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SEEA Revision: Accounting for Sustainability?

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Summary: The 1993 United Nations System for integrated Environmental and Economic Accounting (SEEA) aimed at measuring the – environmental – sustainability of economic performance and growth in terms of produced and natural capital maintenance. To this end it advanced 'greened' economic indicators, notably Environmentally-adjusted net Domestic Product (EDP) and Capital Formation (ECF). A revised (draft) version of the 1993 handbook, entitled 'Integrated Environmental and Economic Accounting 2003' (IEEA), is now available on the web site of the United Nations Statistics Division. Despite its extensive discussion of sustainable development, the IEEA 2003 fails in measuring overall sustainability as it shuns monetary valuation of environmental impacts in a modular framework for physical, hybrid and – selective – monetary accounts. The revision thus missed an opportunity to bridge the persisting dichotomy between ecological and economic sustainability analysis. Future work should explore and test the capability of material flow and environmentally adjusted economic indicators to capture the elusive notions of strong and weak sustainability of economic activity.

Zusammenfassung: Das United Nations System for integrated Environmental and Economic Accounting (SEEA) aus dem Jahre 1993 hatte die Messung von Nachhaltigkeit der Wirtschaftsaktivität und des Wirtschaftswachstums zum Ziel. Modifizierte Wirtschaftsindikatoren wie das Ökoinlandsprodukt und die Ökoinvestition erfassten, zusätzlich zum produzierten Realkapitalverbrauch, auch den des Naturkapitals und bildeten somit das ökonomische Nachhaltigkeitskonzept der Kapitalerhaltung ab. Eine revidierte Fassung des SEEA, 'Integrated Environmental and Economic Accounting 2003' (IEEA), wurde nunmehr vom Statistischen Amt der Vereinten Nationen auf seiner Website vorgestellt. Trotz extensiver Diskussion von nachhaltiger Entwicklung verfehlt das neue Handbuch sein Ziel der Nachhaltigkeitsmessung. Der Grund ist die Ablehnung monetärer Bewertung von Umwelteffekten in einem modularen Rahmenwerk für physische, hybride und – ausgewählte – monetäre Konten. Eine Gelegenheit, die hartnäckige Dichotomie zwischen ökologischer und ökonomischer Nachhaltigkeitsanalyse zu überbrücken, wurde damit versäumt. Künftige Arbeiten sollten u.a. untersuchen, inwieweit Stoffstromaggregate und monetäre Ökoindikatoren starke und schwache Nachhaltigkeit erfassen können.

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SEEA Revision: Accounting for Sustainability?
– A Critique[•] –

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[•] The United Nations (1993) System for integrated Environmental and Economic Accounting (SEEA) has been revised by the London Group of National Accountants and was issued in 2003 by the United Nations (in prep.) as a draft, entitled 'Integrated Environmental and Economic Accounting 2003' (IEEA), on the web: http://unstats.un.org/unsd/envAccounting/seea.htm. I presented this paper, with the generous support of the European Environment Agency, at the Eighth Biennial Scientific Conference of the International Society for Ecological Economics (Montréal, 11-14 July 2004). I gave much of this critique in different publications during the revision process – hence the unusual amount of self-citation.

Acronyms

ECF	Environmentally-adjusted net Capital Formation
EDP	Environmentally-adjusted net Domestic Product
Eurostat	Statistical Office of the European Union
EVA	Environmentally-adjusted net Value Added
FDES	Framework for the Development of Environment Statistics
GDP	Gross Domestic Product
IEEA	Integrated Environmental and Economic Accounting (2003)
IMF	International Monetary Fund
MFA	Material Flow Accounts
NDP	Net Domestic Product
OECD	Organisation for Economic Co-operation and Development
SEEA	System for integrated Environmental and Economic Accounting (1993, 2000)
SNA	System of National Accounts (1993)
UN/CSD	United Nations Commission on Sustainable Development
UNEP	United Nations Environment Programme

1. Institutional background[1]

US national *income* accounting set the tone for first attempts at incorporating environmental and social concerns into the national accounts. The purpose was to modify national income and product, considered to be imperfect measures of national welfare. For example, a measure of economic welfare (Nordhaus and Tobin 1972), extended accounts for national income and product (Eisner 1988) and an index of sustainable economic welfare (Daly and Cobb 1989) deducted 'defensive' (welfare maintaining) expenditures from and added or subtracted environmental and social 'externalities' to/from the conventional indicators.

National statistical offices dismissed these studies as "more appropriate for research than statistical compilation" (United Nations 1977, p. iii). It is the merit of the United Nations Environment Programme (UNEP) and the World Bank to revive these approaches in a number of workshops on environmental accounting. One result were calls for incorporating environmental accounts in the ongoing revision of the international standard System of National Accounts, the SNA (United Nations et al. 1993) – at least as a 'satellite' account (Ahmad, El Serafy and Lutz 1989).

A group of workshop participants responded and proposed a System for integrated Environmental and Economic Accounting (SEEA) derived from the SNA (Bartelmus, Stahmer and van Tongeren 1991). Their draft of an SEEA handbook was submitted to the Rio Earth Summit in 1992 as a means of operationalizing the elusive concept of sustainable development. In response, the Rio Summit's Agenda 21 requested that "integrated environmental and economic accounting… be established in all member States at the earliest date" (United Nations 1994, para. 8.42). One year after Rio, the United Nations issued the SEEA handbook as an 'interim version' (United Nations 1993). Using experience gained in pilot studies, the United Nations later published an *Operational Manual* for 'step-by-step' implementation (United Nations 2000).

Some representatives of national statistical offices considered these relatively fast developments as a 'coup' of the United Nations – skirting the full discussion and approval by industrialized nations. Their reaction was not long in coming. In March 1994 the statistical offices of the European Union (Eurostat) and the United Kingdom convened a first meeting of national accountants on the SEEA in London, later to be known as the 'London Group'. Further sessions of the Group elaborated concepts, definitions and classifications of the SEEA without initially discussing the basic systemic approach.

The Statistical Commission of the United Nations changed this situation when it made the revision of the SEEA a condition for the survival of the London Group. Getting the Group into the limelight of an international revision programme (the World Bank, IMF, OECD and other countries and organizations joined the Group) brought out the natural reluctance of official statisticians to embark on 'analytical', and hence controversial, issues such as the pricing of priceless environmental services. As a result, the original systemic SNA-based approach was abandoned for a more modular accounting framework. The revision also brought out a dichotomy between those favouring the physical measurement of environmental pressure and others advocating the costing of environmental impacts.

Possibly deterred by the sometimes-heated discussion of these issues, or perhaps just because of a lack of communication between accountants and data users, the second Earth

[1] See Bartelmus and Seifert (2003, Introduction) for a concise review of the history and methods of 'green accounting'.

Summit in Johannesburg did not take up environmental accounting. Rather, it called on countries to promote further work on indicators for sustainable development (United Nations 2003, paras 130, 131).[2]

2. From system to framework

Both, the SEEA 1993 and its revised version, the IEEA 2003,[3] proclaim the measurement of environment-economy interaction for the sake of sustainable development as their basic goal. Clearly, the assessment of a development paradigm, which integrates socio-economic performance with environmental concerns, requires the integration and aggregation of social, environmental and economic data. However, the old and new versions tackle the integration problem quite differently.

The SEEA does not dwell on the questions of aggregation and integration as it seeks to maintain the conventions of the national accounts as far as possible. It focuses on environmental sustainability and hence on the comparability of the standard economic indicators with environmentally adjusted ones. The SEEA's operational manual reinforces this approach: the step-by-step implementation process leads directly from the SNA's stock and flow accounts to those of the SEEA by extending the economic asset boundary to include non-produced environmental assets. The Annex illustrates this extension and the resulting costing of non-sustainable asset use as capital consumption; it also shows the corresponding adjustment of the main accounting indicators.[4]

The IEEA does not totally abandon this approach, but deals with it in a round-about way that makes a good (though probably unintended) reason for dropping the 'S' in its title. The reason is that national accountants have generally been reluctant to use the common numéraire of money to assess environmental impacts and to compare their significance with the results of economic activity. The result is a modular presentation of approaches rather than full integration of environmental and economic concerns in one accounting system. In particular, the IEEA

- rejects monetary valuation of environmental degradation as "modeling" (see section 3.2): the presentation of a "SEEAland" data set (pp. 66-67) does show an integrative picture of environmental and economic costs and benefits/income. However, in contradiction to this presentation, monetary valuation is discouraged throughout the handbook, except for natural resources that are traded in markets and are indeed part of the SNA balance sheets

- shows a corresponding preference for physical environmental accounts and indicators: the use of different units of measurement thwarts aggregation of different environmental

[2] Admittedly the London Group revised the SEEA "quite separately" from the "upsurge of interest" in indicators of sustainable development (United Nations et al., in prep., para. 11.180). Including the user community at the outset might have prevented some of the ambivalence and confusion about sustainability concepts and their assessment discussed here.

[3] Despite its title, the new handbook continues to use the term 'SEEA'. This paper distinguishes the original SEEA (United Nations 1993 and 2000) from its draft, revised version (United Nations et al., in prep.) by using 'IEEA' for the latter. References to IEEA paragraphs are given as numbers in parentheses.

[4] See for an elaboration of this approach Bartelmus (2001).

(depletion and degradation) impacts and the comparison of these impacts among themselves and with economic indicators

- presents four principal accounting categories or modules (2.13), including
    1. physical accounts (in different units of measurement)
    2. environmental transaction accounts that are covered anyhow in the SNA, but are shown separately and in greater detail (in monetary units)
    3. environmental asset accounts for natural resources (in physical and monetary units)
    4. adjustment (of economic indicators) accounts for depletion, degradation and defensive expenditures (in monetary units).

The IEEA is thus more of a *framework* for economic and environmental accounting and its underlying database. It opts for integration only where 'economic' (market-bound) natural resources eventually obtain a market price. However, the general rejection of monetary valuation of environmental degradation permits only the 'linkage' of environmental and economic statistics. Such linkage is an important step towards integrative national accounting but not quite accounting itself. This is not to deny the significant progress made in defining and classifying physical data and material flows and relating them to economic transactions. Still, overloading an originally aggregative accounting scheme with detailed environmental statistics on discharges of pollutants and waste, land use and environmental quality (much of which should be explored within ecosystem boundaries) impairs the evaluation of a nation's economic performance and its long-term sustainability.

The organization and coordination of basic statistics are probably better dealt with in existing frameworks of environmental statistics and indicators. These frameworks aim indeed at linkage rather than integration of data. The United Nations (1984) Framework for the Development of Environment Statistics (FDES) classifies environmental and economic data in categories of economic activity, environmental impacts, welfare effects and social responses to these impacts and effects. The IEEA ignores the FDES and its methodological handbooks (United Nations 1988, 1991) and refers to the UN/CSD Framework for indicators of sustainable development[5] only as an afterthought (at the very end of the handbook: 11.180,181). Listing IEEA information as a "source of data" for this indicator framework is not convincing: there is no reason why loose indicator listings should not make direct use of environmental statistics, such as those of the FDES, rather than resorting to secondary data from complex accounting systems.[6]

[5] www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm

[6] There is indeed a lingering tension between accountants and statisticians, both claiming responsibility for presenting environmental and economic data; the IEEA's call for establishing "a spirit of collaboration and respect between environmental accountants and statisticians" (1.108) is revealing.

3. Accounting for sustainable economic growth and development

3.1. Growth vs. development

One of the most disconcerting aspects of the IEEA is the failure to clearly specify its objective of assessing the sustainability of economic performance and growth versus development. Right at the outset, the IEEA sows thus confusion about its scope and coverage.

After stressing the need for addressing all three pillars of development to ensure its sustainability (1.11), the IEEA reduces the very same concept into an "ecological" and "capital approach" to sustainable development. A reference to "human development" seems to bring back human and social (besides natural) capital, but then relates these (non-financial) capital categories to Hicksian income defined as returns from financial and non-financial wealth (see section 3.3).

Both the ecological approach (measuring pressure of economic activity on ecosystems) and the capital approach focus, however, on economic activity and, in the long-term, economic growth. How in fact could (and should) accounts based on the standard economic accounting system focus on anything but economic performance and growth? Characterizing these approaches as dealing with 'development' looks therefore like an attempt to deflect environmentalist critique that considers sustainability of economic growth as anathema (e.g. Daly 1996, p. 167). The final evaluation of the IEEA as "at least a partial framework for measuring sustainable development from all three [economic, ecological and social] of the broad approaches" (1.34) does not convince, considering also that partiality cannot do justice to the integrative and aggregate concepts of economic growth and development.

3.2. Economic vs. ecological sustainability – a dichotomy

The IEEA quickly abandons the measurement of human and social capital (1.22) – probably because of conceptual and data problems. It holds up, though, the objective of measuring sustainable development in its capital approach, since such development "depend[s] upon the maintenance of natural capital" (1.24). On the other hand, the ecological approach (previously rejected for accounting purposes) re-emerges, though, with a focus on physical throughput flows for the assessment of "strong sustainability". The ecological approach is then either recruited into the capital approach, measuring capital stock in physical units, or sidelined as "ecosystem services" where "knowledge and experience is limited" (1.33).

In principle, the IEEA attempts thus to address two basic categories of environmental sustainability, classifying them as weak and monetary, and strong and physical. However, a persistent wavering between (1) recognizing the necessity of monetary valuation for covering environmental externalities and assessing overall capital maintenance (1.31,55,59,121; 2.9; 9.2,6) and (2) rejecting such valuation as research or modeling (1,58,91,138; 2.149; 10.136, 169) blurs the IEEA's objective of integrative accounting. It also misses an opportunity to overcome, or at least clarify, the dichotomy between economists' and environmentalists' views of sustainability by developing operational concepts of economic and ecological sustainability. One attempt at operationalizing these

concepts (Bartelmus, 2003, p. 68) uses the physical and monetary accounting tools, defining

- economic sustainability as keeping produced *and* non-produced, natural capital intact – a necessary condition for non-negative economic growth, and
- ecological sustainability as dematerialization of economic activity – so as to reduce material throughput through the economy and its pressure on natural carrying capacities.

Much of the environmental-economic dichotomy stems from a different worldview of human planetary occupation. "Full-world" ecological economists[7] (Daly 1996, p. 49) argue that human appropriation has now reached a level where essential life-support systems are violated. Consequently they are less interested in marginal costing of externalities for optimal resource allocation, but in reducing the "scale" of economic activity to sustainable levels – clearly a normative and regulatory policy proposal. It all depends of course on the question of how close are we to life-threatening environmental limits of economic activity?

Ecological economists attempt to prove their case with a host of mostly physical (non-monetary) indicators of natural resource shortages, degraded ecosystems, species loss and pollution (e.g. Costanza et al. 1997, pp. 7-13; The Worldwatch Institute, annual). Lacking a common measuring rod they fail, however, to give a comprehensive assessment of the closeness to ultimate limits and hence the general non-sustainability of economic growth. Questioning their dire predictions of environmental disaster draws the ire of the whole profession.[8] Environmental economists do not fare much better: they stress the ability of markets to cost environmental impacts and total capital loss, ignoring possible 'complementarities' in their 'weak' sustainability assumption. In their view, uncertainties in environmental modeling and relatively low environmental cost estimates[9] justify trust in human ingenuity to solve environmental problems in time.

The environmental-economic dichotomy has thus trickled down into measurement (Bartelmus 2000). "Ecological accounting" seems to reject monetary valuation of environmental impacts, and the corresponding integration of environmental and economic data in preference of "coordinated indicators" and "appropriate classification" of environmental impacts (Holub et al. 1999). As a result, physical accounts and indicators skirt the direct comparison of environmental effects with economic costs and benefits.

As mentioned above, the IEEA does not rise, therefore, to the challenge of bridging the physical-monetary dichotomy. This opportunity presents itself as the application of economic double-entry accounting of inputs and outputs to the use (input) and dispersion (output) of material and energy flows from and into the environment according to thermodynamic laws. Some hints in this regard are references to the dematerialization of the economy (3.197; 11.35,36) and the comparison of value added balances with those of residuals (2.57). However, a clear description of economic and ecological sustainability and their 'strengths' in quantifiable terms, i.e. linked to the accounting indicators, is missing.[10]

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[7] The distinction between ecological and environmental economists is of course crude and made here for purposes of exposition only.

[8] Cf. the critique and counter-critique of a 'skeptical environmentalist': www.lomborg.com and www.anti-lomborg.com

[9] Mostly in the range of 2-18% of net domestic product according to case studies of green accounting (Bartelmus 1997, Table 1 and Fig. 2).

[10] Monetary accounting assumes indeed that different non-produced natural capital categories can be substituted by produced ones when making an allowance for total capital consumption. Physical accounting,

3.3. Economic sustainability: maintaining wealth, welfare or income

The SEEA suggests a straightforward way of assessing the environmental sustainability of economic growth, i.e. economic sustainability, in terms of produced and natural (non-produced) capital maintenance. The IEEA obscures this relatively clear concept by an attempt to link it to the micro-economic Hicksian income definition. Capital or wealth maintenance is seen as a way to ensure a continuing flow of Hicksian income and by implication non-declining human welfare (10.133,156). The latter represents, however, a hardly quantifiable sustainability notion (albeit favoured by mainstream economists, e.g. Pezzey 1989). The relationships between wealth, capital, income and welfare are a further source of confusion in the IEEA.

Initially, the IEEA confirms the SNA's view that national accounts cannot and should not measure welfare (1.85, 86). Shortly after, the handbook advances, however, the measurement of environmental damage (including "suffering" from health damage) as "revealing" and "opening the door to … cost-benefit analysis" (1.87) and its welfare-oriented valuation techniques. Damage-adjusted economic indicators "clearly say something about the country's revenue-creation capacity" (10.156) and "give us a useful impression of the direction in which a country is headed" (10.158).

The IEEA thus simply takes it for granted that "sustainable development is closely related to the long-standing concept of income", which in turn is generally seen as Hicksian income. One reason given is that the micro-economic concept applies "equally well" at the national level and can be defined "as the amount that it [the nation] can collectively spend during a period without depleting the capital base (or wealth) upon which it relies to generate this income" (1.20).

The SNA makes it quite clear, though, that Hicks' income definition of "the maximum value… [a man] can consume during a week, and still expect to be as well off at the end of a week as he was at the beginning" (Hicks 1946, p. 172) cannot be simply aggregated into a national income concept, for several reasons (United Nations et al. 1993, para. 8.15):

- Hicksian income is an ex-ante notion (based on expectations) that, as pointed out by Hicks (1946, p. 178) himself, needs to be translated into "realized", i.e. actually received, income
- the 'well-off' or wealth notions need to be defined in terms of the accounting conventions as maintaining 'real net worth' (the net value of financial and non-financial assets and liabilities); it is far from clear to what extent the IEEA's "capital base", which might include human and social capital (1.21), refers to real net worth – at individual and national levels
- using the net worth concept for defining income would change the national (disposable) income concept by accounting also for changes in net worth due to (1) capital transfers (from/to other countries), (2) other changes in volume of assets (from natural disasters, war, discoveries and depletion of non-produced natural assets) and (3) real holding gains (because of relative price changes of assets).

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on the other hand, uses material flow aggregates that reflect a relatively stronger sustainabililty notion but still permits substitution among different material inputs.

These connections between income generated (net domestic product), national income and the treatment of other volume changes[11] therein are, of course, crucial for assessing the sustainability of natural capital use. They seem to be mixed up or misinterpreted when distinguishing between a damage-based stock concept of sustainability of Hicksian income, and a cost- and income-based concept of the very same income notion (10.133). The objective seems to be using Hicksian income for defining sustainability of both welfare and income generation, interpreting 'being well off' as both, 'well-being' and (non-declining) income.

Given the measurement problems and incompatibility of damage valuation with the market prices of the national accounts[12], as well as the opacity surrounding the income and welfare concepts, the obvious solution would be to exclude welfare measurement and damage valuation from any – national – accounting system. Of course this should not prevent damage assessments in narrowly defined project appraisals, or for specific environmental policies, where anticipated welfare effects are easier to estimate.

3.4. Ecological sustainability: dematerializing the economy

The 1993 SEEA elaborates physical accounts in some detail on their own and as counterparts of the monetary ones. However, its operational manual treats these accounts just as 'steps' leading to the compilation of environmentally adjusted monetary indicators (United Nations 2000, Ch. III). As a consequence, the SEEA does not explore the measurement of ecological sustainability in terms of reduced material throughput or dematerialization of an economy.

The IEEA takes up this concern, referring to "decoupling" economic performance from its environmental impacts as "the key sustainability policy goal to which hybrid accounts respond" (1.45). Given its extensive focus on physical accounting, a clearer definition of such physical – ecological – sustainability would have been desirable. Instead, only the last (policy use) chapter broaches briefly the issue. On the other hand, the IEEA deserves credit for its significant contribution to physical environmental accounting, notably the further elaboration of physical stock and flow accounts and their use in environmental management and policy.

Incorporating physical data into the accounting framework meets its limits, though, with the need for aggregating and comparing the data and thus to reach at least a semblance to the monetary accounts. It is quite revealing how the IEEA deals with this challenge. A few paragraphs discuss the problem of using a common physical measuring rod (usually weight) for the different, and differently significant, natural resources and emissions (1.120; 3.20,26,30). The ambivalent conclusion is either to "aggregate all materials on the basis of weight and … use caution in the interpretation of the results", or to "build accounts on a material-by-material basis and avoid altogether the creation of potentially misleading measures" (3.30).

[11] Other volume changes are recorded in the SNA's balance sheets and asset accounts only and do therefore not affect income and output. The SEEA shifts some of these changes, notably the depletion of natural resources, as cost to the income generation accounts. See section 4 for the treatment of 'discoveries' of natural resources by the IEEA. Hicks (1946, p. 178) refers to other volume changes of assets when pointing out the need for including "windfall profits or losses" in an ex-post definition of realized income.

[12] Such as free-rider concerns, inclusion of consumer surplus and short-sightedness (on long-term environmental problems) of individuals in willingness-to-pay surveys; a further problem is the allocation of environmental damages, occurring with delays after their immediate (emission) impacts, to particular accounting periods and responsible economic agents or sectors.

The fact is that except for these paragraphs the IEEA continues to present aggregate stocks and flows, measured in tons, throughout the handbook. The apparent simplicity of physical accounting is deemed to be a good enough reason to favour the physical side of environmental accounting: such accounting "does not in most cases require in-depth knowledge of economic accounting" (3.3) and avoids "a lot of detail" (3.192). Admittedly it might carry significant "scientific uncertainty" (3.4) for which the accountants could of course blame scientific monitoring that is usually not the task of official statistics.

The vacillation between compiling summary accounting indicators and presenting detailed physical statistics re-emerges when looking into the aggregative spin-off of physical accounting, the material flow accounts (MFA). The IEEA refers to the purpose of the MFA, i.e. the "decoupling of economic growth from materials use", as "an important sustainability goal for environmentalists" (11.36). The handbook also mentions standards for dematerialization levels. Such standards are in fact indispensable for defining ecological sustainability if we ask ourselves, how much dematerialization do we need? But the attempt at setting such standards (notably Factor 4) is disparaged as "rather vague for use as guides to policy use" (11.37).

The IEEA does present an alternative – and more-to-the-point – notion of strong ecological sustainability, *critical capital maintenance* (1.33, 11.74). This strong ecological sustainability concept would indeed provide a justification of measuring irreplaceable environmental assets, selectively and in different units of measurement, without forcing them into the straightjacket of tonnage. The opportunity to show how the physical accounts could capture the strong sustainability concept of 'complementarity' by proper definition and identification of critical capital components is not seized, however.

Another alternative for assessing ecological sustainability is the introduction of modeled shadow prices into the accounting framework. This is just the opposite of the IEEA's removal of maintenance costing as modeling. "Ecoprices" (Friend 2004) or "system prices" (Strassert 2000) are determined as the dual solution of a steady-state economy's input-output model. Such 'shadow-pricing' has to contend with the underlying model assumptions about production and consumption functions, as well as standards for carrying capacities. Typically such standard setting involves a normative shift from individual preferences for goods and services to collective ones (or those of the model-builder?).

In summary, one has to concur with the (perhaps unintended) conclusion of the IEEA that aggregation in a comprehensive system is not the ultimate goal of physical accounting as it gives just "an illustration of possibilities and an understandable presentation of the overall material balance of a national economy" (3.140). As a consequence, the IEEA appears to be content with physical accounts giving some "warning of threats to sustainability" (1.65) rather than attempting to measure sustainability itself. Of course, other uses of the physical accounts include the management of particular natural resources and pollutants, and the provision of data inputs into monetary accounts, and physical and hybrid (physical/monetary) models.

4. Greening the accounting indicators

The IEEA presents a bewildering variety of depletion-, degradation- and environmentally-adjusted green and greened-economy indicators of gross and net output, income, operating surplus and saving (Ch. 10). Excluding – as proposed in section 3.3 – welfare measurement and valuation, and following at the same time the IEEA's own objective of capital maintenance accounting (Ch. 1, B.3) would drastically reduce the number of alternative indicators; it would also focus the handbook on the key measures of sustainable economic performance by

- discarding damage-adjusted product, income and saving (10.151-161)
- taking the modeling of a greened-economy GDP out of ex-post accounting (10.195-215) and shifting it to application and policy use (Ch. 11)
- taking environmental cost accounting out of its 'hiding places' of environmentally-adjusted operating surplus (10.38,70) and saving (in an extended capital account: 10.37, Table 10.4), and adjusting instead net domestic product and capital formation by costing natural capital consumption.

Costing natural capital consumption calls for applying net concepts of domestic product and capital formation rather than GDP, which includes fixed capital consumption. In the end, we would thus be left with the original SEEA indicators of Environmentally-adjusted net Domestic Product (EDP), Value Added (EVA) and Capital Formation (ECF).[13]

The IEEA conceals EDP and ECF[14] by showing only the cost of natural resource depletion in the flow accounts and then adjusting the hardly-known and -used sub-item of 'operating surplus' (Table 10.4, pp. 436-437). It does present 'depletion adjusted saving', though capital formation is probably the more pertinent indicator for capital maintenance. The full adjustment of NDP (for both natural resource depletion and environmental degradation) is just listed among a quite confusing array of indicators (Box 10.9, p. 451) and is more or less dismissed as ignoring cost internalization effects on the economy (10.186,193). In this manner, the IEEA effectively excludes environmental impacts (as compared to economic natural resource inputs) from 'environmental' national (monetary) accounting.

We can argue, however, as does economic theory of externalities, that non-marketed environmental assets and their services are still economic, since they have become scarce, and their loss *should* be valued from a natural capital maintenance point of view. The maintenance costing of the SEEA sets out from this social concern about environmental social costs. Contrary to economic theory it does not assess the externalities in damage (negative utility, welfare) values[15] but as capital consumption cost, in consistency with the

[13] Rather than having to sort out and choose from dpOS, dpS, dpNDP, daNI, daS, eaGDP, eaNDP and geGDP and its numerous options for alternative definitions of depletion and degradation. For practical reasons of data availability, the SEEA did distinguish, in particular in its case studies, between EDP I (in market values for natural resource depletion) and EDP II (in combined market values and maintenance cost for depletion and degradation).

[14] The IEEA presents EDP I (dpNDP in its terminology) only in passing as a sub-item in calculating damage-adjusted national income (daNNI [sic] 10.152). ECF does not show up at all although it is different from damage-adjusted saving which is derived from national income rather than net domestic product (NDP).

[15] Economic theory weighed in heavily in the recommendation of the US Panel on Integrated Environmental and Economic Accounting of the National Research Council to assess damage rather than cost, even if cost is

pricing and costing conventions of the national accounts. These costs are defined as those "that *would* have been incurred if the environment had been used in such a way as not to have affected its future use" (United Nations 1993, para. 50); they are indeed hypothetical, as the IEEA does not tire to point out (1.92; 9.13; 10.14,171,239; 11.138).

There is nothing hypothetical, however, about the environmental impacts from economic activity during the accounting period, such as the loss of nature's safe waste disposal services from overextended absorptive capacities. Rather than stressing the hypothetical character of not-carried-out cost internalization, we might therefore stress the actual environmental deterioration. For accounting purposes this deterioration can be *weighted* by the (maintenance) effort that society should have made to mitigate the environmental impact. This is probably the only realistic way of an ex-post assessment of social cost in consistency with the replacement cost value of capital consumption.[16] Of course, if economic agents already account for environmental depletion and degradation, either owning the depleted resource or anticipating liability for degrading environmental sinks, the environmental adjustment of macro-indicators would simply correct the inflated value of the conventional aggregates.

According to the IEEA, accounting for externalities overlooks the fact that their deduction from economic indicators implies an internalization by economic agents that could "trigger major behavioural change" and hence bring about different economic production and consumption patterns and levels (10.192,193). This is in fact a misinterpretation of the objective of maintenance costing as measuring an economy's NDP *after* environmental cost internalization (2.176; 10.171,184). Rather, EDP presents a still-life picture of the economy *before* any potential, total or partial, cost internalization. As already pointed out, a scenario of a 'greened economy' that reacted to social cost internalization should be left to modeling. Such modeling could, of course, make good use of social (environmental) cost estimates.

The 'behavioural change' argument also sounds hypocritical. For one, it applies also to conventional fixed capital consumption. Admittedly, the value of capital consumption is an amount "excluded from a measure of income to permit the *possible* maintenance of capital intact" (6.63). This applies even more so to the (imputed) cost of natural resource depletion, but is not argued there. Similar 'hypothetical' calculations are the constant price estimates of economic indicators. However, here the argument is that the effect of price changes on economic behaviour are "marginal" (10.193) whereas environmental cost are obviously much more significant – a claim for which no evidence is given.[17]

The IEEA is much more positive and clearer about accounting for the use of natural (economic) resources. In particular, it treats the 'economic appearance' and 'disappearance' (in SNA terminology) of these resources in detail and presents alternative calculations of depletion cost and natural asset changes (Chs 7 and 10). The interpretation of these calculations would have deserved more scrutiny, since economists tend to stress the near-renewable (through discovery) character, especially of sub-soil resources, while environmentalists focus on the limits of (exhaustible) resource availability. The question

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easier to measure (Nordhaus and Kokkelenberg 1999, p. 164). This view might have contributed to the extensive discussion of damage valuation in Ch. 9 of the IEEA.

[16] In practice, one would have to set environmental (emission) standards for costing compliance with environmental (societal) standards where high cost estimates make the total avoidance cost unrealistic. This is quite similar to the well-known recommendations by Baumol and Oates (1971) for a practical assessment of externalities.

[17] As already pointed out (note 9), environmental costs tend to be relatively low. A case study for Germany estimated these cost (largely externalities) at about 3% of NDP (Bartelmus 2002).

here is whether discovery of natural resources should be seen as an increase of natural capital, despite the fact that these resources had been in existence before the accounting period and were generated by natural processes rather than economic production. For resource-intensive economies the difference in income and product, treating discovery either as natural capital formation or as other asset volume changes (cf. note 11), can be substantial.

In summary, EDP and ECF simply indicate to what extent past economic performance has been (environmentally) sustainable or not. The analysis of EDP trends would however require long time series that are for now usually unavailable. An alternative would be the use of ECF that indicates the extent to which an economy has been able to create new capital, taking both produced and natural capital consumption into account (Bartelmus 2003, p. 75). Of course such performance of environmentally adjusted indicators gives only an indication of a somewhat better sustainability situation, as it neglects potential non-sustainabilities of human, social and institutional capital.

In conclusion, the IEEA's vacillation between recognition and rejection of environmentally adjusted indicators is both confusing and unwarranted: why not use the *satellite* accounts for what they are intended, namely to present and test alternative assessment tools for new concepts and paradigms? In this way, the SNA could and should continue its focus on short- and medium-term fluctuations in economic performance. The SEEA, on the other hand, should assess the long-term goal of attaining environmental sustainability. The two approaches could be presented without prejudice to either goal, competing for their application according to the objectives and priorities of the user community.

5. Outlook: SEEA 2010?

The IEEA admits that much of the handbook is still work in progress (1.135). The half-hearted attempt at recruiting sustainability as the rationale for integrative accounting confirms this statement. Moreover, a distinct bias against the modification of economic accounting indicators makes the handbook look in parts more like a framework for environmental data than an integrated economic and environmental accounting system. One cannot help sharing the IEEA's opinion that "the handbook itself is likely to need revising again in the not too distant future" (1.135).

Clearly, much progress has been made in elaborating the physical base underlying the national accounts. Still, much of the elaboration of concepts and classifications of environmental data could be left to existing frameworks of environmental statistics and indicators rather than forcing them into the national stock and flow accounts. The accountants and statisticians responsible for greening the national accounts appear thus to be torn between an ambition to incorporate environmental statistics and indicators in an extended accounting framework, and caution about being drawn into controversial 'analytical' estimation.

As a consequence, a number of opportunities to operationalize the opaque notion of sustainability with the help of rigorously defined accounting indicators are missed. Raising issues of capital maintenance, dematerialization of the economy and declining social

welfare without defining them rigorously in terms of conventional and extended accounting aggregates fails, in particular, to bridge the unfortunate polarization of normative environmentalist versus more positivist economic approaches to assessing the sustainability of economic activity.

Future work of environmental accounting might thus

- focus less on the further deepening of statistical concepts and classifications for particular areas, such as fishery, forestry and mining, but rather on the capacity of physical and monetary accounting aggregates to capture sustainability of economic performance, growth and broadly defined development
- streamline a voluminous and difficult-to-read handbook by concentrating on the modification of the national accounts; aggregative physical accounts should thus be part of the accounting sequence, as elaborated in the *Operational Manual* of the United Nations (2000), while the supportive data bases for different resource accounts could be presented in separate handbooks
- explore possibilities of assessing the 'strengths' of sustainability, i.e. the incidence of substitution and complementarity of production factors, notably through the identification and measurement of 'critical' natural capital
- reassess the use and usefulness (compatibility with market prices) of environmental damage valuation in the national accounts
- discuss the need for linking environmental corporate and macro-accounting (the so-called micro-macro link)
- conduct national case studies and compile estimates of international green accounts (with available data) for comparing the sustainability of participating economies, and, perhaps most importantly,
- involve the user community in preparing a handbook on policy use and applications to address unresolved analytical questions, including
  - environmental debt owed to future generations but also to other countries, from which sustainability is 'imported'
  - the treatment of discoveries of natural (mostly mineral) resources, from a sustainability point of view, as capital formation, offsetting their depletion cost, or alternatively as 'other volume changes' that do not affect income and output
  - direct data use versus the use of (assumption-laden) modeling information by policy makers: this should include the setting of market instruments according to assessed environmental cost, on the one hand, and the effects of environmental cost internalization on the growth and structure of the economy, on the other hand
  - accounting for human and social capital generation and loss for a broader notion of sustainable economic growth
  - the use of modeled deco-prices in environmental accounts
  - assessment of 'driving forces' behind non-sustainability of current economic performance, including population growth and migration, technological change, and environmental cost 'externalization' facilitated by a globalized world economy.

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ANNEX: SEEA structure and indicators

		OPENING STOCKS	Economic assets	Environmental assets	
			+		
	DOMESTIC PRODUCTION (industries)	FINAL CONSUMPTION (households, government)	CAPITAL FORMATION	CAPITAL ACCUMULATION	REST OF THE WORLD
SUPPLY OF RODUCTS	Output (O_i)				Exports (X)
USE OF PRODUCTS	Intermediate consumption (IC_i)	Final consumption (C)	Gross capital formation (CF)		Imports (M)
USE OF FIXED CAPITAL	Fixed capital consumption (CC_i)		Fixed capital consumption (-CC)		
Value added (VA), NDP	$VA_i = O_i - IC_i - CC_i$ $NDP = \Sigma VA_i$				
USE OF NATURAL ASSETS (depletion and degradation)	Environmental cost of industries (EC_i)	Environmental cost of households (EC_h)	Natural capital consumption (-EC)		
Environmentally-adjusted indicators	$EVA_i = VA_i - EC_i$ $EDP = \Sigma EVA_i - \Sigma EC_h$		ECF = CF - CC - EC		
			+		
			Other changes of economic assets	Other changes of environmental assets	
			=		
		CLOSING STOCKS	Economic assets	Environmental assets	

Source: Bartelmus (2001), Fig. I3.

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