

# Environmental accounting in Papua New Guinea

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*The use of macroeconomic indicators based on the traditional system of national accounts for planning purposes may result in development strategies which are neither environmentally sound nor sustainable, mainly because these indicators do not account for the depletion of natural resources and losses in environmental quality due to social and economic activities. A new system of environmental and economic accounting is discussed, highlighting some of the problems of implementing such a model in Papua New Guinea.*

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A country could exhaust its forests, erode its soils, pollute its aquifers, and hunt its wildlife to extinction but measured income would not be affected as these assets disappeared (Repetto et al. 1989:4).

The Rio Earth Summit held in Rio de Janeiro, Brazil in June 1992, was pathbreaking. For the first time, a major international conference attended by world leaders was devoted to the environment. Although the meeting reached a low point when the United States refused to endorse key resolutions, the fact that the summit took place at all was hailed as a major breakthrough. The legacy of the Earth Summit is to translate resolutions into practical steps for achieving sustainable development. This includes integrating

environmental considerations into the development planning process.

All types of development planning rely on statistics. At the national level, the main source of statistical information used for macroeconomic policymaking is the system of national accounts. The system of national accounts is flawed in that it does not fully account for the role of environmental resources in national development. This point was forcefully underscored by Robert Repetto and others in their assertion that the system of national accounts

- neglects new scarcities of natural resources which threaten the sustained productivity of the economy
- fails to account for degradation of environmental quality and its effects on human wealth and welfare

- distorts accounting for environmental protection expenditures which tend to increase gross national product (GNP) but which may actually be social costs of the maintenance of environmental quality, that is, defensive expenditures (Repetto et al. 1989).

In a developing country such as Papua New Guinea where natural resources account for more than 50 per cent of national income, the use of national accounts statistics as indicators may provide a false picture of economic progress and welfare. Long-term development strategies based on such statistics may not be environmentally sound or sustainable.

In acknowledgement of these criticisms, the United Nations Statistical Office (UNSO) prepared a new framework for integrated environmental and economic accounting, the System of Integrated Environmental-Economic Accounting (SEEA) (Bartelmus et al. 1991b). In November 1991, a team from the Environment Department of the World Bank visited Papua New Guinea to attempt to apply the new accounting technique (Bartelmus et al. 1991a).

This paper has three objectives: to briefly discuss the features of the SEEA and its potential for measuring sustainable development, to highlight the obstacles to implementation of the SEEA in a developing country like Papua New Guinea, and to draw out the implications for government policy.

### **General features of the System of Integrated Environmental-Economic Accounting**

The traditional system of national accounts focuses mainly on market transactions and thus effectively excludes accounting for changes in the quality of the natural environment and the depletion of natural

resources. The SEEA attempts to account for these two effects and to arrive at adjusted concepts of national income and output, like adjusted net national product (NNP) and adjusted GNP, which are more compatible with long-term environmentally sustainable economic development. There are five major features of the SEEA.

- **Segregation and elaboration of all environment-related flows and stocks of traditional accounts.** The objective of this aspect of the SEEA is to identify that part of gross domestic product (GDP) which reflects the costs necessary to compensate for the negative impacts of economic growth, the so-called defensive expenditures (Leipert 1989).

- **Linkage of physical resource accounts with monetary environmental accounts and balance sheets.** This is an attempt to establish comprehensive physical resource accounts to be linked to the monetary balance sheet and flow accounts of the system of national accounts. The resource accounts will consider the total reserves of natural resources and changes therein even when those resources are not yet affected by the economic system.

- **Assessment of environmental costs and benefits.** The SEEA improves on the system of national accounts by including: (i) the use (or depletion) of natural resources in final demand; and (ii) changes in environmental quality resulting from pollution and other impacts of production, consumption, and natural events as well as environmental protection and enhancement. Other possibilities for inclusion include 'damage costs' of impairment of human health, recreation and aesthetic or ethical values.

- **Accounting for the maintenance of tangible wealth.** Sustainable development stresses the need to fully account for the use of both 'human-made' and 'natural' capital in order to signal non-sustainable production and consumption patterns (Bartelmus 1992). Natural capital, in this

sense, includes not only assets such as agriculture, forestry and fisheries but also non-produced natural assets of scarce renewable resources in the public domain. Examples include marine resources or tropical forests, non-renewable resources of land, soil and sub-soil assets (i.e. mineral deposits), and air and water resources.

- **Elaboration and measurement of indicators of environmentally adjusted product and income.** The underlying objective in accounting for the costs of depletion of natural resources and changes in environmental quality is to develop modified macroeconomic measures of national income. Examples are an environmentally adjusted domestic product (EDP) and an environmentally adjusted national income (ENI), both accounting for the welfare effects of environmental impacts and environmental protection.

The SEEA attempts to describe the main linkages between the environment and the national economy. However, since it is an extension of the system of national accounts, phenomena which occur exclusively within the environment are excluded. It is suggested that such phenomena are best dealt with by complementary physical accounts. The

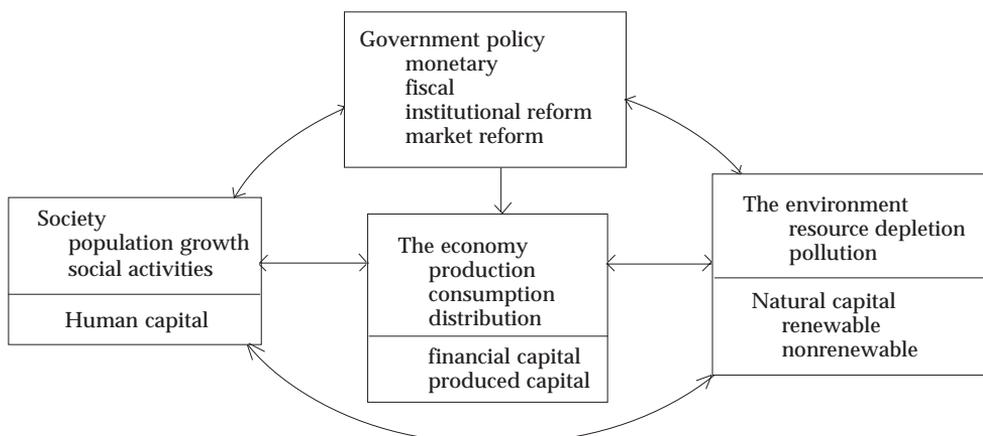
proposed SEEA also does not account for environmental degradation affecting the health and welfare of human capital.

## Developing an integrated data system

A simplified model of the interactions between society, the economy and the environment is shown in Figure 1. Although drawn as separate entities, these three sectors are closely interrelated in complex ways. Social and economic activities, which aim to meet human needs, may impact adversely on the environment. Negative impacts on the environment may also be caused by natural events (floods, earthquakes). Adverse impacts may be in the form of resource depletion and environmental quality degradation. Social and economic activities also tend to reduce the stock of natural resource capital. The fourth element in this model is the government which can affect social and economic activities and the state of the environment by manipulating various policy instruments.

To assist decision-making for sustainable development planning a data

Figure 1 A model of economy–environment interactions



system should be developed to incorporate all three components of this model, namely society, the economy and the environment. The UNSO has proposed a Framework for Developing Environmental Statistics (FDES) (United Nations 1984, 1988). Under this approach, variables are grouped into four major information categories: social and economic activities and natural events; environmental impacts of these activities and events; responses to environmental impacts; and, inventories, stocks and background conditions (Table 1). These information categories assume that social and economic activities, as well as natural events, cause environmental problems. Given that interactions between human beings and the environment are complex and difficult to model explicitly, it is sufficient at this stage to use these indicators as measures of environmental impacts. At present, FDES is meant to provide a starting point for the development of statistical data according to each country's priorities, environmental situation and data collection capabilities. It does not provide guidelines on implementing an environment statistical program.

## Implementing the System of Environmental-Economic Accounting in Papua New Guinea

Papua New Guinea is not lacking in data on the economy, the society, and to some extent, the environment, but the data are buried in various government departments and public institutions. Furthermore, much of it is in formats which are incompatible with environmental accounting. The main types of information required for starting the SEEA in Papua New Guinea are: (i) data accounting for the depletion of natural resource stocks, both renewable and non-renewable; and (ii) data accounting for environmental quality degradation.

### Accounting for natural resource depletion

#### Non-renewable resources

The main non-renewable resources in Papua New Guinea are minerals and petroleum. The share of minerals in total exports increased from 67 per cent in 1980

Table 1 Format for the Framework for Developing Environmental Statistics

Components of the environment	Social and economic, and natural activities	Environmental impacts of activities/ events	Responses to environmental impacts	Inventories, stocks and background conditions
Flora				
Fauna				
Atmosphere				
Water: Fresh water Marine water				
Land: Surface Subsurface				
Human settlements				

Source: United Nations, 1988. *Concepts and Methods of Environment Statistics: human settlements statistics—a technical report*, E.88 XVII 14, United Nations, New York.

to 78 per cent in 1991, while the share of agriculture in total exports declined from 34 per cent to 14 per cent over the same period (Department of Finance and Planning 1992a). The Kutubu petroleum project began production in 1992 and exports in 1993 are projected to reach about 949 million kina.

To account for the depletion of non-renewable resources, adoption of the user cost approach appears to be appropriate (El Serafy 1989). This approach is based on the concept of estimating the 'sustainable income component of mineral revenues'. This is the amount of mineral revenues which must be invested in non-mining investments to yield a permanent stream of income beyond the useful life of the mine. The computation of the user cost for mining is based on a formula which utilises mining revenues and a discount rate (El Serafy 1989). The major disadvantage of the user cost approach is that it does not consider the full extraction costs of mining because it only deals with the flow aspects of mining (i.e. mineral revenues), ignoring the stock aspects.

### Renewable stocks

Papua New Guinea is abundantly endowed with rich reserves of forests, fish stocks and agricultural land. The total land area is 46.5 million hectares of which close to 75 per cent (about 36 million hectares) is forested (Saulei 1990). The forests contain over 10,000 species of flora and fauna, including some 1,200 tree species and a large number of rare and potentially threatened species, especially among the fern and orchid families (Unisearch 1991). Saulei (1990) estimates that only 15 million hectares of the natural forest is commercially operable, and that this contains an estimated 500 million cubic metres of logs. Nadarajah reports recent research which halves this estimate (p. 50 this issue). Forests are a source of building and gardening materials, wildlife,

medicinal plants, food and recreation.

The renewable natural resource sector, comprising agriculture, forestry and fishing, accounts for over 31 per cent of GDP. Agriculture provides a source of livelihood for close to 85 per cent of the population (Department of Finance and Planning 1992a). Although Papua New Guinea has jurisdiction over 2.3 million square kilometres of ocean, the fisheries sector accounts for only about one per cent of total exports.

In order to provide data for the SEEA, there is a need for a data bank on both flows of natural resources and on existing stocks. The current situation regarding such data in Papua New Guinea is as follows.

- **Forestry.** There is a lack of adequate information on tree growth, yield or even the extent of the forest resource. The Forestry Department estimates that total area logged increased from 235,000 hectares in 1980 to 745,000 hectares in 1990, while the area covered by shifting cultivation increased from 106,000 hectares in 1980 to 219,000 hectares in 1990. However, these figures are likely to be underestimated in view of the inadequate level of monitoring and evaluation of forestry operations.

- **Fisheries.** There are only estimates of fish stocks. It is the general belief that for major fish categories (e.g. tuna), current levels of exploitation are well below potential yields, with the exception of prawns and crayfish (Harvey 1987).

- **Agriculture.** There are currently no reliable estimates of the extent of subsistence agriculture. Commercial agriculture (mostly export crops) is the mainstay of the economy. The bulk of commercial agriculture is in the form of plantation tree crops. Expansion of agricultural land is at the expense of forest land.

- **Wildlife.** Estimates of the economic value of wildlife have been put at

between 165 million kina and 220 million kina per annum (Unisearch 1991). These figures underestimate the true value because they do not consider non-economic and other uses of wildlife. Efforts to estimate the impacts of human activities on flora and fauna will be constrained by lack of knowledge about the broad patterns of species distribution, lack of adequate taxonomic information to allow species definition, and lack of skilled personnel in the Department of Environment and Conservation to survey wildlife resources.

### **Accounting for environmental quality degradation**

The major activities which cause environmental degradation are agriculture, logging, mining and hydroelectric energy development. Other activities which impact on the environment are manufacturing, mining, household waste disposal, marine transportation and natural events. Soil erosion is caused by a combination of natural processes and human factors such as clear felling of logs and shifting cultivation. Nearly all the mines operating in Papua New Guinea discharge wastes into rivers, adversely affecting aquatic life in both fresh and marine waters.

Data on environmental impacts of economic activities is virtually non-existent in Papua New Guinea. There is a lack of independent nationwide monitoring of soil loss through erosion. There is also little data on air and water pollution caused by agricultural chemicals (pesticides and fertilisers), although use of both fertilisers and pesticides is increasing in both plantation and smallholder agriculture. Individual mining and logging companies are required by law to provide environmental impact information as part of their 'Environmental Plans'. In most cases, however, such information is qualitative in nature and unsuitable for environmental accounting purposes.

The costing of environmental quality

degradation in the SEEA could be carried out by

- estimating expenditures on pollution abatement or control
- estimating hypothetical costs of achieving government standards
- estimating the cost of pollution damage
- estimating the monetary value of welfare loss according to preferences of individuals' willingness-to-pay for potential loss avoidance or willingness-to-accept compensation for potential economic loss.

Bartelmus et al. (1991b) suggest that the last approach might be useful for assessing some effects in Papua New Guinea given its history of compensation negotiations. In effect, the processes involved in such claims are not dissimilar to the simulation of market valuation techniques which have been introduced in the last two decades (Mitchell and Carson 1989). Indeed, compensation claims by class and tribal groups may reflect environmental and sociocultural values associated with non-market environmental quality losses. However, care should be exercised in the use of such measures in the Papua New Guinea context because some claims have been excessive. Sometimes such negotiations are driven purely by rent-seeking motives on the part of clan leaders rather than the extent of actual or perceived welfare loss. Nevertheless, there is merit in experimenting with the approach to determine whether reliable estimates could be obtained under certain conditions.

### **Policy implications**

#### **Monitoring and data collection**

The first pragmatic step in implementing the goal of sustainable development should be setting up an apparatus to conduct nationwide monitoring of resources and to collect data on a regular basis. Most

government departments already have some data collection expertise. However, such activities are uncoordinated, leading to incompatibility of data collected by various organisations. I would like to propose the idea of setting up 'Sustainable Development Units' within government departments such as Environment and Conservation, Agriculture and Livestock, Forestry, Fisheries and Marine Resources, Minerals and Petroleum, Transport, Trade and Industry, and Village Services and Provincial Affairs. These units could operate out of existing statistical and data collection offices. Their activities, including the format and types of data to be collected, would be coordinated by the Department of Finance and Planning.

If properly set up, such units could produce data which would be useful for national planning and development management. The Commonwealth Scientific and Industrial Research Organisation implemented a Papua New Guinea Resource Information System which could provide some information for the SEEA, but there is a need to extend it to cover aspects such as fauna and flora, including forestry, and to make it available to universities and government departments.

### **Awareness**

In spite of the high profile that environmental issues have been given by governments worldwide, individual governments are not 'putting their money where their mouths are'. In Papua New Guinea, for example, environmental protection services account for only a meagre 0.2 per cent of total budget expenditure (Department of Finance and Planning 1992b). Other areas related to the environment—health, community development, water supply, sanitation services—get less than one-third of budget allocation.

There is a need for an environmental awareness campaign aimed at government

policymakers and analysts, emphasising the need for effective environmental management. Such a campaign should be complemented by environmental education at all levels, from the grassroots to the tertiary level, to raise national awareness of environmental problems and remedies.

### **Training**

Statisticians and economic planners in government departments such as Finance and Planning, Agriculture and Livestock, Forestry, and Mineral Resources and Energy, must be given training (in the form of workshops, seminars, or short-term attachments) not only in the concepts of the proposed SEEA but also in relevant aspects of the emerging discipline of environmental economics. In particular, there is a need for government analysts to understand environmental effects and to have an appreciation for why such effects must be valued in economic terms. Training could be funded under technical assistance programs of the World Bank, Asian Development Bank, AIDAB, or other donor organisations.

### **Research**

Considerable research effort is required to provide the necessary inputs into the SEEA. The problem of data availability is especially acute in developing countries such as Papua New Guinea. In the past, the University of Papua New Guinea has conducted a number of environmental impact assessments for government departments and the private sector, and the university can play a leading role in research related to the SEEA. Possible areas of enquiry could include: impacts on agriculture, forestry and fisheries, soil erosion and run-off, and non-market valuation techniques. As usual, one of the factors constraining research activities is lack of adequate funding. Funding for environmental research could be made available by the World Bank, or through concessional funds made available to the Papua New Guinea government. External

consultants could be brought in to fill the gaps in local expertise and to train local personnel.

### Early warning

Papua New Guinea is in an early phase of industrial development and has not yet experienced the kinds of serious environmental problems occurring in some countries. The use of an approach such as the SEEA could serve as an 'early warning system' for potentially serious environmental problems. Given the dearth of reliable information on specific environmental impacts and the limited statistical capacity in the country, there is an urgent need for a significant injection of resources by the Papua New Guinea government and overseas development institutions before such a system becomes operational.

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