redefining Progress and the Human Economy Center.

This survey has shown the necessity to reject the temptation, often unconscious, to use gross national or domestic product as a measure of social wellbeing and overall economic progress. We have seen that GNP/GDP as an accounting device is vulnerable to a number of criticisms. These may seem technical to those not immersed in the arcana of accounting, but the human meaning of the technical issues is that faulty policy may result from misuse of these tools. As Simon Kuznets emphasized in the early days of GNP accounting, the technical issues reflect value judgements, and these value judgements will in turn be reflected in policy formulation.

While noting several efforts that are eminently worthy of public and private support, we caution that it may not only be the indicators that must change: the users must also adjust to some new ideas. Perhaps chief among these is the idea that there is no single indicator that will do all that we want. One indicator may be most appropriate for one purpose, and a different one for a different purpose. The most important use of all is the attempt to answer the frequently posed questions: "How are we doing? Are things getting better or worse? How can we judge the success of our major policies?" For this purpose -- the broad `assessment of human welfare -- we may need to accustom ourselves to the idea of using several different indices.

This suggests an important role for education, in helping policy makers as well as the public to achieve more tolerance for complexity -- for the realization that important issues cannot generally be well represented in a single, simple bottom line. We conclude this essay then, with a challenge to us all: to continue developing, and supporting the development of, better indicators; and to temper our hopes and wishes, so as to see in any indicator only what it can show, and not what it can not show.

Endnotes

[1] The difference between GNP and GDP is whether or not the foreign earning of individuals and corporations are included in the total. U.S. GNP, for example, includes the foreign earning of U.S. residents and corporations but excludes the earnings of foreign individuals and corporations from activities in the U.S. U.S. GDP includes all income earned within the U.S., regardless of the nationality or residence of the recipient, but excludes earnings of U.S. residents and corporations from foreign sources.

[2] Juster (1973:26), for example, observes that "[E]conomists generally have no desire to turn the accounts into some sort of happiness index... [There] may well be more important considerations than mere material goods and services, but they are not within the purview of the economist or the social accountant."

[3] In a similar vein, see Maddison (1991:5-8).

[4] For earlier discussions of this set of issues, see Kuznets (1941) and Juster (1973).

[5] He did, however, weaken this criterion by including foodstuffs consumed on the farm and services of owner-occupied housing (Kuznets 1941:9).

[6] Kuznets mentioned, as other sources of satisfaction excluded from GDP, services produced within the household which could have been purchased in the marketplace (clothes washing, shaving, etc.), but one might also add conversations with one's friends and viewing a beautiful sunset .

[7] His reluctance seems rooted in a commitment to some combination of humanist philosophy and neoclassical economics: " [Widening] the scope of intermediate consumption... reduces the net national product... to that exceedingly minor magnitude that may be considered as not involved in the replacement of all goods, human capacity included, consumed in the process of economic production. No purely analytical or empirical consideration can invalidate this extension... [However, we] do not look upon human beings... as units for the production of other goods; consequently, we do not view the raising and education of the younger generation or the sustenance of the working population as intermediate consumption destined to produce or sustain so many [human] machines... It is this idea of economic goods existing for men, rather than men for economic goods, that gives point to the concept of ultimate consumption..." (Kuznets 1941:37-8).

[8] Repetto et al. (1989:17) point out, however, that the "notion of `defensive' expenditures is elusive, since spending on food can be considered a defence against hunger, clothing a defence against cold, and religion a defence against sin."

[9] In the WRI study of Indonesia, domestic output adjusted for resource depletion exceeded official GDP in 1974 by 35.7 percent because of significant discoveries of new oil reserves (Repetto et al. 1989:4, 39).

[10] In the user cost method, the discovery of new reserves is not directly included in GDP, but will somewhat reduce the user cost deduction because it extends the expected lifetime n of the reserve and thus reduces the fraction $1/(1+r)^{n+1}$.

[11] El Serafy (1993) discusses these and other policy distortions resulting from use of the standard GDP measure.

[12] A similar set of indicators can be found in the World Bank's SOCIAL INDICATORS OF DEVELOPMENT annuals.

[13] To be fair to the World Bank staff, we need to point out that they are fully aware of these criticisms. See, for example, World Bank (1994:230-234).

[14] The official accounting scheme does count business purchases to accumulate inventories as spending on final output (inventory investment).

[15] The U.S. Commerce Department accounts do include an imputation for the market value of services produced by owner-occupied housing units. Otherwise, the household sector is assumed to consume, not produce, final goods and services.

[16] In particular, the approach taken by the U.N. and the U.S. Commerce Department's Bureau of Economic Analysis have much in common with the proposals by Henry Peskin (1981, 1991) for a sector-specific valuation of environmental services and environmental damages. Peskin notes this similarity in a recent paper (1996), but also notes that his approach is driven more by economic theory, while the UN/BEA approaches are driven more by a need for consistency with existing GNP/GDP accounts.

[17] For a brief description of the UN accounting reforms, see Bartelmus (1992). This System of Environmental and Economic Accounting, SEEA for short, is discussed in detail in UN (1993).

[18] Interestingly, in the early days of U.S. national income accounting, "depletion [of natural resources] was treated symmetrically with depreciation [of plant and equipment], but no entry was made for additions to the stock of mineral
resources parallel to the treatment of investments in
structures and equipment. As a result of dissatisfaction with this asymmetric treatment, the entry for depletion was removed... in 1947" (BEA 1994:36).

[19] The two exceptions are business inventories, which are assumed to not depreciate, and environmental stocks of air and water. In the latter case, it is hard to imagine how one would estimate the total value of the world's atmosphere and waters so the BEA proposes measuring only the monetary value of changes in air and water quality (BEA 1994:46).

[20] The literacy scale ranges from 0 to 100% of the population 15 years and older who are literate. The infant mortality scale ranges from 229 deaths (0%) to 7 deaths (100%) per 1000 live births. The life expectancy scale extends from 38 years (0%) to 77 years (100%). These ranges were chosen to allow improved future performance even by those countries with the best current score for each indicator (Morris 1979:41-44).

[21] Excluding oil-exporting nations, the correlation between PQLI score and per capita GNP is very high for affluent nations.

[22] The Population Crisis Committee (1992) reports that unemployment, external debt, child labor, extent of urban slums and other indicators were also considered, but the criterion used to pick the indicators in Table 7 is unclear.

[23] One might also question the use of telephones per capita to measure access to "communications technology." In some nations, the postal service provides phone access to its customers. Hence, personal phone ownership is not essential in those countries.

[24] A panel of outside consultants including Gustav Ranis, A.K. Sen, Keith Griffin, Meghnad Desai and Paul Streeten assisted the UNDP (UN 1990:iv).

[25] Purchasing Power Parity Dollars compare incomes across countries in terms of ability to purchase goods, rather than by using currency exchange rates. This avoids the distortion introduced by unrealistic or volatile exchange rates.

[26] In the original 1990 UN report, the transformed income figure was the log of real per capita GDP levels up to $4,861 (the average official poverty line for 9 industrial nations). Above $4,861, it was assumed that extra per capita real GDP yielded no additional human development. This stringent assumption was relaxed in later reports, probably in reaction to criticism. For a survey of criticisms of the original HDI specification, see UN (1991:88-91).

[27] The original HDI used adult literacy to measure educational access (UN 1990). From 1991-1994, the UNDP reports used a weighted average of adult literacy and mean years of schooling. Since 1995, the combined enrollment ratio for primary, secondary and tertiary education has replaced mean years of schooling (UN 1995).

[28] Until its 1994 report, the UNDP used the actual maximum and minimum values for each indicator within the sample of nations surveyed during a year. That practice led to a "moving goalpost" problem. Revised scores are now available for 1960-1992 using "fixed goalposts" in UN (1994: 105). The maximum real GDP per capita is now set at $40,000, corresponding to a transformed income of $5,448 for 1995.

[29] One fact revealed by the HDI methodology is the poor life expectancy of the average U.S. citizen compared to the average Canadian, Japanese, or European. That difference reflects, in large measure, the poor life prospects of Afro-Americans (Sen 1993:44-45). Thus, despite having a higher unadjusted average income, the U.S. ranks below Canada in HDI score.

[30] In one of the critical responses collected by Clifford and John Cobb in their volume on THE GREEN NATIONAL PRODUCT, Eisner (1994:100) does not object to Daly and Cobb's declining-marginal-utility-of-income assumption

but argues that their adjustment for income inequality should take place after all other adjustments to BEA consumption have occurred. In the second edition of FOR THE COMMON GOOD, Daly and Cobb note, but fail to pursue, the self-criticism that "our calculus of economic well-being has failed to take in account... that happiness is apparently correlated with relative rather than absolute levels of wealth or onsumption" (Daly and Cobb 1994: 460). Recall the arguments of Duesenberry (1949).

[31] The authors considered several indexes of distributional inequality (harmonic mean of quintiles, Gini coefficient, etc.) but chose an index based on the share of income accruing to the lowest quintile of households. This approach, they argue, "gives special weight to the plight of the poorest members of society, which fits well with the theory of justice propounded by John Rawls" (Daly and Cobb 1994:465).

[32] The authors also acknowledge that their time-series estimates of annual changes in pollution costs are highly unreliable.

[33] An alternative approach to the valuation of environmental losses has been suggested by Roefie Hueting (1991). He suggests the establishment of a standard for environmental sustainability (e.g. maintenance of soil fertility). An estimate of the costs of meeting this standard (e.g. through soil conservation measures) would then be the figure used to correct national income to account for unsustainable use of natural resources.

[34] This is consistent with Hueting (1991), who also suggests using the costs of an alternative, renewable technology to evaluate the depreciation of nonrenewable resources.

[35] The factor of proportionality assumed is $0.50 of future annual damages per barrel-equivalent of nonrenewable energy consumption, in 1972 real dollars.

[36] During the 20th century, petroleum and natural gas have substituted for coal in many nations. Since coal is a dirtier fuel, that substitution has lowered the emissions propensity of nonrenewable energy use.

[37] Manfred Max-Neef (1995) presents data suggesting declining sustainable welfare in several industrial countries, using an ISEW index for the United Kingdom, Germany, Austria, and the Netherlands. However, this hypothesis may simply reflect repeated application of the same imperfect methodology, not empirical evidence that economic growth lowers the quality of life.

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