

# **POLICY USES OF THE PSEEA**

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## LIST OF ACRONYMS

<b>BOD</b>	Biological Oxygen Demand
<b>CO</b>	Carbon Monoxide
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>DENR</b>	Department of Environment and Natural Resources
<b>ENRAP</b>	Environment and Natural Resource Accounting Project
<b>GDP</b>	Gross Domestic Product
<b>NAMEA</b>	National Accounts Matrix including Environmental Accounts
<b>NEDA</b>	National Economic Development Authority
<b>NH<sub>3</sub>-N</b>	Ammonia
<b>NO<sub>2</sub>-N</b>	Nitrites
<b>NO<sub>3</sub>-N</b>	Nitrates
<b>NO<sub>x</sub></b>	Nitrogen Oxides
<b>NSCB</b>	National Statistical Coordination Board
<b>Pb</b>	Lead
<b>PCSD</b>	Philippine Council for Sustainable Development
<b>PM</b>	Particulate Matter
<b>PO<sub>4</sub>-P</b>	Phosphates
<b>PSEEA</b>	Philippine System of Integrated Environmental and Economic
<b>SEEA</b>	System of Integrated Environmental and Economic Accounting
<b>SNA</b>	System of National Accounts
<b>SO<sub>2</sub></b>	Sulfur Dioxide
<b>SS</b>	Suspended Solids
<b>TS</b>	Total Solids
<b>TSS</b>	Total Suspended Solids
<b>VOC</b>	Volatile Organic Compounds

## Policy Uses of Environmental Accounting

### 1. Environmental Accounting and Sustainable Development

All economies are heavily dependent on the environment as a source of materials and energy, as a sink for waste products, and as the physical habitat for human communities. This capacity of the environment constitutes our "natural" capital, which needs to be maintained intact, if not augmented, for sustainable development. Nevertheless, the state of this essential asset is rarely measured or monitored and often compromised for economic growth. Over the past decade, many countries have begun to seek environmentally sustainable strategies for development. Few people would dispute the importance of integrating environmental concerns into economic thinking. The question is, how can this be done in practical, operational terms? One approach to operationalize sustainable development has been to incorporate aspects of sustainability into the system of national accounts (SNA) through the system of integrated environmental and economic accounts, or SEEA (United Nations, 1993).

The national accounts are particularly important since they constitute the primary source of information about the economy and are widely used for policy analysis and development planning in all countries. However, the national accounts have a number of well-known shortcomings regarding the treatment of the environment and natural capital. SEEA, also known as environmental accounts or "green" accounts, are designed to correct these shortcomings by including the following:

- **Measurement of Wealth.** A country's wealth is critical in assessing its well being. The SEEA include all of a nation's "natural capital" such as minerals, fisheries, and wildlife, which is often not included at all, or only partly included in the national accounts.
- **Consumption of Wealth.** Over time, well-being depends on whether natural capital is being maintained for future generations, or is being depleted. While the SNA records the depreciation of produced assets, changes in natural capital have often not been treated in the same way. The SEEA record the extraction of nonrenewable assets like minerals, or unsustainable harvest of renewable assets like forests, as depletion of natural capital. Consequently, the SEEA provide a more complete assessment of the rate at which all assets are changing (declining or increasing), and can show if there is a substitution of produced for natural capital .
- **Dependence of Economic Activity on the Environment.** The national accounts often do not record the use of many natural resources which are essential to livelihoods but do not have a market price, like fuelwood or forest products. While some countries attempt to estimate the value of these essential goods, the coverage is usually incomplete in national accounts. SEEA estimate these non-market resources.
- **Cost of Environmental Degradation and Pollution.** The SEEA record the cost of degradation of natural capital resulting from economic activities, like soil erosion or water pollution, and indicate the source of degradation.

- ***Environmental Protection Expenditures.*** Expenditures to prevent environmental degradation or to mitigate harm may be included in the SNA but in a manner which makes them hard to identify; the SEEA makes these expenditures explicit.

SEEA assess the economic value of a country's natural resources and how they are used. They provide better measures of economic performance and link problems such as land degradation, groundwater depletion, or deforestation to the economic activities that cause them, or are affected by them. This encourages policy makers to regard the nation's natural resources as capital assets rather than unlimited "free goods" and promotes sound economic decision-making.

## 2. Role of SEEA in Policy Dialogue

The SEEA contribute to improved policymaking in several ways by:

- providing technical information for *monitoring and policy analysis* at the national level (discussed further in section 3)
- introducing a new way of thinking about resource management. This new way of thinking has two components. First, SEEA are based on a *systems approach* in which the key feature is to understand the interdependence of activities, of economic and environmental considerations, and consequently of tradeoffs. Secondly, the use of SEEA is based on a *pro-active approach* to policy-making rather than a reactive one, an approach to policy based on anticipation of possible future situations through a series of What if? scenario simulations.
- providing a *transparent system of information* about the state of the environment and relation between human activities and the environmental situation. The power of the SNA for economic information stems from the fact that it has become an information system to which all parties agree (despite recognized limitations). The SEEA organizing framework can play a similar role in searching for common ground to describe the environment and environment-economic linkages in a potentially conflict-ridden situation. Also, by making the environment-economy interactions more transparent to non-specialists, it improves the role the public can meaningfully play in policy dialogue.
- bringing environmental considerations into *macro-level economic policy analysis* in a formal and consistent way which, in turn, provides a concrete basis for productive dialogue among line Ministries about alternative, cross-sectoral development strategies and the associated policy trade-offs.

From the contributions described above, it is clear that SEEA has two broad roles to play: 1) a purely technical role, providing essential information to technical experts for monitoring and policy analysis, and 2) a broader, institution-building role by providing the framework and information system for more effective dialogue throughout government and society about environmental-economic possibilities. While most emphasis on SEEA has been on the technical contributions of SEEA to policy analysis, the importance of institution building for transforming the policy-making landscape should not be underestimated.

This paper discusses the contribution to policy of the Philippine version of the SESA, the PSEEA. The next section provides an overview of the broad role PSEEA can potentially play in policy making and planning. This is followed by examples of policy applications of environmental accounts, based on the PSEEA where possible and from other countries where the data from PSEEA are not yet available. This discussion is divided into two sections, one for the asset accounts and one for the activity accounts. The last section addresses some of the institutional factors that may make PSEEA more effective in the policy-making arena.

The Philippines has been a pioneer in the area of environmental accounting and has made major contributions to the improved understanding of environmental accounting, both the conceptual and practical aspects. Because environmental accounts are a new addition to the area of national accounts, the international community has not yet come to a consensus on the best way to handle many issues, and is still learning about the potential for using these accounts in policy analysis. Consequently, PSEEA should be viewed as an evolving system. This is an area in which the Philippines also has much to teach the rest of the world.

### **3. PSEEA: Contributions to Policy**

The Philippines has produced a number of strategic planning reports, such as, *Philippine Agenda 21* (PCSD, 1997), and *Medium Term Philippine Development Plan* (NEDA, 1998), which make clear that the Philippines must design a strategy for development that takes into account increasing environmental degradation and resource scarcity. Sustainable development can be achieved, in part, by greater reliance on sound economic practices. For example, it is recognized that, except for basic humanitarian needs, environmental and natural resources should go to the most productive economic use, and that user costs should reflect the full economic value of resources.

For extractive industries, like mining, forestry and fisheries, this principle for resource management means that taxes should capture the full economic rent, and that the rent should be used to promote sustainable development. For other resources, including the use of water and air as a sink for pollutants, user charges should cover the full economic value - the financial cost, the cost of degradation of resources, plus a scarcity cost, where appropriate.

The implementation of strategies for sustainable development relies, in part, on two key activities: 1) continuous *monitoring* of the state of the environment and the economy, and progress toward meeting the goals identified in strategic plans; and 2) *policy analysis* of specific elements of the plans, especially potential trade-offs among the principles of efficiency, equity, and sustainability. The PSEEA can play a critical role in both of these activities by providing policy-makers with the information necessary for sustainable management of resources. The information - categorized according to the two components of the PSEEA, the asset accounts and the activity accounts - can be used to address the following issues:

1. Sustainable management of natural capital (Asset Accounts)
  - what is the *economic value* of natural assets
  - what is the *economic cost* of depletion of natural assets
  - is the resource *rent being recovered* successfully by government through economic instruments

- is rent from exhaustible resources used to promote a *sustainable economy* - e.g., is it being reinvested in other activities that can take the place of minerals once exhausted
  - is rent from renewable resources used to promote a sustainable economy - e.g., are fees set high enough to discourage over-harvesting
  - is the *maximum rent* being generated by natural resource policies
  - if not, are there *other socio-economic objectives* that are being met, such as regional equity or employment creation
  - what are the economic *trade-offs* between economic efficiency and equity/employment creation
2. Economically efficient use (“allocation”) of resources (Activity Accounts)
- what are the *full economic prices*, including environmental degradation?
  - what is the *sectoral comparative advantage* of resource use- the contribution to GDP of using resource for specific economic activity
  - what are the *opportunity costs* and *trade-offs* among competing users of resources
  - what are the costs of resource *degradation*
  - what are the costs of *environmental protection services*
  - what are the environmental implications of *alternative development strategies*

The asset accounts and the activity accounts both provide indicators for monitoring progress toward sustainable development as well as more detailed information necessary for policy analysis. Indicators used for monitoring can usually be drawn directly from the PSEEA by the staff of the statistical office with little or no manipulation. Policy analysis based on the PSEEA, such as integrated environmental-economic modeling, usually requires collaboration with other technical experts, especially economists. In addition, questions raised by the policy analysis of the PSEEA can act as a catalyst for a wide range of sectoral and macroeconomic analysis concerning the environment.

Some of the applications described in this section have already been carried out by the NSCB in its reports on the asset accounts, environmental degradation and environmental protection expenditures (NSCB, 1998). Some additional applications can be carried out with the information already available, while other applications would require additional data collection and collaboration with technical experts in other Departments. In the next sections each application is illustrated with examples from the environmental accounts of different countries, followed by examples based on data from the PSEEA.

#### 4. Policy Applications of PSEEA Asset Accounts

##### ***Value of natural capital***

One of the fundamental indicators of sustainable development, and thus one of the most important indicators to monitor, is the state of a country’s wealth, both produced (manufactured) assets and natural assets<sup>1</sup>. Economic sustainability requires, at a minimum, that total wealth is not decreasing over time (Pearce and Atkinson, 1993). The PSEEA asset accounts give a more accurate picture of the country’s wealth by providing an estimate of the value of forest, land, mineral, fishery, and water assets, and changes

<sup>1</sup> Human capital is equally important, but a satisfactory way to measure it has not yet been found.

in these values over time. The value of all natural assets can be summed over all resources to provide an indicator of the total natural capital in the country. This indicator can further be compared to the value of manufactured capital in the country. The kinds of indicators useful for monitoring the country's well-being and progress toward sustainable development include:

- changes in the physical volume of capital over time
- the economic value of natural assets, changes over time and comparison to produced capital
- the cost of depletion of natural capital

The physical accounts are necessary for an ecological assessment of resource stocks; in addition, the physical accounts alone can sometimes provide a striking picture of the state of a resource that is highly informative and useful for motivating necessary changes in policy. For example, the physical asset accounts of Namibia's fish stocks since the 1960's have provided a very clear picture to policy-makers of the devastation resulting from uncontrolled, open-access fishing (Figure 1). However, a more complete assessment of sustainability requires that the economic value of a resource also be known.

A comparison of produced (manufactured) and natural capital indicates not only *total wealth*, but also the *diversity* of wealth, and its *volatility* due to price fluctuations, an important feature for economies dependent on sensitive commodities. Diversity is important because, in general, the more diverse an economy is, the more resilient it will be to economic disturbances. Volatility is also important in planning for the future- lower volatility contributes to more stable economic development.

A number of countries now routinely report figures for natural assets along with produced assets, for example, Australia (Figure 2) and Canada. In the case of Australia, its non-produced assets, consisting of land, subsoil assets, and forests, account for 34-40% of the value of total assets with land accounting for most of the value (Australian Bureau of Statistics, 1998). Botswana, a country highly dependent on mineral resources (averaging 30% of GDP), has adopted a development goal of diversifying its economy to reduce dependence on minerals. The combined asset accounts for manufactured and natural capital provide one way to monitor progress toward diversification. There has been a gradual substitution of manufactured capital for natural capital: minerals accounted for nearly two-thirds of total assets as recently as 1990, but has since declined to about 50% (Figure 3). A similar analysis of the PSEEA indicates that the value of total assets has been increasing since 1988 in the Philippines (Figure 4) with the share of produced assets increasing from about 25% to about 30% of total assets (Figure 5).<sup>2</sup>

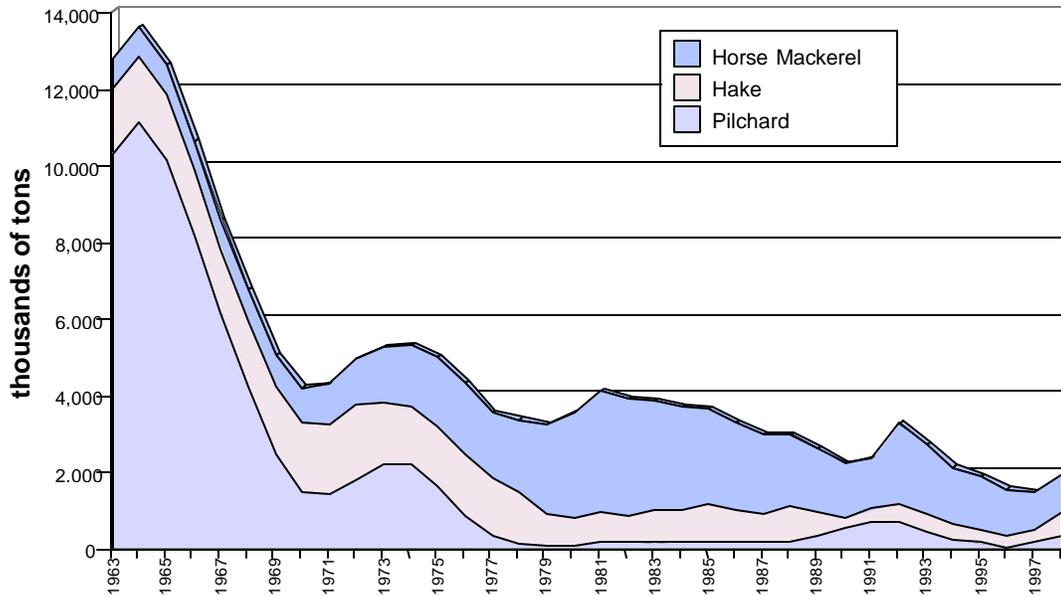
In addition to a measure of overall wealth, a measure of the annual cost of depletion is necessary in order to monitor how fast non-renewable resources are being used up, or whether renewable resources are being used sustainably. Figure 6 indicates relatively high depletion for the Philippines in 1988, about 27 billion pesos, falling to about 5,000 billion pesos by 1993. A rapid decline in depletion is considered a move toward a more sustainable economy. About 90% of the resource depletion in 1988 occurred in forestry, which means that forests were being used unsustainably. The ban

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<sup>2</sup> Manufactured capital stock was estimated by applying the perpetual inventory method with linear depreciation to an unpublished times series of Gross Fixed Capital Formation. Figures for the value of fish stock have not been included due to lack of information at this time. Also, it seems likely that the value of water stocks has been overestimated. With future revisions to the asset accounts of PSEEA, produced capital is likely to assume a more important role.

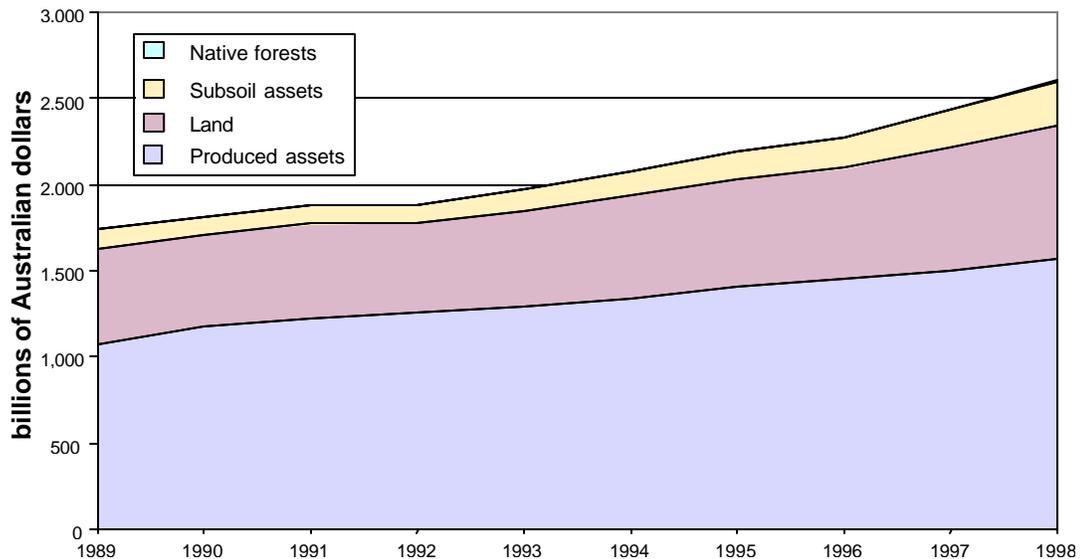
on logging in 1992 eliminated forest depletion. However, examining resource depletion for resources other than forestry (Figure 7), a disturbing trend is emerging: depletion of water and fisheries has been increasing rapidly.

**Figure 1. Biomass of commercial fish species in Namibia, 1967 to 1998**



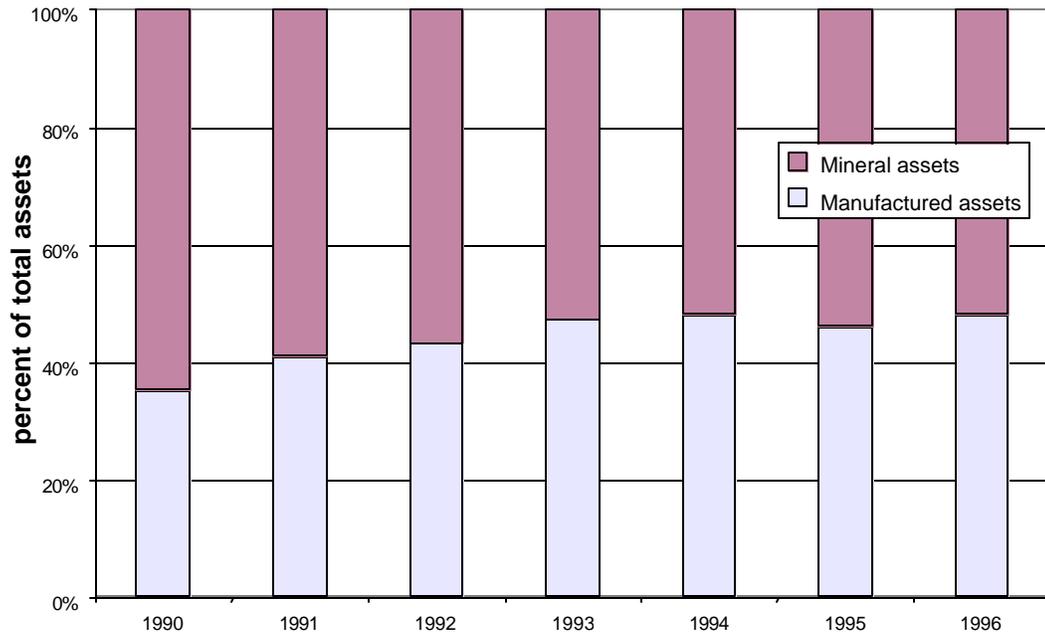
Source: Lange and Motinga, 1997.

**Figure 2. Value of produced and non-produced capital assets in Australia, 1989-1998**



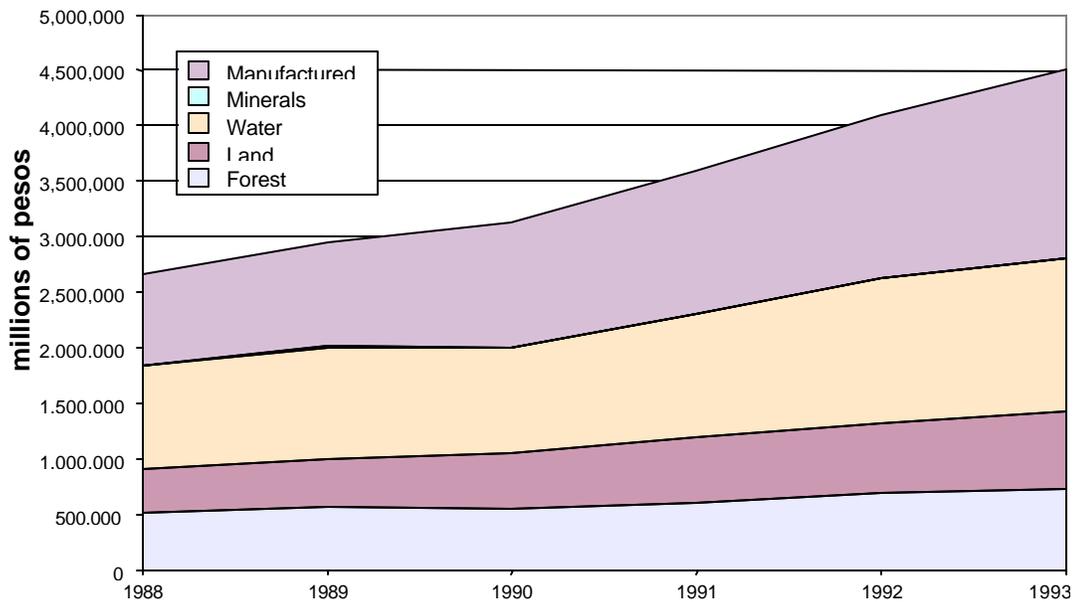
Source: Table 1, Consolidated Balance Sheet of (Australian Bureau of Statistics, 1998)

**Figure 3. Shares of produced assets and mineral assets in Botswana, 1990 to 1996**



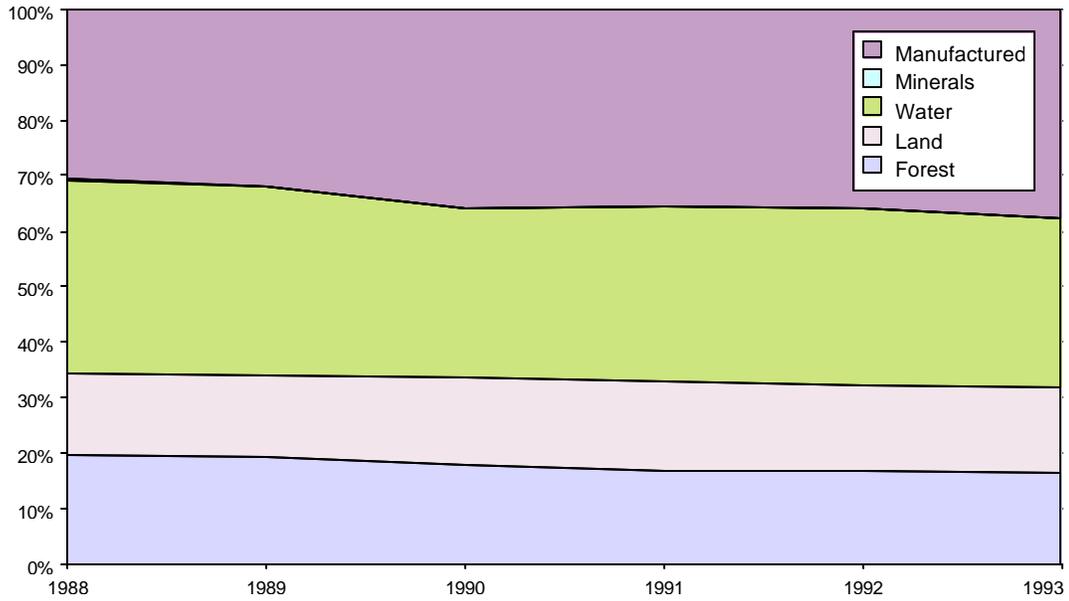
Source: Lange and Gaobotse, 1999.

**Figure 4. Value of produced and non-produced assets in the Philippines, 1988 to 1993**



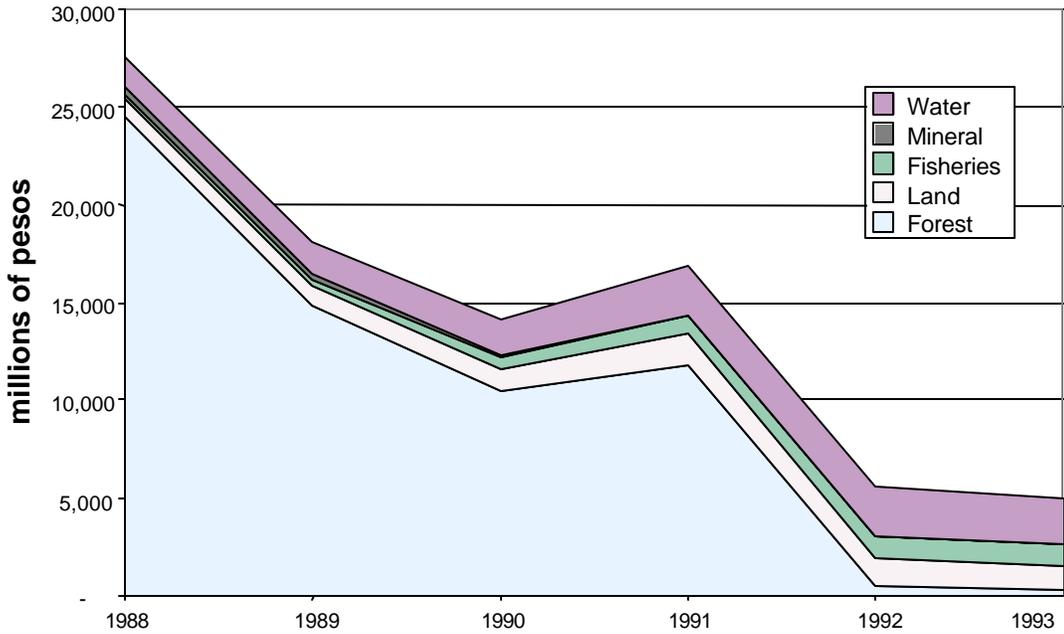
Source: (NSCB, 1999)

**Figure 5. Shares of produced and natural assets in the Philippines, 1988 to 1993**



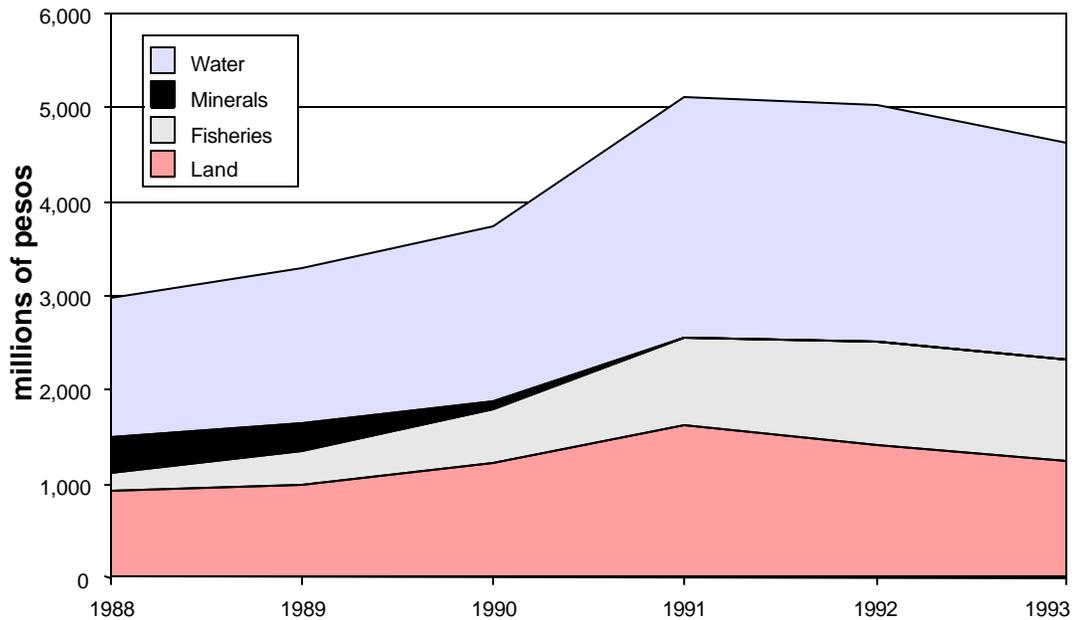
Source: (NSCB, 1999)

**Figure 6. Resource depletion in the Philippines, 1988 to 1993**



Source: (NSCB, 1999)

**Figure 7. Resource depletion except for forestry, 1988 to 1993**



Source: (NSCB, 1999)

### **Resource rent**

The value of resources stems from the high profit that they generate - in excess of the opportunity cost of capital - due to the scarcity of the resource ; this “excess profit” is called resource rent. In many countries, resources such as minerals, natural forests, and marine capture-fisheries belong by law to the government. Private companies utilizing these national assets are often regulated by government to ensure that these resources are managed for the best interest of the citizens. From an economic perspective, sustainable and equitable management of these resources requires that the resource rent be recovered by the government through appropriate taxes and used for the benefit of all citizens.

Non-renewable resources like minerals (or renewable resources like fisheries that are harvested unsustainably) will eventually be exhausted, and the employment and income they generate will end. Economic sustainability requires that some portion of these rents be re-invested in other assets or economic activities which can replace the employment and income from the resource-based industries once the resources are exhausted. In this way, exploitation of the resource can be *economically* sustainable - because it creates a permanent source of income - even though non-renewable resources are, by definition, not *biologically* sustainable

Renewable resources, like forests or fisheries, are capable of providing an income for all future generations, if managed sustainably. But in the absence of regulation or sustainable management practices, they are often subject to over-exploitation and eventual exhaustion. Policy instruments to guarantee sustainable management include setting limits to the amount that can be harvested and levying fees to discourage over-exploitation. The fees should be set high enough to recover the rent generated at the most profitable and sustainable level of production, so that it becomes unprofitable for companies to harvest at levels that deplete the resource stock.

In addition to concerns about efficiency and sustainability, recovery of resource rent from commercial operations is necessary for a more equitable benefit from the use of resources. This is especially true in developing countries that rely heavily on extractive industries. The excess profits can be used to support development that better the lives of all citizens, not only the minority who may own companies.

The economic rent is used to construct the monetary asset accounts for resources, but it is also an extremely useful indicator in its own right, and can be used to help address a number of critical policy issues:

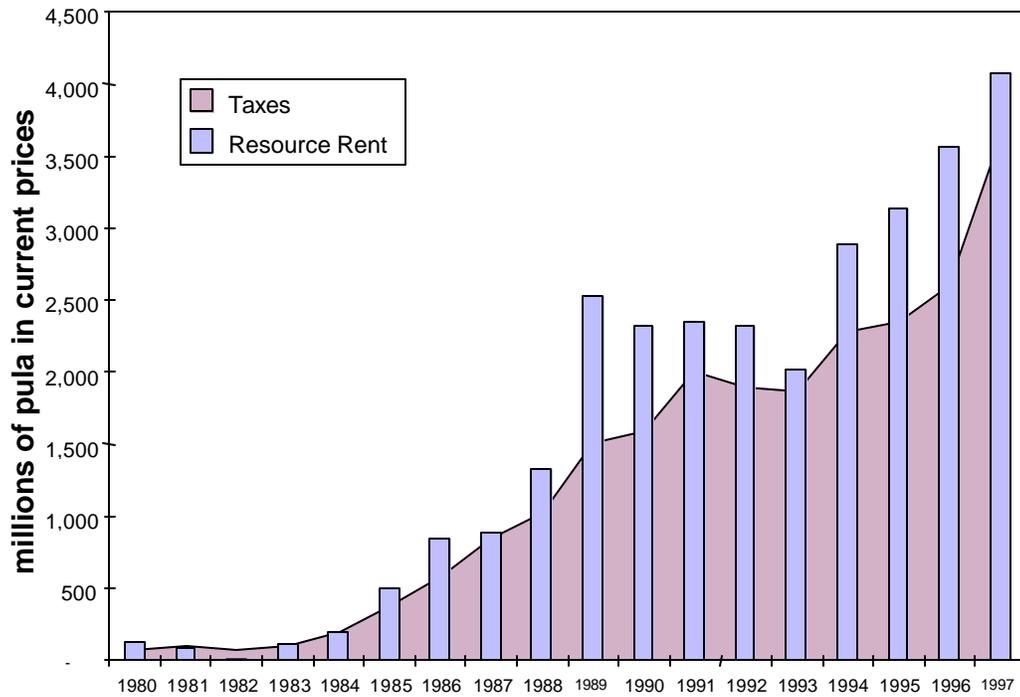
- how much rent is being generated, and is the resource rent being recovered by government
- is rent being used to promote a sustainable economy - i.e., is rent from non-renewable resources being reinvested in other activities and are fees for renewable resources close to the economically optimal rent
- is the maximum rent being generated by natural resource policies?
- if not, are there other objectives that are being met, for example, equity and employment creation. What are the economic trade-offs between economic efficiency and equity?

Figures 8-10 provide several examples from the mining industries of Botswana and Namibia, and the fishing industry of Namibia. In all cases, significant amounts of resource rent have been generated. It is instructive for policy-makers to note that in some cases, e.g., Botswana, rent may be increasing in a relatively stable manner (Figure 8), while in other cases, e.g., Namibia, rent may be quite volatile (Figure 9). Rent has been successfully recovered from mining activities in both Botswana and Namibia. By contrast, much of the resource rent has not been recovered from Namibia's fishing industry, and, instead, is accruing to the private sector (Figure 10). This is partly the result of Namibia's policy to promote an indigenous industry (an issue discussed further below). This observation was important in helping to spur a review of Namibia's fisheries policy.

Rent and the recovery of rent in the Philippines are shown in Figures 11-14. As with the asset accounts, forestry dominates the generation of rent, and total resource rent has declined significantly in response to the logging ban (Figures 11 and 12). Overall (Figure 11), taxes do not fully recover rent. Mineral rent (Figure 14) has also declined, reflecting lower world prices. Only rent from fisheries has increased (Figure 13), which accounts for the slight increase in total rent between 1992 and 1993.

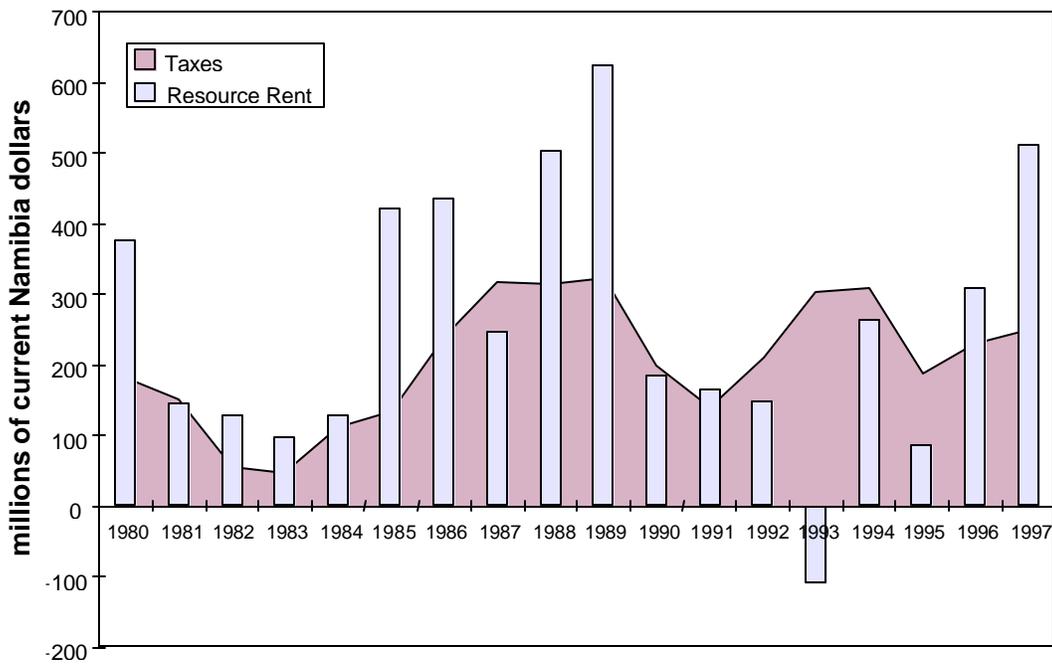
In future work, it would be useful to disaggregate this analysis further, for example separating commercial and municipal fishing. This distinction is important both because the rent generated per unit of production may differ, and therefore the economic value of the assets may differ according to how they are being exploited (value depends on production technology and policy). In addition, the distinction may be important for understanding the social implications for regional development and equity, or access to resources of different groups in society. It may also be useful to review taxation of natural resources in order to determine under what circumstances it is appropriate for resource rent to accrue to private users (for example, municipal fishing) and when it is appropriate for government to collect the rent for use on behalf of all citizens.

**Figure 8. Resource rent and taxes from mining in Botswana, 1980 to 1997**



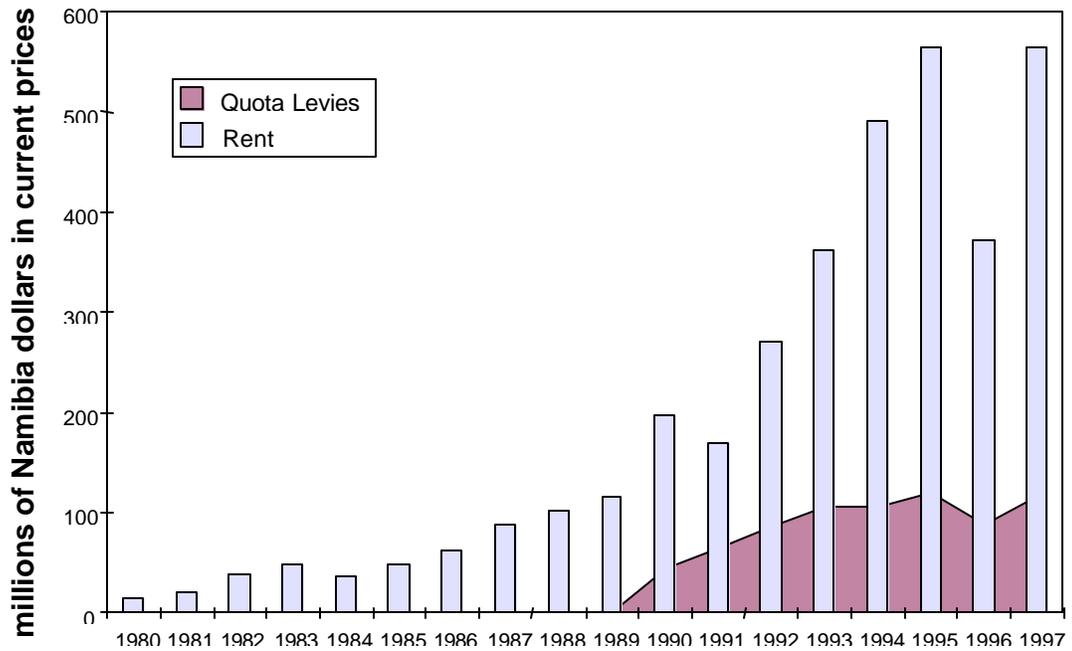
Source: Lange and Gaobotse, 1999

**Figure 9. Resource rent and taxes from mining in Namibia, 1980 to 1997**



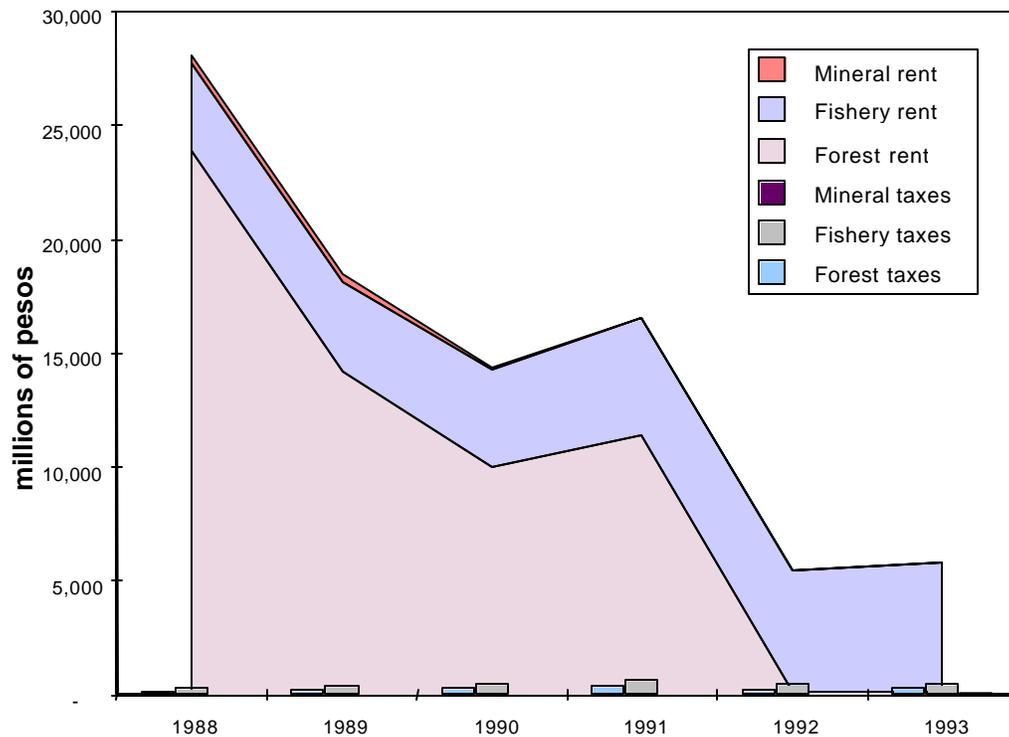
Source: Lange and Hassan, 1999

**Figure 10. Resource rent and taxes from fishing in Namibia, 1980 to 1997**



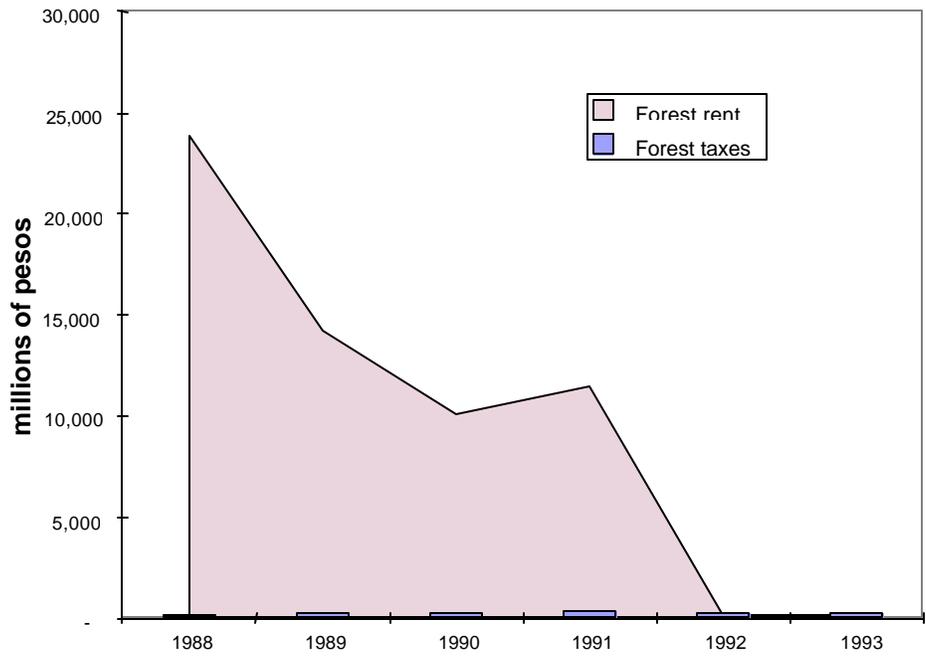
Source: Lange and Hassan, 1999.

**Figure 11. Resource rent and taxes from forestry, fishing and mining in the Philippines, 1988 to 1993**



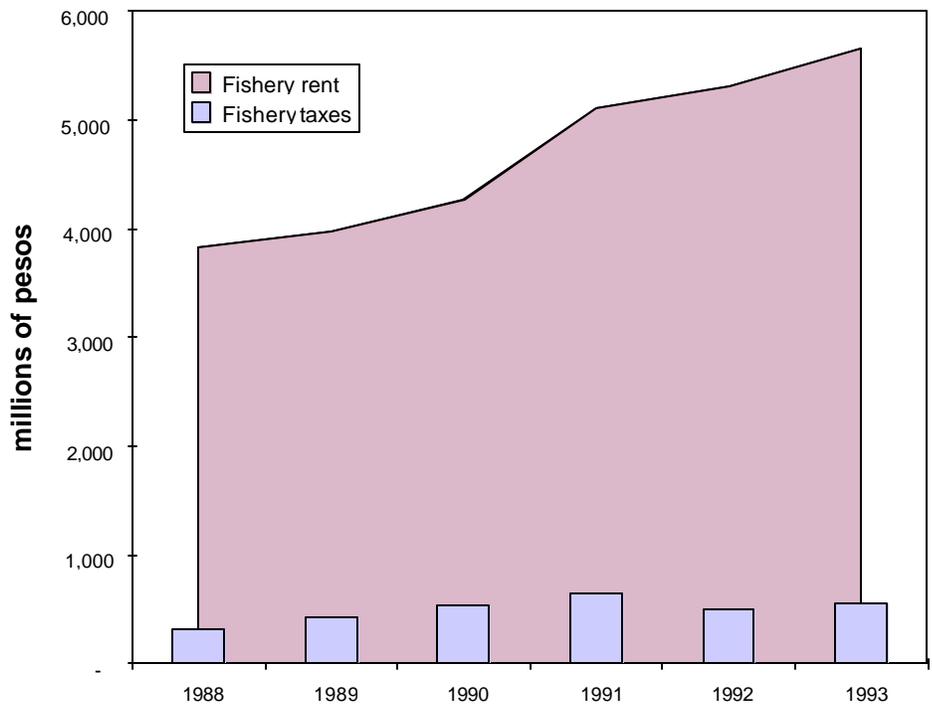
Source: (NSCB, 1999)

**Figure 12. Resource rent and taxes from forestry in the Philippines, 1988 to 1993**



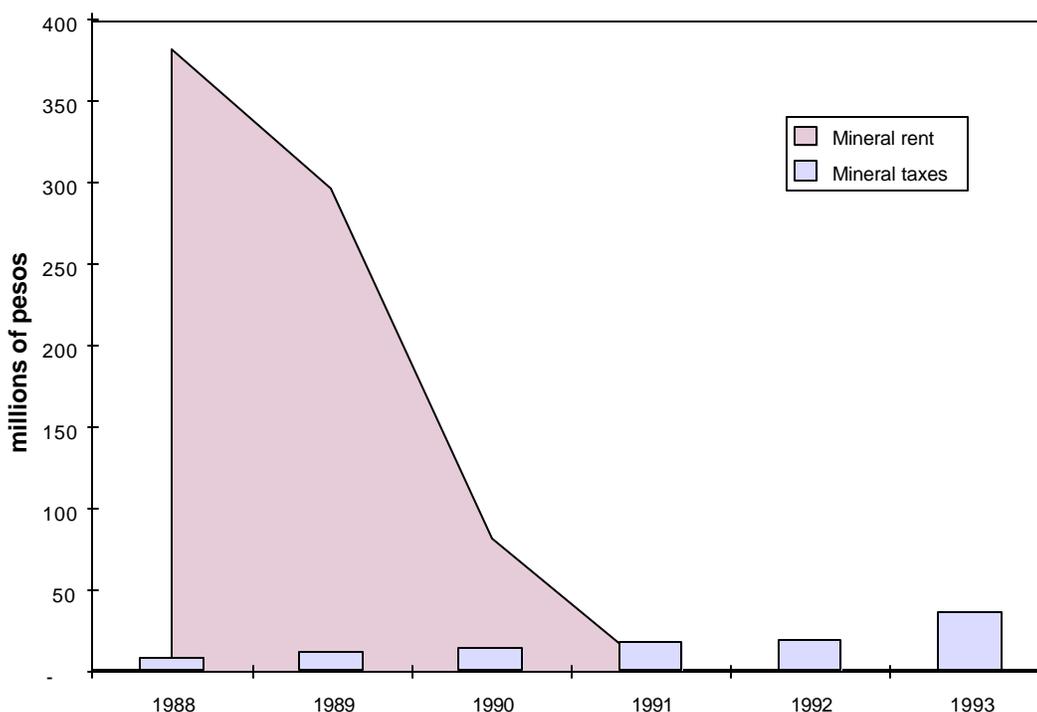
Source: (NSCB, 1999)

**Figure 13. Resource rent and taxes from fishing in the Philippines, 1988 to 1993**



Source: (NSCB, 1999)

**Figure 14. Resource rent and taxes from mining in the Philippines, 1988 to 1994**



Source: (NSCB, 1999)

The issue of whether extractive industries are being used to promote sustainable development is an important one for all economies. Minerals are not very important in the Philippine economy, so the assessment of management of non-renewable resources will not be further addressed in this paper (See Lange and Gaobotse, 1999, for further discussion of this issue). Given the importance of renewable resources, it is important for policy-makers to know whether the taxes and user fees promote sustainable harvesting at the economically optimal level. Such an analysis would require considerably more information about the fishing and forestry industries in the Philippines.

Sometimes countries choose policies that sacrifice economic efficiency in order to achieve other objectives such as more equitable regional distribution of employment and income. For example, the fisheries policy of Norway is not economically efficient—the industry earns less than the opportunity costs of capital, so rents are negative and the value of fish stocks, under current policy, is zero (Sorenson and Hass, 1998). The industry only continues with government subsidies. Support to small-scale fisheries is a component of the strategy to promote equitable regional development in Norway.

The pursuit of broader socio-economic goals may have an economic price and policy can be most effective when this price is known. Where potential conflicts exist, the trade-offs need to be identified and quantified, and clear guidelines for decision-making should be defined. The PSEEA can contribute to this kind of policy analysis, though it will typically require cooperation with other Departments and fairly detailed information.

Environmental accounts constructed from detailed company surveys provide data that allow the calculation of rent generated by each company. A comparison of rent across companies sheds light on economic efficiency within an industry. It can also be used to assess the effectiveness of policies designed to achieve other socio-economic objectives. This kind of analysis has been done for Namibia, for example, in order to determine the cost of a policy of Namibianization of the fishing industry.

Prior to independence in 1990, Namibia's fishing industry was controlled almost entirely by foreign operators and created little employment in Namibia. After independence, policies were changed to encourage Namibians to enter the industry and to create Namibian employment. These policies have resulted in over-capacity and, essentially, a trade-off between economic efficiency (maximizing rent) and other socio-economic objectives (Namibianization and employment creation) designed to improve equity (Manning and Lange, 1998). The company surveys indicate that there is a wide range of rent per ton of fish generated by different companies. The rent generated by the high-earners is a rough indication of the rent that could be generated if the industry operated in a more efficient manner. The difference between that efficient rent and actual rent is a preliminary measure of the economic cost of promoting equity.

Similar analyses can be applied to any resource-based industry, and can be used to assess various kinds of trade-offs between economic efficiency and equity, such as the access of small-scale v. commercial sectors within an industry. The issue of who benefits from resource exploitation, both regionally and within a region, can be especially important for equity, and is also related to sustainability because poverty alleviation and sustainability are often linked.

Some countries already conduct extensive analysis of rent recovery and of the beneficiaries of rent. These analyses are typically carried out by respective line ministries. Even in such countries, the advantage of environmental accounts is to integrate this kind of analysis for all natural resources, so that it can be viewed as a single system, rather than each resource managed independently. In this way, the management of all resources can be viewed simultaneously, and significant differences in the way different industries or resources are treated can be readily identified, such as the case of mining and fishing in Namibia.

## **5. Policy Applications of PSEEA Activity Accounts**

### ***Monitoring and simple policy analysis***

The activity accounts are much more extensive than the asset accounts and their applications are subsequently that much more extensive. Activity accounts consist of three components: sectoral use of resources (in physical and monetary terms), the emission of pollutants and degradation of resources (in physical and monetary terms), and expenditures for environmental protection services. The NAMEA system for environmental accounting, which is being adopted by Eurostat, goes further with the physical accounts than the SEEA: physical emissions are aggregated into groups based on environmental "themes" such as greenhouse gases or acidification (Keuning et al., 1999). The emissions are aggregated by weights corresponding to the strength of their contribution to an environmental problem. This is an especially useful way to report information, maintaining the detail of each individual pollutant, but aggregating them in a way that indicates their total effect.

At their simplest, the activity accounts monitor the time trend of resource use, pollution emissions, the costs of environmental degradation, and environmental protection expenditures, both total and by industry. A rising share of environmental degradation costs and expenditures for environmental protection services, for example, would be a clear warning sign of sustainability problems associated with economic development. Monitoring allows the easy identification of major problems and their sources, which is necessary for setting priorities for action to reduce pollution. However, much more information and analysis is needed to determine what to do about a deteriorating environment.

Environmental accounts, like PSEEA, should help policy-makers answer fundamental questions such as the following: When there are so many environmental problems, what should be done first? Economic principles provide an answer to that question: priorities are based on opportunities to achieve the greatest benefit at the cheapest cost. In this case, the benefit refers to the value of environmental degradation and damage avoided, and the cost refers to the cost of measures to prevent or remediate pollution<sup>3</sup>. The information needed for this includes several different kinds of accounts:

- Physical accounts that show the sources of environmental degradation
- Monetary accounts that show the cost of policy action, that is, prevention or remediation
- Monetary accounts that show the benefits of policy action, that is, the value of damage that will be prevented

In terms of assessing the relative importance of different sources of degradation, the construction of environmental-economic profiles, or “eco-efficiency” indicators has become a common first step. The eco-efficiency indicators report for each industry’s economic and environmental factors such as levels or shares of:

- value-added
- employment
- environment impact, physical and monetary (water use, soil degradation and pollution emissions, etc.)

These descriptive statistics provide a first approach to comparing the relative economic contribution and environmental burden from each sector. One way these profiles can be calculated is as each industry’s percent contribution to the country’s total, e.g., the percent of total value-added, employment, and CO<sub>2</sub> emissions contributed by each industry (and households, where applicable). In the example of greenhouse gas emissions in Germany, the electric power sector stands out as a disproportionately high source of emissions relative to its low employment and value-added contributions (Figure 15).

Eco-efficiency profiles can also be calculated as the emissions per unit of sectoral value-added. For example, Figure 16 shows the comparative economic benefits of water use between two countries that share increasingly scarce water sources, South Africa and Namibia: the amount of value-added generated per cubic meter of water input by sector. For both countries, the difference in value-added generated by water in agriculture and in manufacturing is as much as two orders of magnitude. Namibia consistently generates more economic value for the water it uses than South Africa

<sup>3</sup> This is the basic principle of benefit-cost analysis. An alternative principle for setting priorities is cost-effectiveness analysis, in which a physical target is specified, such as a given concentration of a pollutant, and a policy-maker’s only concern is how to achieve that target in the most inexpensive way.

(discussed below), which has been a factor in the on-going negotiations between South Africa and Namibia over how to share their common water in the future.

This kind of analysis can also be done for other environmental impacts, such as water pollution and land degradation, and can be spatially disaggregated within a country. To obtain a rough indicator of a broader social contribution, these profiles can be constructed on the basis of employment created, e.g., employment per cubic meter of water input or water pollution by industry. This kind of analysis is particularly useful for putting a concrete figure to ideas that may be commonly acknowledged but not quantified sufficiently for sound policy decisions.

This simple statistical description can be greatly improved by additional analysis. Two examples are provided here: calculation of eco-efficiency profiles for total (direct + indirect) emissions, and calculation of resource subsidies, which provide an estimate of the difference between the actual user cost and the economic cost.

While the eco-efficiency indicators shown in Figure 15 report the *direct* generation of pollution associated with production, it is important for policy makers to understand the *driving forces* that cause such levels of pollution. That is, what are the demands in the economy that led to such high levels of industry output and the associated greenhouse gas emissions from the electric power sector in Figure 15?

The driving forces for economic production are the final users—to meet a given level and composition of exports or of household consumption, for example, an extensive web of industrial production is required. Input-output analysis is used to measure the total (direct + indirect, or upstream) impact of a given final use. As many years of environmental input-output analysis has shown, the total impacts can often be much larger than the direct impact (Miller and Blair, 1985). Figure 17 provides a comparison of the direct and total emissions of sulfur dioxide for industries in Sweden. This approach is especially useful in understanding the effects of different patterns of household consumption or trade on the environment (Duchin and Lange, 1998). Similar statistics have been constructed for countries such as the Netherlands (Keuning et al. 1999), Germany (Tjahjadi et al. 1999), Canada (Statistics Canada, 1997), Norway (Sorensen and Hass, 1998), and the UK (Vaze, 1999).

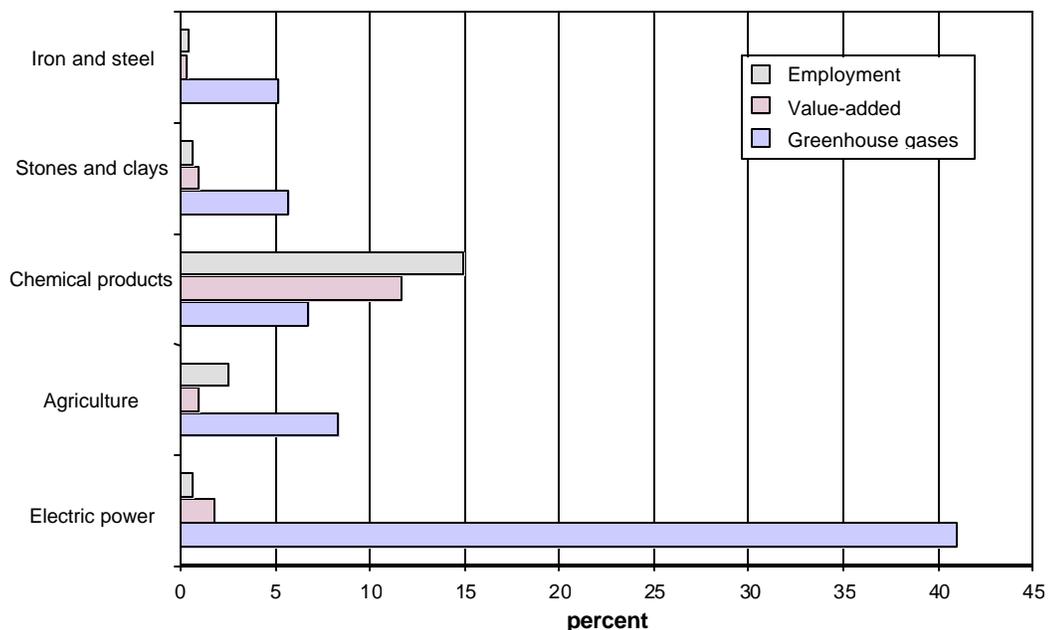
Environmental accounts have also been used to monitor resource pricing, another important issue for environmental management. In many countries, the market price for resources such as water or water effluent does not reflect the true financial cost, let alone the full economic cost. Monitoring subsidies is clearly important both for sustainable management of resources (when prices are subsidized, there is little incentive for conservation) as well as for equity (identifying which groups in society receive the greatest subsidy). Often, different groups in society are charged different prices and receive different subsidies. The relative subsidies received by each group may actually conflict with other government policies.

For example, in a comparison of Namibia and South Africa, Namibia's farmers continued to receive significant water subsidies, though much less than South Africa's farmers, despite government policy objectives for this sector (Figure 18). Quantifying the value of the subsidy has been particularly useful both in domestic discussions about water and agricultural policy, and also in the negotiations over future allocation of shared water sources between Namibia and South Africa.

Similar profiles of the sectoral use of all resources and pollution would provide a very clear and comprehensive assessment of the economic incentives for pollution control and sustainable resource use in the Philippines. In a country as large and diverse

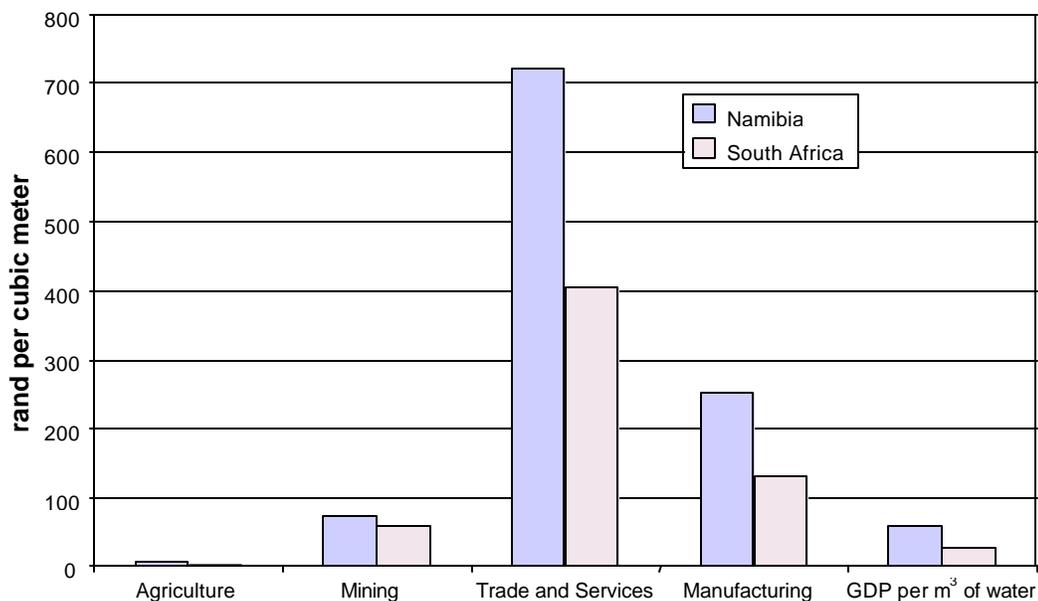
as the Philippines, it would also be useful to compare these profiles among different regions, especially given the concern with regional development.

**Figure 15. Shares of greenhouse gas emissions, value added, and employment by selected industries, Germany 1993**



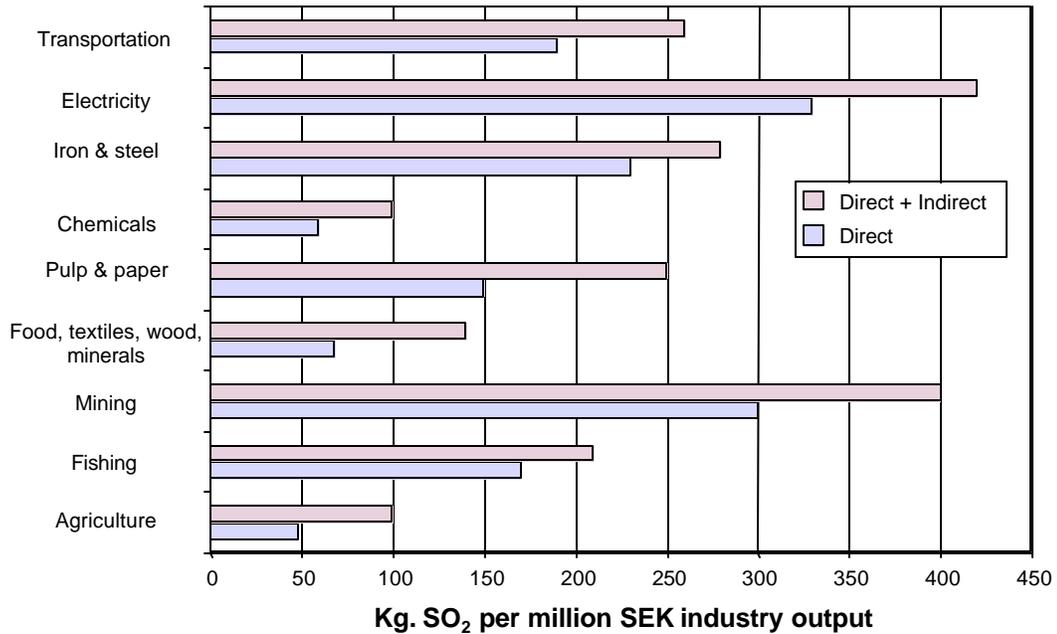
Source: Figure 10 in (Tjahjadi et al. 1999)

**Figure 16. Value-added per cubic meter of water input by sector in Namibia and South Africa in 1996**



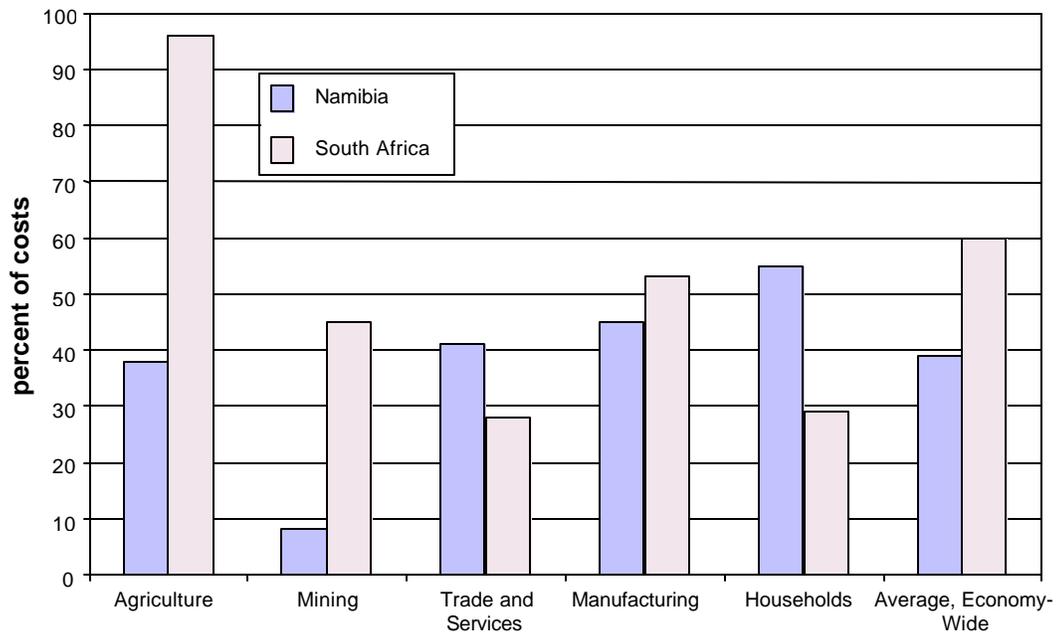
Source: Lange and Hassan, 1999

**Figure 17. Direct and total emissions of SO<sub>2</sub> by industry from the Swedish environmental accounts, 1991**



Source: Table 9 in Hellsten et al. (1999)

**Figure 18. Water subsidy by sector in Namibia and South Africa in 1996**



Source: Lange and Hassan, 1999

To be useful for policy, environmental accounts must, to the extent possible, be comprehensive with respect to *major* pollutants and *major* sources, which include both economic activities and households. A review of the framework for PSEEA (Appendix) shows that comprehensive coverage is not available at this time. For example, of the ten different kinds of air pollutants included in PSEEA, only one (particulate matter) is reported for more than a few industries. This limits the amount of cross-sectoral analysis that can be done with PSEEA. Monetary valuation is based on the “maintenance cost” approach, which estimates the cost of preventing environmental degradation, but does not provide additional information about benefits of reducing pollution (the damages averted). Nevertheless, PSEEA can provide useful policy insights.

The accounts for emissions of particulate matter and BOD (biological oxygen demand) cover the largest number of economic activities, and, thus, provide an example of what could be achieved by expanding the PSEEA. Particulate matter is a major health concern in many countries, including the Philippines. The levels of emissions for nine major sources (eight industries and household transportation) are shown in Figure 19. The Electric power industry is the most important source of emissions, two orders of magnitude larger than the next largest source, Cement. Cement is followed by Sugar, and Household transportation.

The costs of reducing emissions, measured in pesos per ton of pollutant, were estimated for five of these industries (Figure 20), though, unfortunately, this information was not available for Electric power, Transportation or Petroleum refining. Comparison of Figures 19 and 20 indicates that, excluding electric power, the two *largest sources* of particulate pollution, Cement and Sugar, also provide the *cheapest opportunities* for reducing emissions.

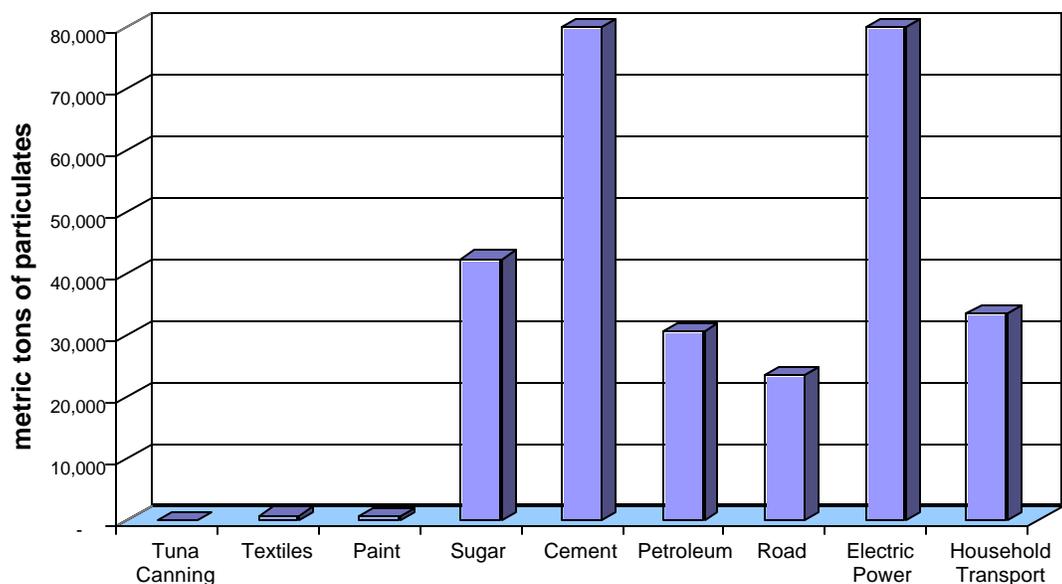
Similar figures for BOD are provided in Figures 21 and 22. In this instance as well, the two largest sources of BOD, Aquaculture and Hog farming, also provide the cheapest opportunities for reducing BOD pollution. As mentioned at the beginning of this section, in setting priorities for action, policy makers need to know not only the major sources of pollution, but also where limited resources will be most effective, i.e., where the greatest benefit from reducing pollution can be achieved for the least cost. The PSEEA provide very useful information about the cost-effectiveness of reducing pollution for particulates and BOD.

Finally, Figure 23 provides a snapshot of the overall economic contribution and environmental burden posed by each industry. The figure includes ten industries which together account for about 225 billion pesos of value-added, or 15% of GDP. The figure shows the percentage contribution from each industry to the 225 billion pesos of value-added as well as the percentage of environmental damage contributed by each industry. The economic contribution is greater than the environmental burden in Fisheries, Food processing, Petroleum refining, and Road transportation. The environmental burden is greater than the economic contribution in Gold mining and Cement; in the remaining industries the contribution and burden are roughly equal.

Information about relative economic contributions and environmental burdens is essential for policy-makers when identifying industries that will play a key role in the development strategy. In the absence of such information, incentives to promote growth of a specific industry, such as subsidies to the Cement industry, may result in levels of environmental damage that far outweigh apparent economic gains. If the true cost, including the environmental cost, is taken into account, other industries might appear to be better, more economically efficient targets for preferential treatment. The industries presently covered by PSEEA represent only 15% of total GDP; it would be extremely

useful for policy-makers to have a more complete picture of the economy, which could be provided by expanding the coverage of PSEEA in the future.

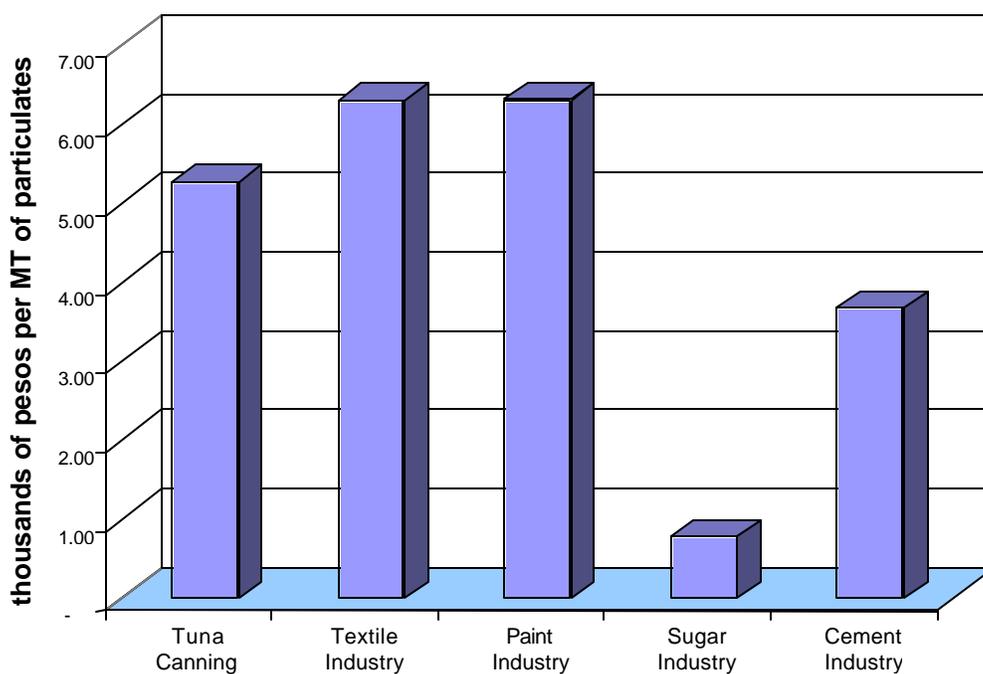
**Figure 19. Emissions of particulate matter by industry in the Philippines, 1993**



Note: Emissions of the Cement and Electric power industries were truncated at 80,000 in the graph; actual figures are 866,000 and 7,066,051 metric tons, respectively.

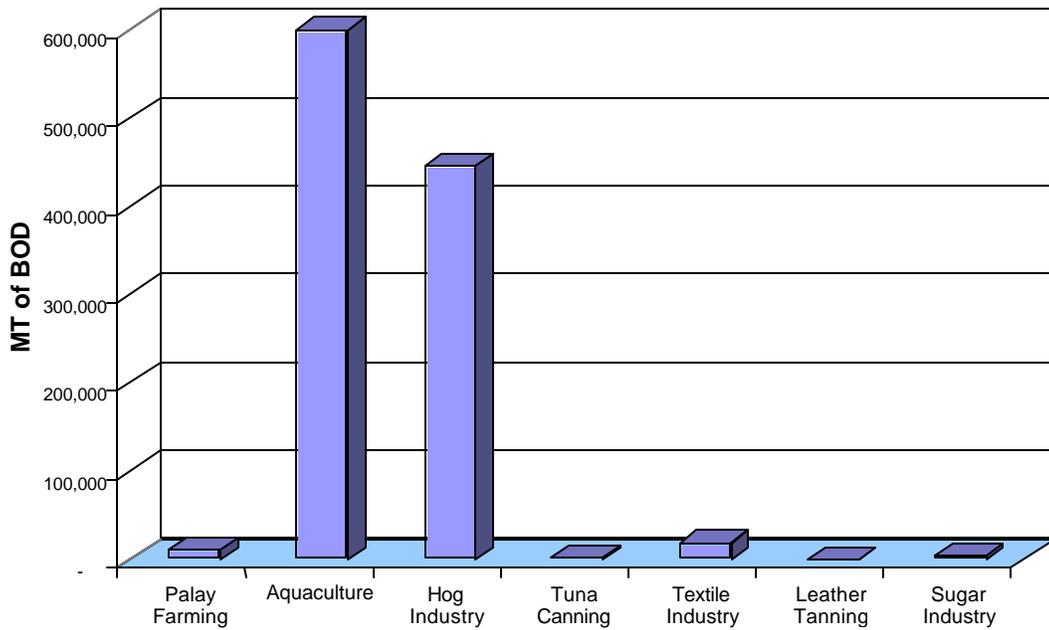
Source: (NSCB, 1999)

**Figure 20. Costs of reducing particulate emissions by industry in the Philippines, 1993**



Source: (NSCB, 1999)

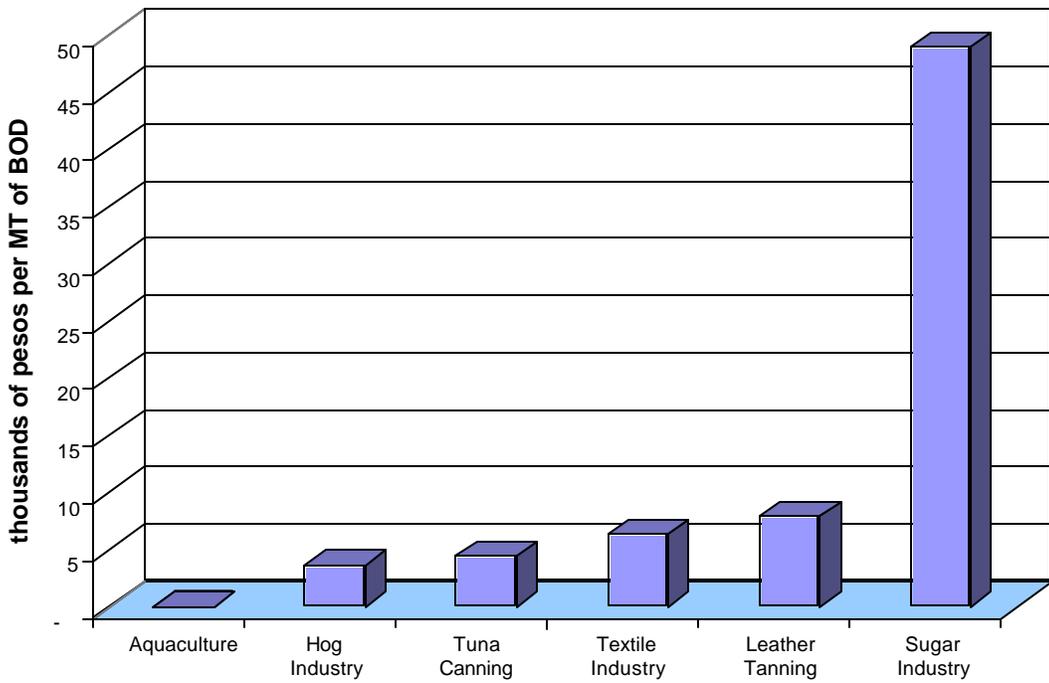
**Figure 21. BOD emissions by industry in the Philippines, 1993**



Note: The figure for aquaculture was truncated at 600,000 MT

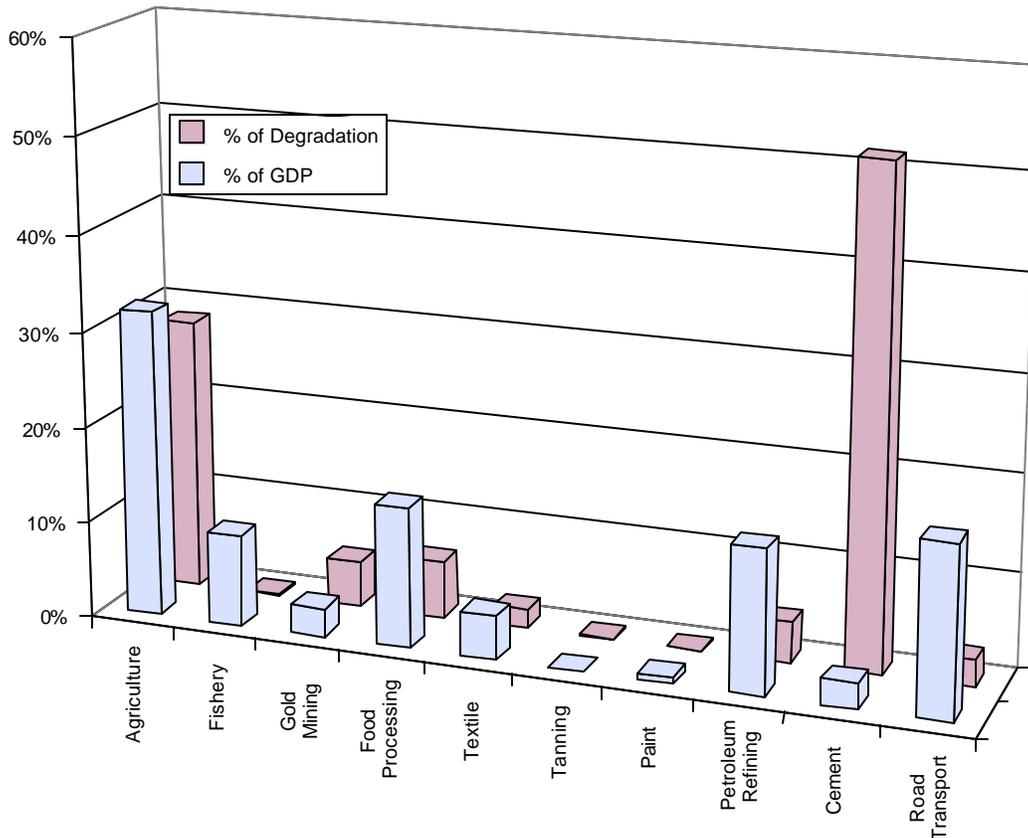
Source: (NSCB, 1999)

**Figure 22. Costs of reducing BOD emissions by industry in the Philippines, 1993**



Source: (NSCB, 1999)

**Figure 23. Economic contribution and environmental burden by industry in the Philippines, 1993**



Note:

- Total value-added in the industries covered = 225,245 million pesos, or 15% of GDP
- Total cost of degradation = 6.2 million pesos

Source: (NSCB, 1999)

### **Strategic planning with the activity accounts**

One of the most important applications of the activity accounts is for strategic planning, understanding what may happen in the future. How will the environmental situation change as population grows, and as the economy grows? How will levels of resource use and pollution be affected by changes in pricing policy, or the introduction of cleaner technology? What effect would changes in trade patterns or household consumption have? These are essential questions that policy-makers must answer. The PSEEA can provide a unique tool to assist in addressing these questions.

Most governments attempt to answer these questions through indicative planning based on multi-sectoral economic models, usually carried out by an economic planning authority or Ministry of Finance. Economy-wide modeling is used to examine policy issues which have far-reaching, economy-wide effects that can only be anticipated in a comprehensive modeling framework. Planning for *sustainable* development requires an integration of environmental and economic modeling. The advantage of integrated analysis is that it forces economists to recognize the links between the economy and the

environment, and to take into account potential tradeoffs between economic and environmental goals.

In the past, it was difficult to integrate environmental and economic planning because the underlying database for such models did not exist. Most environmental and economic analyses were carried out independently from each other. The contribution the PSEEA can make is to provide the economist with a consistent, comprehensive, and reliable set of accounts that are directly linked to the economic accounts. This provides the economist with a ready-made database about the environment and resource use - the difficult and time-consuming work of making different sets of information compatible has already been done.

Models built from environmental accounts have been used in a number of European countries to explore various policy options for addressing environmental problems, both nationally and regionally. Policy issues have included calculating the shadow-prices of pollutants, the economy-wide effects of a carbon tax, and the effect on economic growth of emission caps. A similar modeling approach has been used in South Africa to explore the economy-wide effects of a new water pricing policy, based on full-cost recovery (Hassan, 1998). Both the carbon tax and the water pricing examples illustrate the use of environmental accounts for specific policy issues which have far-reaching effects that can only be anticipated in a comprehensive modeling framework. The PSEEA can be used for such policy analysis, and can also be used for broader strategic analysis to explore issues such as:

- the effects of alternative development strategies on the environment
- the costs and benefits of alternative sectoral and macro-economic policies
- the effects of introducing clean technology

An example of the use of environmental accounts for strategic analysis is provided by the work undertaken for Indonesia's Ministry of Planning by myself and my colleagues in the early 1990's. In this project environmental accounts were constructed and incorporated as the environmental module in an environmental-economic model in order to project the demand on the natural resource base of Indonesia's Second Long Term Development Plan (1994-2018). The study represented the economy in terms of 30 industries and the environment in terms of three categories of land, soil erosion, water, three types of water pollution, energy and three types of air pollution. Several alternative scenarios were formulated based on different assumptions about environmental policies.

The Indonesian study considered issues such as continued food self-sufficiency, forest management and the development of the paper industry, the effects of urbanization on water and air quality. The analysis sought to anticipate emerging conflicts between economic development and sustainable resource management, and to identify the kinds of technological changes that might make it possible to achieve Indonesia's development objectives within the constraints posed by the natural resource base. A similar kind of analysis could be undertaken of the Medium-Term and Long Term Development Plans for the Philippines with the PSEEA.

## 6. Institutional Issues

PSEEA already includes a great deal of useful information. As an evolving information system, it needs to be expanded and more of the information could be made available in a way that relates the information to policy issues<sup>4</sup>. Table 1 summarizes the kinds of policy applications that have been discussed in this paper. Some of these policy applications can be compiled by the NSCB on its own without requiring input from other Departments. Other applications will require the collection of additional data and collaboration with economists in other Departments.

In some countries, the environmental accounts have acted as a catalyst for environmental-economic analysis, initiating analysis of other important sectoral and macro-economic policy issues. These additional policy applications need to be determined jointly by those who construct the PSEEA and the policy-users of the accounts. Because environmental accounts are so new, most people do not know what they can provide. Discussions with each Department about their long-term goals, strategies for achieving these goals, and measures for monitoring their progress will reveal the specific contributions that the PSEEA can make.

The following is an example of the process that might lead to greater use of PSEEA. NEDA and the PCSD have identified "sustainable development" as a broad objective. Under this objective, the Department of Environment and Natural Resources might then identify a specific problem, such as air quality, and a strategy to address this, which includes promoting cleaner technologies. The Department most likely would then identify specific policies to bring this about, such as pricing (pollution and energy taxes), performance standards for industrial and household equipment especially motor vehicles, the development of public transportation, etc. It might further target production technologies in specific industries like electricity generation and transportation.

PSEEA could be constructed to assist in monitoring progress toward sustainable development by monitoring the emission of pollutants (Various forms of eco-efficiency profiles for water would be constructed.). In addition, the activity accounts could be used with an environmental-economic model to assess the impact of the different policies designed to achieve the goal of reducing water use. While the policy uses of PSEEA need not be limited to these uses, it provides very concrete guidance to those who will construct the PSEEA, and, by targeting well-defined policy concerns, is more likely to be useful and, therefore, used.

Finally, for these applications to be useful to policy-makers they need to be communicated effectively. Often the results of environmental accounts are reported in detailed technical reports which policy-makers are often too busy to read, even with an executive summary. A short policy brief, published on a regular basis, that summarizes the main results can improve the usefulness to policy-makers.

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<sup>4</sup> While PSEEA already incorporates some of the work done by ENRAP (DENR, 1999), it would be useful to more fully integrate the two environmental accounting activities.

**Table 1. Policy Applications of the PSEEA**

<b>A. ASSET ACCOUNTS</b>	
Monitoring trends over time of:	<ul style="list-style-type: none"> <li>Volume of natural capital, by resource</li> <li>Value of natural capital, total and by resource</li> <li>Total capital by manufactured and natural capital</li> <li>Shares of natural and manufactured capital over time</li> <li>Value of rent generated, total and by resource</li> <li>Rent recovered through taxes</li> </ul>
Policy analysis and planning	<ul style="list-style-type: none"> <li>Is the resource rent being use to promote sustainable development</li> <li>Is maximum rent being generated, what other objectives are being met, what is the trade-off</li> <li>What groups in society are benefiting from resource exploitation?</li> </ul>
<b>B. ACTIVITY ACCOUNTS</b>	
Monitoring time trends of:	<ul style="list-style-type: none"> <li>Environmental protection expenditures by type</li> <li>Share of government environment protection services in GDP</li> <li>Cost of environmental degradation and pollution, by type of pollution and by source</li> <li>Ratio of the cost of environmental degradation and pollution to GDP</li>   <li>Eco-efficiency profiles</li> <li>Economic contribution</li> </ul>
Policy analysis	<ul style="list-style-type: none"> <li>Driving forces: Total (direct + indirect) environmental impact</li> <li>Appropriate prices: Market price v. full economic cost</li> </ul>
Strategic analysis	<ul style="list-style-type: none"> <li>Integrated environmental-economic modeling</li> </ul>

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