GREEN ACCOUNTING FOR A SUSTAINABLE ECONOMY

- Policy Use and Analysis of Environmental Accounts in the Philippines -

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EXECUTIVE SUMMARY

- New York Times (28 & 29 November 1997): "Hovering environmental disaster in East Asia; Philippines with one of the worst environmental records" - journalistic dramatization or alert to unsustainable development?
- Environmentalists and economists disagree on how to deal with sustainable development. *Ecological sustainability* focuses on the carrying capacity of and physical stress on natural systems. *Economic sustainability* aims at the maintenance of produced and natural capital in economic production and growth.
- Indices of *throughput* of materials and energy (through the economy) measure overall environmental pressure on the environment. An Index of Material/Energy Intensity indicates environmental depletion and degradation in the Philippines, delinked from economic growth from 1970 to 1984 and closely linked with accelerated growth thereafter. No conclusion about reaching the limits of growth can be made without further research into environmental thresholds in the country.
- Physical indices suffer from arbitrary selection and weighting of underlying indicators. *Green national accounts*, as institutionalized by President Ramos in March 1997, use the market price as the common numéraire within an established statistical system. The approach is to include in the national accounts natural capital and its depletion and degradation.
- Environmentally-adjusted net Domestic Product (EDP) measures NDP net of environmental costs. EDP in the Philippines maintains the upward trends of GDP and NDP. The overall sustainability of national economic growth can thus not be rejected. Overall sustainability is confirmed by positive net capital accumulation (net capital formation minus environmental capital consumption). However, positive capital accumulation may have been achieved through increased foreign liability, with final consumption close to 100% of EDP.
- Analysis of foreign trade in natural resources can provide an indication of *import and export of sustainability* in terms of import and export of natural resources (depletion).
- Depletion of forest and groundwater is most significant in terms of depletion cost as a ratio of gross value added generated by forestry and water supply. Deforestation dropped after introduction of a logging ban in 1992. Somewhat lower pollution costs are observed for the different economic sectors. An exception is the "cost" of water supply which is close to or greater than value added generated by utilities - an indication of heavy "subsidy" by Nature, bearing the cost of overloading its waste absorption capacity. Low levels of total environmental cost may reflect undercoverage, notably of pollution.
- Natural resources represent a significant part of *national wealth* or capital stock which is the baseline for assessing the long-term growth potential of the economy. Improved asset accounts should measure the productivity and distribution of wealth for policies of achieving*intra- and intergenerational equity*. Establishing property rights, notably for indigenous people and local communities, may improve environmental management by "stakeholders".
- Economic instruments of environmental cost internalization (user fees, effluent charges, tradable pollution permits) aim at changing production and consumption patterns. If set too low they generate revenues but do not affect environmental behaviour. Environ-mental accounts provide the - cost - information at which to set economic instru- ments of full-cost pricing.
- Prevention or avoidance costing, as applied in the Philippine implementation of the System of integrated Environmental and Economic Accounting (SEEA), alert to the opportunity of avoiding past environmental errors of industrialized countries.
- Policies of economic sustainability, i.e. capital maintenance, suggest re-investment of fiscal revenues generated by economic instruments to maintain the growth potential of the economy.
- Modelling is needed to establish the incidence of environmental cost according to prevailing elasticities of supply and demand. Input-output or other models of general equilibrium may assess an optimal net domestic product with regard to environmental objectives.
- A comprehensive survey of *environmental protection expenditures* is needed to assess the "environmental efforts" made by the Philippines and its different sectors. Effects of different levels of environmental expenditures on employment, production patterns and competitiveness need to be modelled.

- Indices of human or sustainable development, the quality of life, genuine progress, or the value of nature’s services have proliferated. They all suffer from arbitrary indicator selection and weighting, controversial valuation and inconsistencies with established statistical concepts and methods. The objective of the Philippine Agenda 21 "to adopt a new, comprehensive indicator of sustainable development seems to be unrealistic from this point of view.

I. Introduction: environmental disaster in Asia?

A recent front-page series of the New York Times (28 and 29 November 1997) proclaimed that pollution of air and water across Asia represents a "hovering environmental disaster", with over two million Asians believed to die annually from the effects of pollution. The cost of Asia's economic miracle shows up in the world's "dirtiest water, filthiest air, most worrisome overfishing and the fastest disappearing coral reefs". At the same time, the environmental threat meets with obliviousness by both the governments and governed. The Philippines are part of this picture, deemed to have "one of the worst environmental records around", with Manila among the top polluted cities of the world.

Can we dismiss this dismal picture as journalistic dramatization of anecdotes? If the data provided are just "statistical stabs in the dark", what is the probability that these stabs have hit upon vital elements of Asia's life-support system?

Professional statisticians, notably those of the "official" statistical services, have, in the past, been reluctant to engage in the development of data and indicators on the environment which cannot be surveyed by traditional means of surveys and questionnaires. They thus left the field to "amateurs" from the user community, hard pressed to come up with rapid assessments of potential environmental disasters. The result is a proliferation of indicators and indices of the value of nature, genuine progress, genuine saving, economic welfare, natural wealth of nations and human or sustainable development. Invariably they were defined and compiled outside a rigorous statistical system which could ensure consistency with national or international statistical standards of concepts, methods, valuation, coverage and classification. As a consequence, the validity of data collected is not assessed, nor assessable. The purpose seems to be provocation by shocking sum totals or rankings rather than statistical support to decision making.

International statistical standards do exist, however, and are rigorously applied by national statistical services. The System of National Accounts (SNA) provides a world-wide adopted framework for a host of socioeconomic statistics. The system also provided the framework for the consistent incorporation of environmental concerns and data in a "satellite" System of integrated Environmental and Economic Accounting (SEEA) (United Nations 1993). For those environmental issues that cannot be captured in an accounting system, frameworks of environment statistics (United Nations 1984 and 1991) and indicators of sustainable development (Bartelmus 1994b) have been advanced.

The Philippines, by presidential decree, has now "institutionalized" economic-environmental and natural resource accounting as part of its official statistical system. The Philippine Council for Sustainable Development (PCSD), on the other hand, is the main coordinator for the development of sustainable development indicators under the auspices of the United

Nations Commission on Sustainable Development. Similar institutionalization of the indicator programme, as envisaged under the Philippine Agenda 21 (Republic of the Philippines 1997, pp. 26, 99), might lead to rigorous data definition and compilation through the direct involvement of the national statistical services.

Once data collection has been carried out, statisticians tend to walk away from the results of their work. The rationale is not to taint "objective" statistical measures, and indeed the well-established reputation of the national statistical office, with interpretation or analysis, e.g. through assumption-fraught modelling. This has the unfortunate consequence that a good deal of knowledge about the meaning and contents of indicators or aggregates compiled is lost for data analysis. In new areas of applied statistics, such as environmental accounting, users may thus be at a loss about the relevance of indicators for planning and policy making.

The national seminar on the Presentation of PSEEA Results, Policy Uses and Applications (Manila, 15-16 January 1998) to which this paper was first presented was one of the first initiatives to overcome this schism between data production and use in the field of environmental accounting. The following rough assessment of the potential uses of the results of the Philippine pilot study of environmental accounting should thus be seen as a starting point only for a continuing dialogue on data use between statisticians, administrators, policy makers, researchers and other involved groups of civil society.

II. Getting at the policy sources: measuring sustainability in growth and development

Sustainable development - a paradigm for policy integration

Environment and economy interact. Policy failures in both environment and development can be traced back to the neglect of this interaction in compartmentalized line ministries and agencies (WCED 1987). As pointed out above, the costs of Asia's economic miracle show up as losses of natural resources and environmental degradation. Environmental source and sink functions, i.e. natural resource supply and waste absorption, are both impaired by economic activities, with repercussions on these very same activities and human well-being.

The obvious answer to this interaction is policy integration "to ensure", in the words of the Brundtland Commission, "that ... policies, programmes, and budgets support development that is economically and ecologically sustainable" (WCED 1987, p.20). Taking its clue from the Brundtland Commission, "sustainable development" has been propagated by the 1992 Rio Summit on Environment and Development as the new paradigm for integrative planning and policies. Last year, governments reconfirmed their commitment to sustainable development policies in the Rio+5 Special Session of the UN General Assembly.

The Philippines was one of the first countries to respond to the call for sustainable development by the Rio Summit. It created a Council for Sustainable Development and remains committed to the implementation of the new paradigm: President Ramos, in the foreword to the Philippine Agenda 21 (PA 21), considered sustainable development as "a matter of survival". PA 21 also recognizes the interaction between environment and economy: "while there is an acceleration in the growth of our economy, there is evidence that environmental quality is fast deteriorating" (p. 7). A long list of concerns of natural resource depletion (deforestation, erosion of agricultural lands, destructive fishing) and environmental quality degradation (air and water pollution, habitat destruction) follows. How bad is all this? To paraphrase PA 21: are the gains of economic growth diminished or even negated by environmental destruction? In other words, is economic growth as seen now in the country sustainable in the long run?

Measuring sustainability - a dichotomy of approaches

To assess environment-economy interaction in an integrative fashion both "economists" and "environmentalists" looked into their analytical tool kits so as to apply them to the other field. Environmental economists seek to incorporate scarce environmental goods and

services into their economic, *monetary* value system. Their premise is that the environment can be treated like a commodity for which individuals can specify their preferences in money terms, e.g. by expressing their willingness to pay (for the provision of environmental goods and services) or be compensated (for the loss of these goods and services). A variety of valuation techniques to capture these values have been developed for cost-benefit analyses of environmental projects; to some extent they have been incorporated in methodologies of environmental accounting, notably the SEEA.

Environmentalists contest the notion that the environment can be treated as a commodity. They find it repugnant to see the value of a national heritage subjected to a "willingness to pay" which might indeed reflect more of an "ability to pay" (Jacobs 1994). Since the real value of nature cannot be expressed in money terms, *physical* indicators or indices of the quality of life, human development or sustainable development have been advanced (see e.g. Bartelmus 1994b).

The result is a distinct dichotomy in measuring and analyzing the interface between environment, economic performance, growth and development. The dichotomy reflects two different views of the role of the environment which can be expressed in terms of the sustainability of human activity. On the one hand, *economic sustainability* aims at the long-term preservation of economic output, income or consumption through the maintenance of natural capital. *Ecological sustainability*, on the other hand, focuses on the preservation of human populations in a given territory, endowed with limited natural assets; it represents an application of the ecological concept of carrying capacity to human populations. The environment is thus seen as either a requisite of economic growth or as the provider of essential consumer services or amenities. The former can be measured in monetary terms, the latter makes use of physical indicators of carrying capacity, or pressures on carrying capacity.

Environmental pressure in the Philippines: reaching the limits of growth?

Ecological sustainability and its measure, carrying capacity, imply the existence of physical limits or thresholds whose transgression disrupts economic growth with disastrous consequences such as famine, environmental catastrophes or social strife. Are the Philippines close to these limits because of population pressure on natural assets, resulting in their depletion or destruction?

Carrying capacity is usually measured by the number of people a territory can sustain indefinitely, or for a specified time period, at particular standards of living. The problems with carrying capacity measures are assumptions about minimal or desirable standards of living, current and future technologies that may affect the use of available resources, the

time horizon of the analysis, and trade with other territories that appear to render the concept inapplicable except at the global level (Cohen 1995). Data on population growth and concentration, the availability of different natural resources and the emission of pollutants, representing possible pressures on carrying capacities, are readily available. However, these physical data are not directly comparable and are thus usually presented in loose statistical frameworks without attempting linkage or aggregation. It remains to be seen if the current programme of indicator development in the Philippines will produce information which allows, in the context of PA 21 monitoring, the envisaged determination of carrying capacities and/or quantifiable limits to growth in the country (PA 21, pp. 19, 32, 79).

In the absence of an agreed set of thresholds or (ecological) sustainability standards for economic growth, attempts have been made to measure at least overall pressure from economic activity on the national carrying capacity. One such pressure index is the "throughput" of energy and materials through the economy (Jänicke *et al*. 1989; de Bruyn and Opschoor 1997). Material throughput turns low-entropy mass into high-entropy waste (Georgescu-Roegen 1971). Figure 1 shows the trends of an Index of Material/Energy Intensity (IMEI) (defined in note ‘a’ of the figure) for selected Asian countries. Declining average material and energy intensity is typically found in industrialized countries as illustrated in the figure for Japan. It indicates a "delinking" of economic growth from environmental depletion and degradation. In contrast, the newly industrializing countries (NICs) of the Republic of Korea, Thailand and Indonesia show trends of increasing IMEI as a possible result of rapid economic growth.

The Philippines exhibit fairly erratic changes in the 1970s and early 1980s, but seem now to follow the IMEI trends of the NICs, i.e. an increasing average throughput pressure on the environment, brought about by economic growth. These results do alert to positive correlation of economic activity and environmental impacts, and may thus call for a policy of discouraging wasteful use of natural resource inputs. However, it is not possible to make any direct conclusions about the closeness to some physical carrying capacity limits without further examination of the relations between environmental pressure and ecological thresholds at local and national levels.

The calculations suffer furthermore from the general drawbacks of any physical indicator aggregation, i.e. arbitrary weighting and indicator selection. In the case of IMEI, different environmental impacts produced by different material inputs are given equal weight, possible substitution of materials is not accounted for and the effects of environmental protection are not always reflected in reduced material intensities. All these effects would require further analysis, impairing the direct use of a physical index in policy making. It is for these reasons that use has been made of the superior integrative capacity of the national accounts which apply a common numéraire, the market price, and a rigorous system of accounting relationships to compare the relative importance of heterogeneous goods and services in a common format. Given the obvious failure of the environmentalist approach to

assess overall ecological sustainability in physical terms, the alternative is indeed to apply the economists' tools of assigning monetary values to scarce environmental functions. This is done "systematically" by extending the world-wide adopted national accounts system into the environmental field.

Is Philippine growth economically sustainable?

Economic theory and accounting already use a narrowly defined sustainability criterion when considering the depreciation or consumption of produced capital. The rationale is to distinguish clearly between income and capital, in order to avoid consuming the capital base of income generation. By opening the asset boundary of national accounts to non-produced natural assets of land/soil, minerals, forests, fish, water and environmental sinks for pollutants (air, water, land), a broader concept of sustainability of economic performance can be defined operationally as the maintenance of produced *and* natural capital used in the production of goods and services. Costing produced and natural capital consumption in the national accounts obtains thus an Environmentally-adjusted net Domestic Product (EDP). In analogy to measuring economic growth by trends of GDP or NDP, past - upward - trend of EDP can be interpreted as sustained economic growth in an economy.

Extrapolation of this - positive - trend into the future defines sustainable economic growth as non-dealing EDP, assuming that the allowances made for capital consumption are reinvested in capital maintenance. In addition, this definition would have to consider that trends of depletion and degradation can be offset or mitigated by technological progress, substitution of production factors, discoveries of natural resources and changes in production and consumption patterns. Other effects, e.g. of natural disasters, changes in the productivity of human capital or high inflation and indebtedness, may also affect the sustainability of economic growth. Using non-declining EDP as the indicator of sustainable growth thus yields only a "more sustainable" measure of economic growth - as compared to conventional growth indicators (Bartelmus 1994a, p. 70). Further refinement or modelling of this concept, allowing for these effects, would significantly enhance the assessment of the sustainability of long-term economic growth.

In the Philippines, the environmental accounting project produced first estimates of EDP. Figure 2 shows the typical parallel movement of GDP and NDP, which might be largely due to estimation procedures (applying constant capital consumption factors to gross value added) rather than actual "wear and tear" of capital. Overall, the EDP aggregates maintain the general upward trend of their conventional counterparts, GDP or NDP. Of course, the deduction of environmental costs reduces the level of NDP by amounts ranging between 2% and 5%, but sustainability of economic growth cannot be rejected by the accounting results shown in Figure 2. In fact, there seems to be some convergence between EDP and NDP in the 1990s, indicating a relative reduction in environmental costs generated by the economy.

There is little difference between EDP 1, i.e. NDP adjusted for natural resource depletion, and EDP 2, obtained by further deducting pollution costs from EDP 1. The reason might indeed be that, with a relatively small effort, in terms of costs of pollution prevention, emissions could have been reduced to desirable levels; it might also simply reflect undercoverage of emissions.

Another way of looking at the (non)sustainability of economic growth in the Philippines is to assess the country's ability to generate new capital after taking produced and natural capital consumption into account. Figure 3 shows net capital accumulation (NCA: net capital formation minus natural capital consumption) in per cent of NDP for the Philippines and Indonesia. According to the Indonesian study, economic growth was not sustainable owing to disinvestment in the 1970s. Throughout the 1988-1993 period, the Philippine economy exhibited positive rates of environmentally adjusted capital formation (NCA 2). This confirms the positive EDP trend of Figure 2. However, overall positive NCA may hide the fact that capital formation may have been achieved by increasing the country's liability, i.e. foreign debt. At an average of 93% (during the 1988-1993 period), the ratio of final consumption over EDP hovered indeed close to 100%, i.e. at a level where all that is produced is consumed and hardly any saving is generated for new capital formation.

Overall, the Philippine economy seems to be on an - economically - sustainable path. However, strong linkage of economic growth with environmental pressure, in terms of IMEI, suggests a risk of violating environmental thresholds or standards. For more concrete policy recommendations, such generic statements need further exploration, both in terms of the origins of environmental costs of depletion and degradation and in terms of their physical counterparts, linked to explicitly set sustainability standards. The following two sections address these questions in more detail. They deal, on the one hand, with the policies and strategies of conserving natural wealth and, on the other hand, with the instruments of internalizing the social costs of pollution. Given the multi-purpose character of national accounting, many other analyses of their greening could be imagined. The following is therefore more an illustration of selected applications than a comprehensive review of policy uses.

III. Natural wealth: maintaining productive capacities

The SEEA links natural asset accounts to income and production accounts in line with the basic SNA principle of recording consistently economic flows and stocks. This permits the assessment of both the stock of natural resources and produced capital at a particular point in time and the costing of changes in stock during the accounting period.

Availability, productivity and distribution of national wealth

The analysis of the availability of productive wealth is the baseline for assessing the long-term growth potential of the national economy. It is questionable, though, if this argument justifies a paradigmatic shift from flow (income, finance, production, capital formation, trade) to stock (capital) analysis of sustainable development as advocated by the World Bank (1997, p. 19). Rather than providing a static picture of economic potential at a particular point in time, it is probably more important to measure what a nation is actually *doing* with its wealth, i.e. the changes in wealth during a period of time. There are, however, important aspects of economic power (ownership of wealth) and productivity of different wealth categories that can be usefully assessed for policies of improving social equity and efficiency of capital use.

Comparing the physical stocks of natural and produced wealth is hardly possible in different units of weight, area or volume. For the analysis of the relative significance and distribution of different wealth categories, physical stock data need to be expressed in monetary values. Lack of data on fish stocks and produced assets prevent for the time being such analysis for the Philippines. Table 1 thus shows only that forests, agricultural land and groundwater are of about equal economic importance in the country. The table also indicates that natural wealth increased in monetary terms. Of course this may be largely due to price increases. For example, the value of forests went up by nearly a quarter by 1994 (from its 1988 level), while at the same time its volume decreased by 70%. Clearly both physical and monetary accounts need to be consulted before making any managerial or policy decision on the short- or long-term exploitation of particular natural resource stocks.

Expanded wealth accounting can provide essential information for the analysis of capital productivity, short- and medium-term policies of redistributing national wealth more equitably and long-term policies of preserving national wealth for future generations. In the absence of such information, one can only speculate about possible analytical and policy uses of comprehensive wealth accounts.

Comparative analysis of conventional and environmentally adjusted indicators of capital productivity, i.e. net value added per capital stock (NDP/CAP vs EDP/CAP) might prompt changes in sectoral investment policy. Such policy might either support or discourage investment into different sectors or categories of natural and produced capital.

Policies of redistributing wealth more equitably would require information on the ownership of natural assets by both domestic and multi-national agents. In the Philippines there is particular interest in ancestral rights of indigenous people (PA 21, p. 46), security of land tenure (p. 57) and empowerment of local communities (p. 8). The provision of property rights to individual "stakeholders", for turning common-access resources into private ownership, is generally considered to be a tool of more efficient environmental and natural resources management. Such policy would not absolve governments from tenurial control, notably of multi-national corporations whose resource exploitation rights and pricing strategies should be made transparent for realistic rent (profit) assessment and capture (taxation).

It should be noted that the table does not include "environmental" assets such as lands in the wilderness, habitat or biodiversity. The "option" or "existence" value of these assets, which are not traded in markets but for whose availability individuals may be willing to pay, are hardly valid for national accounting purposes (see note 17, below). The availability of environmental functions is therefore better measured by physical indicators of area, volume, absorptive capacity and quality. PA 21 calls for both types of assessment, notably option values of forest resources (p. 21) and biodiversity (p. 93), and physical inventories of forests (p. 36), freshwater (p. 79) and biodiversity (p. 88). Only further experience with both information categories will tell about their comparative use and usefulness in monitoring the national agenda.

Beyond tangible (productive) wealth examined above, financial wealth could also be included for the "portfolio management" of wealth, i.e. its use as a source of development finance (World Bank 1997, p. 28). For the Philippines, national wealth data would thus reveal the high level of indebtedness to other nations. From an environmental point of view, indebtedness to future generations could be added by applying a concept of "environmental debt" (National Institute of Economic Research and Statistics Sweden 1994). Intergenerational liability would refer to the costs of restoring environmental degradation and destruction to more or less pristine levels as inherited from past generations.

Depletion of natural resources: costing capital maintenance

The analysis of the stock of natural capital provides an outlook on the long-term potential for economic growth, based on the availability of "economic" natural assets. For short- and

medium-termdecisions on the management of natural resources, flow data on the changes of stocks, in both physical and monetary terms, become more relevant. The SEEA uses the SNA categories of these changes to derive a concept of depletion consistent with - produced - capital consumption and to be distinguished clearly from "other volume changes". Other volume changes are brought about by activities other than production and cannot, therefore, be considered as cost of production.

Overall, depletion seems to be decreasing in terms of the EDP1/GDP ratio in Table 2, and at a relatively low level, especially after a logging ban (of old-growth dipterocarp forest) in 1992. It would be interesting to learn to what extent low depletion is due to an already largely depleted natural resource base or undercoverage, or whether compensating efforts, e.g. of plantation, aquaculture or importation of natural resources, are responsible for low-level resource use/losses. For example, imports of roundwood did jump by about 45% from 1991 to 1992. This example points to the important question of how national sustainability is affected by international trade and its liberalization. Current trends of globalization seem to have received a conditional welcome by President Ramos. Accounting for current, and further analysis of expected, exports and imports of natural resources would provide an indication of corresponding imports and exports of asset depletion at the expense or to the benefit of the sustainability of the national economy.

Depletion, that is the non-sustainable use of natural resources, takes place as part of production by enterprises and households. In the Philippines, as in many other countries, difficulties in measuring subsistence activities are the reason of considerable undercoverage of output generated by households for own use. This is revealed in Table 2 where depletion costs exceed value added in forestry and water supply. Full coverage of household production,

as recommended by the 1993 SNA (para. 6.24) would not only produce a more realistic share of depletion cost in gross value added but would also provide a more accurate picture of economic performance in the country.

It is reasonable to expect that depletion costs are already accounted for in the corporate accounts of the resource users or owners. In this case, the calculation of environmentally adjusted net value added and EDP would be simply a correction of inflated values of the conventional indicators. Such correction would describe more accurately the production structure and sources of income of the economy, required for the assessment of the effects of economic (stabilization, structural adjustment etc.) policy throughout the economy.

For natural resource policy and management, the measurement of the cost of depletion, in terms of permanent losses in production and income generation, is the basis for making decisions about desirable exploitation regimes. In the case of renewable or conditionally renewable resources such as forests, fish or water, physical environmental accounts alert to

permanent losses beyond renewability or sustainability. "Bioeconomic models" (PA 21, p.78) are needed to determine the levels of sustainable cut or catch. Policy reactions may include command-and-control action such as the Philippine logging ban. Alternatively, and considered to be more efficient from a resource allocation point of view, the use of market instruments would discourage over-exploitation and encourage sustainable resource use, for instance by selective cutting for timber production. Royalty payments or user fees are to reduce depletion up to the amount where sustainability is reached and depletion costs become zero.

Alternatively, government policy might accept the loss of a renewable resource for the sake of economic development. In this case, rents captured by fees or taxation should at least be reinvested in alternative forms of human capital (education, training), other renewable natural assets or reproducible fixed assets - a policy of weak sustainability, i.e. overall capital maintenance. This would include produced natural capital which may maintain some of the ecological functions of the original asset as in the case of forest plantations. Of course, governments might consider to make good on their "environmental debt" of past depletion and invest in reforestation or other regeneration of natural systems for the benefit of current and future generations. Such expenditures are recorded in the SNA as current or capital expenses according to conventional accounting procedures.

Any extraction of non-renewable resources is per definition permanent depletion of the resource, unless "discoveries" are considered capital formation. Non-use of the resource could be considered squandering the resource, needed for purposes of economic growth. The government might intervene, however, by capturing resource rents or depletion costs if it considers private exploitation regimes and rent uses inappropriate. This would be the case when rents are used for consumption rather than invested in capital maintenance, or when the government applies non-economic criteria of intergenerational preservation of natural capital. As in the case of renewable resources, user fees or production taxes, set at the level of depletion cost (obtained from the monetary accounts), can be considered preferable to direct control, such as exploitation quotas, in encouraging more efficient patterns of resource exploitation and structural adjustments in the economy.

It should be noted in this context that microeconomic strategies may differ from macro- or mesoeconomic ones. Individual corporations may wish to maximize profits or rents from natural resource exploitation. For governments, on the other hand, any generation of value added would be welcome from an economic growth maximization point of view. Negative rents might thus be of a lesser concern to governments, especially when considering the common practice of "transfer pricing".

The role of physical accounting data is largely limited to alerting to non-sustainable exploitation and lifetime assessment of depletable resources. It thus serves managerial purposes rather than policy making, unless physical data are taken as indicators for

non-economic characteristics of natural assets. Thus, forest inventories may serve the assessment of the availability of the resource with all its environmental functions such as habitat, climate and flood control, or scenic beauty. This seems to be the rationale behind PA 21's request for establishing such inventories for forests (p. 36), fish (p. 79) and biodiversity (p. 88).

Another use of physical data is due to the fact that monetary costs hide actual physical depletion trends behind the veil of sometimes erratic price fluctuations. For longer-term analyses of resource availability, beyond short-term profitability, physical exploitation data become a check on economic depletion cost. Figure 4 indicates that fishery faces increasing depletion of fishing grounds from overexploitation in both money terms of depletion cost and weight of fish catch exceeding sustainable catch. However, valuation appears to show a less dramatic picture at lower percentage rates but mirrors physical depletion rates, except for the first two years. As already pointed out, long-term national policy might wish to be more cautious in the exploitation of the national fishing grounds than indicated by the costs of current overfishing.

IV. Pollution: accounting for accountability

Monitoring pollution

Systems or frameworks of environment statistics aim at measuring the full sequence of pollution, including the

- emission of pollutants at the source by households and enterprises
- loading and concentration of pollutants in environmental media of air, water and land
- exposure of biota, including humans, to these concentrations and
- effects of exposure on human health and well-being.

Tracing the physical impacts and effects of pollution entails already difficult estimations and modelling, notably of pollution pathways, dispersion and concentration of pollutants, and dose-response relationships. Even more controversial is the costing of the effects of pollution on human health and well-being at the programme or project level, but such costing becomes near-impossible at the national level. Furthermore, time-lagged and synergistic (from different pollutants) effects of emissions and cross-border flows of pollutants impair the correct allocation of environmental effects to causing agents as required in principle by the internalization of these "externalities".

The SEEA application in the Philippines restricted itself, therefore, to costing only the direct interaction between environment and economy. Only in this case can emissions of pollutants be linked unequivocally to economic - production and consumption - activities.

Figure 5 shows times series of key pollutants of the electricity sector as an example for possible trend analysis of pollution in physical units. The different pollutants show very similar trends which may be due more to the use of constant emission factors, applied to the same input and output indicators, than to a reflection of actual emission patterns. The meaning of such data, be it for a particular sector or the whole economy, is limited, unless the emissions can be confronted with some kind of standards. At the international level, for instance, CO_2 standards have been proposed at 1990 emission levels, or lower. At the national level, other emission standards might be set, reflecting safe absorption levels or otherwise specified "acceptable" (considering local environmental effects and conditions) levels.

At this stage of analysis, an accounting format is not really required, since the presentation of emissions is typically part of separate systems of environmental statistics or indicators. Nonetheless, the integration of physical emission data has been proposed by one environmental accounting framework, the Dutch National Accounting Matrix including Environmental Accounts (NAMEA) (Keuning and de Haan 1997). NAMEA simply presents

physical emissions next to the emitting sector for possible further aggregation into environmental "themes" contributions. Such linkage of physical indicators with monetary aggregates permits the application of input-output analysis for the estimation of cumulative (direct and indirect) pollution generated per unit of final demand. Alternative scenario modelling for different environmental policies and/or final demand levels and patterns can then assess the total environmental pollution burden of those scenarios.

Maintenance costing and cost internalization

The SEEA goes a step further by costing the impacts on the environment. Accounting only for the depletion of "economic" assets, as for instance in case studies of the World Resources Institute (Repetto *et al*. 1989; Solórzano *et al*. 1991) can be criticized for neglecting or denying the real social - environmental - cost of production and consumption. Those costs are the result of external effects of economic activities on the environment, which in turn affect the quality of human life, if not life itself.

Focusing on the immediate environment-economy interface, these externalities can be considered as the loss of environmental services of waste absorption, resulting from the (over)use of natural capital by economic activities. As in the case of natural resource depletion, environmental externalities represent thus a form of capital consumption, neglected in conventional accounts. As such, they are economic costs, reflecting the need to maintain the capital stock of a country (Bartelmus 1977a). The SEEA applies therefore a conservative valuation method of maintenance or avoidance/prevention costing for weighting the emissions generated directly by production and consumption processes. Maintenance costs are those that could have been avoided if appropriate technologies or protection measures would have been applied during the accounting period.

Comparing the cost of depletion of natural resources with pollution/emission cost shows that the former are a multiple of the latter in the period of 1988-1991. Thereafter, both environmental cost categories converge to a relatively low level of about 1% each of GDP (see Tables 2 and 3). This is due to the logging ban of 1992 which reduced significantly natural resource depletion. The low and constant level of overall pollution cost deserves further scrutiny. It may be due to successful pollution control, undercoverage which has been the case in other SEEA studies, e.g. in the Republic of Korea (Kim *et al*., in prep.) and Japan (Oda *et al.* 1997), or overly optimistic estimates of pollution control costs. Aquaculture exhibits one of the highest costs of discharges, but the percentage refers to the total value added generated by fisheries for which no further emission is recorded. Water supply is a glaring example of pollution cost offsetting value added. The explanation might indeed be that this is an economic activity which is heavily "subsidized" by Nature, offering its capital consuming services free of charge. "Removal" of this subsidy by charging consumers the full price, covering the estimated pollution and depletion cost, would be the

appropriate policy response from an economic efficiency point of view.

Weighting emissions with the unit value of environmental protection measures is of course hypothetical since the emissions did actually take place during the accounting period; in other words, the emission costs were not internalized in the accounts or budgets of the responsible economic agents. However, these costs do provide an indication of the amount of environmental cost that *should* or *could* have been internalized by economic agents if they would have behaved in an environmentally sound manner.

Environmental cost accounts thus provide essential information about the level at which "economic instruments" of cost internalization, such as effluent charges or tradable pollution permits, need to be set in order to effectively prevent undesirable levels of emissions. PA 21 envisages a "mixture of market-based instruments and command-and-control measures ... to set into motion financial flows that would help achieve [its] goals" (PA 21, p. xxvii). Those instrument seem to apply to both natural resource depletion (mining and forestry: p. 26) and pollution (air quality: p. 66, mine waste and tailings: p. 83). Actual experimentation has begun under the auspices of the Laguna Lake Development Authority with a wastewater discharge fee, based on BOD loadings into the lake.

A comparison of the hypothetical accounting (maintenance) cost with actual levels of fees or effluent charges set would provide an indication of how realistic these charges are with regard to actually inducing the implementation of environmental protection measures. Typically, fiscal instruments proved to be good income spinners, succeeding indeed to "set into motion financial flows" but being less successful in changing microeconomic production and consumption behaviour. The reason is that the introduction of relatively high levels of taxation is politically difficult, and economic instruments are therefore usually set too low. One way around this dilemma is to finance a reduction of direct taxes through the funds obtained from environmental charges.

Textbook economics tells us that, for the optimal allocation of scarce resources, social cost internalization should refer to the actual damage in terms of welfare or utility losses of environmental impacts rather than the cost of preventing or mitigating these welfare effects. As already pointed out, the well-known measurement problems of utility and the willingness to pay for its loss or upkeep, as well as inconsistency with market values in the conventional accounts, are the reasons why no such valuations are attempted within the environmentally extended national accounting framework of the Philippines. Any calculation of environmental damage, for instance in terms of the benefits of nature services lost, should thus be regarded with a sound dose of skepticism. This would apply in particular to aggregation at the national level and comparison with the maintenance cost of potential damage avoidance. For example, one such calculation for the Philippines comes to the conclusion that the total maintenance "cost of reducing uncontrolled residuals to harmless levels through least-cost, available technology" exceeds environmental damage caused by

pollution (delos Angeles and Peskin 1997) - an invitation to inaction on the pollution front?

Assessing the potential incidence of hypothetical maintenance cost in appropriate models of general equilibrium, notably the fixed-technology model of input-output analysis, is an altogether different issue. Environmental accounts can indeed provide the "first-round" internalization cost whose further effects on (shadow) prices, economic aggregates, patterns of production and final demand components could be usefully modelled. One overall outcome might thus be the calculation of hypothetical aggregates such as an "optimal net domestic product with regard to environmental targets" (Meyer and Ewerhart 1996), or a "maximum NDP generated in an economy in which the burden on the environment is reduced to a sustainable level" (de Boer *et al*. 1994). Under certain, and possibly quite unrealistic, conditions of perfect competition, full substitution of production factors and optimal (resource use) behaviour, such modelling would indicate how both maximum output and long-term sustainability of consumption can be achieved (Solow 1974, Hartwick 1977, Dasgupta and Mäler 1991). The actual use and usefulness of such modelling in economic and environmental policy making is a challenging task of further research and analysis.

Cost internalized: assessing environmental protection

Once environmental costs are actually internalized, i.e. incurred, they are in principle

accounted for in standard concepts of cost (expenditure for environmental services bought or otherwise internally incurred), fees, charges or subsidies, and capital formation (acquisition of capital goods for environmental protection). Typically, a comprehensive survey of all economic agents needs to be undertaken to obtain this information. In the Philippines, only budgetary estimates are available from governmental institutions, amounting to about 2.5% of total government expenditures in the average (1988-1994).

The identification of total (capital and current) expenditures for environmental protection by all economic sectors in the country seems to provide a comprehensive picture of the national effort to protect the environment. However this effort is not directly comparable to the net productive effort of the economy, reflected in NDP generated during the accounting period. For a better comparison, either a separate environmental (service) sector could be created, combining both internal (ancillary) and external (traded) environmental activities, or the direct and indirect value added generated in environmental protection could be modelled with the help of input-output analysis (Schäfer and Stahmer 1989). The latter approach would more accurately assess the total (including antecedent industries’ net contribution) involvement of the economy in environmental protection.

The part of environmental expenditures that is restorative (rather than preventive) can be considered as a repayment of the above-mentioned "environmental debt", owed to future

generations. The level of environmental expenditures incurred during the accounting period is therefore not necessarily an indicator of environmental merit of society, since high expenditures might only address past environmental sins.

Some scholars suggested that expenditures to mitigate or avoid environmental effects are "defensive" in nature since they serve to maintain human welfare rather than to increase it; they should therefore be deducted from GDP to obtain Net Economic Welfare (NEW) (Samuelson and Nordhaus 1992), or a Genuine Progress Indicator (GPI) (Cobb, Halstead and Rowe 1995). However, such deduction is questionable as it would draw national accounting into the murky waters of welfare measurement where "desirables" and "regrettables" are arbitrarily added or deducted. Rather than deducting defensive expenditures in national accounts, input-output analyses could usefully explore the effects of anticipated or budgeted changes in environmental expenditures on prices, production structures, employment and international competitiveness.

V. Outlook: from growth to development

Integrated environmental and economic accounting, as implemented in the Philippines, allows the valuation of *immediate* environmental impacts of economic activities on natural assets (resource depletion and emission of pollutants). It reaches its limits when attempting to extend this valuation to welfare effects on human health, and to apply other environmental option or existence values, e.g. to cherished species like the Philippine eagle. While integrated accounting does assess a "more sustainable" economic growth concept, the market-transaction based system cannot measure more remote aspects of the human quality of life or, in fact, "development". Development goals of equity, health, literacy, freedom, culture or political stability are quite impossible to quantify in monetary terms unless one resorts to controversial methods of measuring the "revealed preferences" of individuals for these goals. PA 21's strategic objective to adopt "a new, comprehensive indicator of sustainable development" (p. 17) to supplement environmental and natural resource accounting and other indices of income, product and human development does not seem to be realistic from this point of view.

For measuring comprehensively a concept of sustainable development, physical indicators related to the above-mentioned development goals would need to be developed. As those indicators are impossible to aggregate, given the lack of a common numéraire, their policy relevance would have to be assessed by linking them to explicit policy targets, thresholds or sustainability standards. Sustainability defined and measured above in terms of natural and produced capital maintenance is thus changed into a notion of compliance with standards and norms. In other words, market valuation is replaced by social *evaluation*, and the notion of sustainability by *feasibility* of development programmes (Bartelmus 1994a).

The explicit specification of standards and norms is not an easy task. Standards and targets may include standards of living, natural resource capacities, pollution and contamination standards, carrying capacities of bioproductive systems, distributional standards of income and wealth, and other cultural, political, social and demographic targets. In principle, capacities of the produced, human and natural capital stock, i.e. aspects of economic sustainability, could be combined in this manner with ecological sustainability limits of carrying capacity of natural systems. The purpose would be to bridge the above-described dichotomy of economic vs. ecological approaches to growth and development.

Together, those standards, thresholds and targets can be considered as a normative framework for environmental and socioeconomic action. PA 21 is a first step towards developing such a framework. In some instances, the national agenda already specifies concrete targets as, for example, the maintenance of six million ha of forests before 1998 (p. 36), the 100% satisfaction of forest product needs of rural communities by 2002 (p. 36), or the delineation of 2.5 million ha of productive forest for 1998-2005 (p. 39). However, most

other "targets" are still more anecdotal than operational in the sense of explicitly defining quantifiable milestones or limits.

The development of an agreed system or list of indicators of sustainable development, linked unequivocally to targets and standards, is indeed a rich field for further research and political consensus building. Such research should provide PA 21's Action Agenda with an assessment of possible trade-offs among the long list of desirable programmes and projects, within a coherent and explicit framework of budgetary and biophysical constraints.

Notes

. For example, the World Bank (1995) made a "short-cut" estimate of the global *stock* value of natural capital of $35 trillion (own calculation based on per capita estimates of the World Bank) which is about the same as another estimation of the wealth *services* of nature of $33 trillion (Costanza *et. al.* 1997). Adding desirables such as leisure and community services and deducting regrettables of environmental and other "defensive" cost, the Genuine Progress Indicator (GPI) (Cobb, Halstead and Rowe 1995) tries to explain why America is "down" by 45% since 1970, while GDP is "up" at the same time. Genuine Saving (World Bank 1997) deducts environmental costs of natural resource depletion and pollution damage (the latter at a "place holder" value of $20 per ton of carbon emitted!) and adds a human capital formation component of educational expenditures. Finally, UNDP's (1995) Human Development Index (HDI) applies basically equal weights in combining three indicators of life expectancy, literacy and GDP per capita.

2. Executive Order 406, signed by President Ramos in March 1997, authorizes the establishment of the Philippine Economic-Environmental Natural Resource Accounting (PEENRA) System to be implemented by the National Statistical Coordination Board (NSCB) in cooperation with the National Economic Development Authority (NEDA) and the Department of Environment and Natural Resources (DENR).

3. In the context of deforestation (PA 21, p. 7).

4. The following discussion of the different approaches to operationalize the concept of sustainability in growth and development is based on Bartelmus (1997b).

5. The SEEA proposes different modules or "versions" built around three valuation categories, market valuation, maintenance costing and contingent valuation. See for a discussion of the use and usefulness of different valuation techniques in the context of environmental accounting, Bartelmus (1997a).

6. For example, the United Nations frameworks for environment statistics (United Nations 1984) and for indicators of sustainable development (Bartelmus 1994b) are simple juxtapositions of statistics or indicators under "information categories" of stress, impacts and social response. Modelling of functional relationships among these categories is laden with assumptions that render the results of such modelling highly questionable; cf., for instance, the doomsday predictions of the Club of Rome's model of the "Limits to Growth" (Meadows *et al*. 1972).

7. Also, a declining IMEI could indicate both an increase in the absolute level of throughput, but relatively lower than GDP increase (termed "weak" delinking or dematerialization), or

an absolute decrease of throughput ("strong" delinking) (de Bruyn and Opschoor 1997).

8. The approach to, and concepts and methods of, integrated environmental and economic accounting, and in particular those of the United Nations SEEA, have been described in detail elsewhere (United Nations 1993). A recent publication on the outcomes of an international conference describes country experiences to date, as well as outstanding methodological issues: Uno and Bartelmus (1997).

9. Contrary to some calculations, the use of surface water is assumed here to be sustainable in the long term, and depletion cost is estimated for groundwater only.

0. The Indonesian data are adjusted values of a study carried out by the World Resources Institute (Repetto *et al*. 1989) outside a national accounting framework; they are thus not fully comparable to SEEA categories.

1. Sustainability of natural systems may differ considerably at the local levels owing to different endowments with natural resources and waste absorption capacities. Economic activities, their impacts and responses by sub-national administrations can be usefully explored by regional (sub-national) environmental accounts currently tested in the Philippines.

2. "Economic" in the sense of the 1993 SNA (para. 13.12) definition of assets "over which ownership rights are enforced ... and from which economic benefits may be derived."

3. This distinction is typically ignored in attempts at assessing natural resource use outside the national accounts format. See for example the Philippine Environmental and Natural Resource Accounting Project DENR *et al*. 1994, pp. 2/3) which calculates the physical basis of natural resource "depreciation" as the difference of *all* additions and reductions during the accounting period. As a result, "cost" or "benefit" values and corresponding aggregates are generated that are not comparable with the conventional macroindicators such as NDP or capital formation.

4. In his 1997 Rafael Salas lecture in New York.

5. A 20% allowance for undercoverage in forestry for subsistence and illegal logging may not be sufficient, nor does there seem to be any allowance for self-supply of water.

6. However, capital formation in the national accounting sense is only possible through a production process which does not apply to the generation of natural assets by "Nature". See however for a different view, Landefeld and Howell (1997).

7. Well-known problems of applying damage valuations in cost-benefit analysis at the

project level accumulate at the national level. For instance, contingent valuation, exploring the willingness to pay for the avoidance of environmental effects, faces free-rider attitudes, short-sightedness or ignorance about long-term environmental impacts, and typically neglects effects of income levels and distribution when questioning individuals. At least for now, such valuations do not seem to be applicable in recurrent national accounting, but might be usefully explored in more experimental studies of selected environmental concerns or particular regions.

8. Themes include greenhouse effect, ozone layer depletion, acidification, eutrophication and waste.

9. Emissions by households are considered to be the result of household production generating negative value added.

20. Note that willingness-to-pay values include consumer surplus which is excluded from the price actually negotiated in the market. On the other hand, it can be shown that under certain (perfect market) conditions the marginal maintenance cost are indeed equal to the market price negotiated for pollution reduction (see e.g. Bartelmus 1997a).

2. The argument is that the incremental cost of *complete* reduction is very high while the incremental benefits of this reduction are not (DENR *et al.* 1994, p. 11). Optimal levels of control are therefore much lower than those of complete pollution abatement. However, marginal cost and benefit curves are hardly possible to establish unequivocally. Moreover, preventive avoidance is usually much cheaper than "abatement" or restoration and was therefore chosen as the basis for valuation in the SEEA study for the Philippines. Especially for a developing country, keen on avoiding the environmental mistakes of industrialized countries, such prevention costing seems to be particularly relevant.

22. Source: NSCB estimates.

23. Desirables include household production, leisure and environmental services of nature. Regrettables refer to environmental protection and mitigation of health effects or indeed defence itself. Any additions for leisure and nature services and deductions for defensive expenses would change the production boundary of the national accounts in an arbitrary manner because it would hardly be possible to obtain consensus on what is desirable or regrettable in society.

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