ENVIRONMENTAL ACCOUNTING FOR SUSTAINABLE GROWTH AND DEVELOPMENT WITH SPECIAL REFERENCE TO A SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING (SEEA): THE INDONESIAN EXPERIENCE

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While the desirability of development is universally recognised, there are growing concerns over whether environmental constraints will limit development and whether development will in turn cause serious environmental damage, worsening thereby the quality of life of future generations. The negative impacts of development are now becoming evident in the increasing degradation of the environment and scarcity of natural resources reserves. This paper considers the issue of environmentally sound and sustainable socio-economic development and points to the need for clarifying this new development concept and for developing methodologies for its assessment and implementation through a discussion of the links between environmental accounting and the System of National Accounts (SNA) based on the conceptual framework of SEEA described in the new version of the United Nations' SNA for 1993. The paper also presents the Indonesian experience in building an institutional framework for natural resources and environmental management through a joint effort in a project entitled Natural Resources and Environmental Accounting where concepts and methods of Natural Resources Accounting have been developed and applied in compiling the resource account for oil, gas and forest.

1. INTRODUCTION

The achievement of sustainable development remains the greatest challenge facing the human race. Beside the successful story of economic growth and good progress over the past generation, many people still live in poor conditions and suffer from inadequate access to resources such as health and educational services, land, infrastructure and asset facility which are required to give those people a change for a better life. The desirability of

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development is universally recognised, nevertheless we have witnessed rising concern about whether environmental constraints will limit development and whether development will cause serious environmental damage, which in turn will worsen the quality of life of future generations.

Currently, the progress and welfare of a country is measured by per capita income, based on national income divided by the number of population. National income accounting tends to be a tool for political and economic analysis. The understanding of national income from year to year [as] including changes in investment, savings, structure of industry, etc., will facilitate the task of development planners and politicians to formulate policies. However, the negative impacts of development are now becoming evident in the increasing degradation of the environment and scarcity of natural resources reserves. As natural resources become increasingly scarce, and the environment increasingly deteriorated, the cost of development will become more and more expensive, which in turn will hamper future development.

The discussion of environmentally sound and sustainable socio-economic development has received increased attention, from the international community, stimulated in particular by the report of the World Commission on Environment and Development. The need for clarifying this new development concept and for developing methodologies for its assessment and implementation has been recurrently stressed in international conferences. A consensus emerged in the workshop to the effect that enough progress had been achieved to develop the links between environmental accounting and the System of National Accounts (SNA), and to elaborate certain aspects of environmental accounting in the revised SNA. The SNA presented a unique opportunity to examine how the various concepts, definitions, classifications and tabulations of environmental and natural resources accounting can be linked to the SNA. The satellite approaches to environmental accounting expand the analytical capacity of national accounts without overburdening the central framework of the SNA.

The new version of the SNA (SNA'93) is a comprehensive, consistent and flexible set of macro-economic accounts to meet the needs of government and private-sector analysts, policy makers and decision takers. It deals more fully with the integration of the whole economic accounts of the nation including balance sheets. The system lays down the groundwork for

dealing with interaction between the economy and the natural assets (resources and the environment), and elaborates an analytical approach to the assessment of poverty and other social aspects of the population. The backbone of the SNA is an overall picture of the central framework. The framework is an integrated system where the same concepts, definitions and classifications are applied to all accounts and sub-accounts.

In certain types of analysis, the basic intention is not to use alternative economic concepts, but simply to focus on a certain field or aspect of economic and social life in the context of national accounts. The intent is to make apparent and to describe in more depth aspects that are hidden in the accounts of the central framework of surface only in a limited number of points. In other types of analysis, more emphasis is given to alternative concepts. For instance, the production boundary may be changed and the concept of fixed assets and the related fixed capital formation may be broadened. In these approaches, the economic process itself is depicted differently, and complementary or alternative aggregates are calculated. The analysis of a number of important fields such as social protection, health or environment may benefit from building a framework to accommodate elements which are included in the central accounts, explicitly or implicitly, plus complementary elements (either monetary or in physical quantities) and possible alternative concepts and presentations. Those special constructs, which are semi-integrated with the central framework, are called satellite accounts.

Typically satellite systems allow for: (a) the provision of additional information on a particular social concern of a functional or cross-sector nature; (b) the use of complementary or alternative concepts, including the use of complementary and alternative classifications and accounting frameworks, when needed to introduce additional dimensions to the conceptual framework of national accounts; (c) extended coverage of cost and benefits of human activities; (d) further analysis of data by means of relevant indicators and aggregates; (e) linkage of physical data sources and analysis to the monetary accounting system. These characteristics, even in this summary form, point to important roles for satellite analysis and accounts. Satellite accounts in various fields may, in addition, help to connect analysis between some of those fields. Satellite accounts are thus able to play a dual role, as tools for analysis and for statistical co-ordination.

Environmental accounting is a complex and elusive subject. It is also a tool with great potential that can help ensure that the future estimation of national income represent more accurately true “sustainable” income. The existing system of national accounts has some limitations. Gross Domestic Product (GDP) figures are widely used by economists, politicians, and the media. Unfortunately, they are generally used without realising that they represent an income that cannot be sustained. Current calculations ignore the loss of natural assets and the decreasing quality of environment and view the sales of non-renewable resources entirely as income. A better way must be found to measure the prosperity and progress of mankind.

Economic growth is important in raising the standard of living, but it tells us only part of the story. In addition to the poverty associated with slow economic growth exacerbated by rapid population increases, many side effects of development which are not incorporated in the GDP estimations take their toll on social welfare. Among the more important of these effects are environmental damages caused by development and urbanisation problems. For several reasons, environmentally adjusted GDP is beginning to receive the attention of policy-makers. The accounting system attempts to include all components or nature that can be quantitatively or qualitatively changed by human activity.

Keeping in mind the general trend of establishing environmental information systems and if a comparison is made of the various approaches adopted in the light of the planning objectives, it turns out that each country seems to have adapted its environmental accounts to its own national needs, institutions, and culture. The approaches pursued by different countries reflect several planning concerns and objectives, such as: diagnosing the current state of the environment; analysing the effect of environmental policies on economic performance and welfare; assessing the value of resources that can be exploited for development as well as the conditions of their regeneration; and identifying the possible options among the social, economic, and ecological objectives of development, with a view to global negotiation.

So far, no natural resource accounting effort has made it possible to attain all of the planning concerns and objectives, as mentioned before, simultaneously or to cover the entire range of planning processes. It is difficult to imagine a system capable of meeting the needs of economists,

ecologists, the public, decision-makers, and environmental managers all at the same time. Developing countries may thus have to choose from the various possible approaches by referring to their own needs, level of development, and environmental management problems. It also indicated the difficulties of finding a consensus on a theoretical framework that would present clearly the complex relation between the economy and the environment. Therefore, a case by case, and country by country analysis is called for, based on a simplified accounting framework with an operational perspective containing more practical recommendations.

2. SCOPE OF ENVIRONMENTAL ACCOUNTING

2.1. Scope and Coverage

There is a large variety of approaches in the design of statistical systems describing the interrelationships between the natural environment and the economy. The two extreme positions can be identified as: (a) the statistical description that focuses on the environment. Environmental-economic linkages are described with regard to impacts on the environment. Much of the statistical framework is concentrated on the spatial description of the natural environment, involving the use, for instance, of maps of particular regions (ecosystems or eco-zones). The information is normally presented in physical units; (b) the statistical framework that focuses on the economy and takes environmental-economic linkages into account only in so far as they are connected with actual economic transactions (for example, environmental protection expenditures and actual damage costs). The data systems are typically more detailed presentations of conventional national accounts, as they present monetary data on actual transactions in market values. In figure 1, these two concepts are indicated in boxes 1 and 6. Approaches that are located between these two extremes could be classified with regard to that use of the unit of measurement, for example, money values or physical units.

Systems that mainly use physical units could extend the description of the natural environment to include information on the physical flows between the environment and the economy (use of natural resources, flow of residual products). This description in physical terms could be further extended to include information on transformation processes within the

economy. Material/energy balances comprise a physical description of the use of natural resources, their transformation by production and consumption activities and the flow of residuals back to the natural environment. The description of economic activities in monetary terms has been extended in the case of the System for Integrated Environmental and Economic Accounting (SEEA) to the valuation of the use of the national environment. The comprehensive measurement of costs and benefits of economic activities and their environmental impacts is the purpose of such calculations. Such valuation not only facilitates the incorporation of environmental concerns into economic analysis but also creates a common scale of measurement that allows the compilation of economic-environmental aggregates on a highly condensed level. The SEEA thus covers in principle both national accounts describing economic activities and environmental accounts including all monetary and physical flows that describe the interrelationship between the environment and the economy.

The following four elements are included in the SEEA, namely: (a) transaction and other economic flow and stock elements of the established economic accounting system of the SNA, which are of special relevance to the measurement of the environmental impact of economic activities and will have to be further disaggregated to identify monetary flows and assets related to the use of the natural environment and/or treated differently in environmental analysis carried out in the context of the SEEA; (b) environmental stocks and flows to which alternative monetary (non-market) valuations for the use of the environment are applied; (c) physical data on the flows of natural resources from the natural environment to the economy and their transformation within the economy, and on the flows of residuals of economic activities to the natural environment; (d) a description of the natural environment in physical terms in so far as it is necessary for the purpose of analysing the impacts of human use. The SEEA focuses on the interrelationships between the environment and the economy. Economic activities, as well as events within the natural environment, are dealt with in detail only in so far as they are necessary for understanding the relations between the economy and the environment. Using the SNA as a starting-point for the SEEA does not necessarily lead to a purely economic view of environmental concerns, rather it permits the introduction of ecological elements into economic thinking and decision-making through the employment of a common framework. If ecological issues can be translated into monetary terms, the possibility of economic decisions, taking

environmental problems into account is much improved. The aim of the SEEA is thus to establish a suitable database for policies of sustainable development that incorporate the issue of the environment into mainstream policies.

2.2. The SEEA Versions

The SEEA contains four parts, each of which follows the concepts of the SNA to a different extent (Figure II). Part A, setting out from the production account of SNA, provides the basic framework for the SEEA. It contains a description of production and consumption activities (supply and disposition tables), and of the accounts of non-financial assets. The production segment of the SNA constitutes the data basis for input-output tables within uniform row and column classifications. The input-output framework is the most suitable economic one for analysing environmental-economic relations, because it can be easily extended to include flows of natural resources from the natural environment as input to economic activities and flows of residuals of production and consumption activities, as unwanted asset accounts of the SEEA are the non-financial asset accounts of the SNA, partly in an aggregated version and partly in a more disaggregated form. Disaggregation facilitates the identification of the environmental protection activities that prevent and mitigate environmental deterioration or restore the damage (effected in health expenditures, material corrosion) caused by the deteriorated environment. In the case of non-financial assets, further disaggregation of stocks and volume changes of natural assets is proposed.

The second part of the SEEA (part B) consists of a description of the interrelationships between the natural environment and the economy in physical terms. This part incorporates the relevant concepts and methods of natural resources accounting, material/energy balances, and input-output table; and it is closely linked to the monetary flows and assets of the SEEA, derived from the production segment of the SNA. The inclusion of natural resource accounts and balances can be made without modifying the concepts of the SNA.

In the third part of the SEEA (part C), different approaches for estimating the imputed costs of the use of natural assets are discussed. In this context, these different valuation methods are used: (a) market valuation according to the concepts of the non-financial assets accounts in the SNA; (b)

maintenance valuation, which estimates the costs necessary to sustain at least the present level of natural assets: (c) contingent valuation, which could be applied especially for estimating the value of the consumption services of the natural environment.

The fourth part of the SEEA (part D) contains additional information that could be obtained by further extensions of the SEEA. Those extensions have been applied especially in the case of household activities whose detailed analysis can contribute to a better understanding of the social and demographic forces behind the impacts of human activities on the natural environment and of the effects on human welfare. Furthermore, the consequences of treating environmental functions in terms of the production of environmental services are discussed. Finally, treating both internal and external environmental protection activities as production activities can be viewed as introducing a broader concept of output (by means of externalising internal intermediate costs of environmental production). The different parts of the SEEA are described not as separate entities but as an extension comprising the data of the preceding stages. Based on those four parts of the SEEA and various methods of valuation, six basic versions of the SEEA modification could be obtained for different purposes of analysis.

3. ALTERNATIVE APPROACHES TO ENVIRONMENTAL ACCOUNTING

The System of environmental accounting broadens the SNA concepts of cost, capital formation and stock of capital by supplementing these with additional data in physical terms in order to encompass environmental cost and the use of natural assets in production, or by amending them through the incorporation of these effects in monetary terms. However, within this general orientation, the several existing approaches differ considerably in terms of methodology and environmental concerns addressed. The SEEA synthesises as far as possible the various approaches and integrates them into one comprehensive approach. Three main approaches to environmental accounting which are complementary and overlap each other are: (i) what is generally referred to as natural resource accounting, which focuses on accounts in physical terms; (ii) what is generally called monetary satellite accounting, which is linked to national accounts and is in monetary terms. It identifies the actual expenditures on environmental protection and deals with

the treatment of environmental cost to natural and other assets caused by production activities in the calculation of the net product. Monetary satellite accounting is generally more limited in coverage of environmental concerns than physical resource accounting; and (iii) the welfare-oriented approach. The approach deals with the environmental effects borne by individuals and by producers other than the producers causing these effects. The latter effects may often be much larger than the cost caused and do not affect the net product but rather the net income through transfers of environmental services. In terms of practical implementation, physical resource accounting is the most advanced approach compared to the others. Experience with monetary satellite accounting is much more recent, and many controversies still surround this approach, particularly with regard to valuation. The least consensus exists with regard to the welfare approach to environmental accounting.

3.1. Natural Resource Accounting in Physical Terms

Natural resources accounting focuses on physical assets balance--i.e., opening and closing stocks and changes therein--of materials, energy and natural resources. Where applicable (for selected pollutants), it may also include changes in environmental quality of natural assets in terms of environmental (quality) indices. Several examples, developed by individual countries or sponsored by international organisations, now exist. Also the multipurpose Framework for the Development of Environmental Statistics, developed by the United Nations, includes the environment statistics elements from which the physical asset balances can be constructed, although it does not include the balances themselves. The SEEA, which shows the links between physical and monetary accounts, includes natural resource accounts as a module.

3.2. Environmental Accounts in Monetary Terms

Monetary environmental accounts, in a restricted sense only, separately identify within the nationals accounts the actual expenditures on environmental protection. In some instances, these expenditures are externalised by treating ancillary environmental protection activities as separate establishments. Monetary environmental accounts in this restricted sense would also include the functional approach to environmental accounting. A broader interpretation of monetary environmental accounting

may include the sort of environmental adjustments developed in projects carried out in several resource-oriented developing countries. In these studies, GDP is adjusted for selected environmental costs, including the cost of oil depletion, deforestation, depletion of fish stock and the cost of soil erosion. While these studies are based on detailed analyses in physical terms, distinguishing between a variety of species of timber, fish and different types of soil, based on geographical location and agricultural use, the ultimate focus is on the adjustment of GDP. These studies do not deal with an explicit allocation of the environmental adjustments between activity and expenditure components of GDP.

The comprehensive accounting approaches take the SNA as a point of departure and thus stay very close to the analytical orientation of economic analysis. At the same time, they emphasise the importance of recording physical flows and stocks in support of the monetary environmental economic analysis. The SEEA does not distinguish between depletion and degradation, but rather between quantitative and qualitative use of natural assets. In the first case reference is made to the use of environmental goods and in the second case to the use of environmental services. In this matter we assumed that depletion approximately coincides with the quantitative use and degradation with the qualitative use of natural assets. Even though the distinction between depletion and degradation is made, it should be understood that economic activities may result in depletion and degradation at the same time.

The comprehensive accounting approaches allocate the environmental impacts of depletion and degradation to the separate economic activities causing these environmental impacts and to expenditure components, reflecting the immediate effects corresponding to quantitative and qualitative changes in natural assets. The SEEA and the case studies mainly consider the effects on production analysis, identifying the environmental cost of depletion and degradation caused by different economic activities and showing the corresponding effects on natural and other assets. The SEEA furthermore introduces an enlarged concept of capital formation, which not only allows incorporation of depletion and degradation effects but also the transfer of natural resources to economic uses.

3.3. Welfare and Similar Approaches

One welfare approach, instead of dealing with the cost caused by production activities and their effects on capital used in production, focuses on environmental impacts of cost borne or, in a broader sense, on well-being. The approach considers the free environmental services provided by nature to producers and consumers and subsequent damage borne by them. The environmental services provided free and the damage borne are implicitly considered as transfers by and to nature, which increase or decrease the environmentally adjusted net national income.

Another approach is based on the concept of environmental sustainability standards and on estimating the necessary avoidance or restoration costs to meet these standards. The approach does not deal with the immediate environmental impacts of production during the present accounting period, but rather with those impacts incurred over an unspecified length of time. The approach suggests that the cost should be changed to those industries that are able to absorb such cost given the price of their products; these are not necessarily the industries which caused the degradation in the first place.

4. GENERAL FRAMEWORK OF ENVIRONMENTAL ACCOUNTING

4.1. Basic Structure

The basic structure of the SEEA shows the concepts of SNA together with the alternative concepts used in environmental accounts. The use of the SEEA framework to present environmental accounting and the relationship to the SNA is convenient as the SEEA was developed in immediate relationship to the SNA so that its concepts and classifications are more closely linked to those of the SNA than is the case with any other environmental accounting system. However, format, concepts and classifications of the SEEA should be considered as work-in-progress, as many of its elements continue to be discussed among national and environmental accounts. In the description of the SEEA framework, environmental cost and capital elements included can be interpreted in physical as well as in monetary terms. Much caution should be exercised in the use of these elements in monetary terms and in the corresponding derivation of environmentally adjusted aggregates. This does not reduce the usefulness of environmental accounting, however, as the approaches to environmental accounting described above show that analysis in physical terms is as useful as environmental accounting in monetary terms, as long as

the analysis is carried out in the context of a well-defined framework of satellite accounts.

The flow and stock items of the SNA are shown in the shaded area of Figure III (basic structure of the SEEA). The columns of the table related to flows are a column (1) for production, covering output (p), intermediate consumption (Ci), consumption of fixed capital (CFC) and net domestic product (NDP); a column (2) for the rest of the world, which includes export (X) minus imports (M) and a column (3) for final consumption (C). The rows of the table referring to the SNA flows are a row (ii) for supply, including output and imports; a row (iii) for economic uses, including elements for intermediate consumption, exports, final consumption and gross capital formation (lg); a row (iv) for CFC and, finally, a row (v) for NDP, which presents the elements that define the national accounts identity between NDP and the expenditure categories. The SNA column (4) asset balances of produced assets includes the opening and closing stocks of produced assets (Kop.cc & Klp.cc) and the elements explaining the change between the two, i.e., net capital formation (I=Ig-CFC), holding gains/losses on produced assets (Revp.cc) and other changes in volume of produced assets (Volp.cc).

The assets balances in the SNA area cover all economic assets, and therefore include the assets covered by column (5) for non-produced natural assets. The elements of this column, however, do not figure in the calculation of NDP as all changes in non-produced natural assets between opening and closing stocks (Konp.cc Klnp.cc) are “explained” in the SNA as holding gains/losses (Revnp.cc) and as other changes in volume of assets (Volnp.cc).

4.2. Extended SNA Framework to Environmental Accounts

The non-shaded area of figure III includes the additional elements that are needed to supplement the SNA concepts with data in physical terms on environmental cost and capital, or amended the SNA concepts by valuing the physical data and incorporating the values in environmental adjusted concepts of cost and capital. There are two types of additional elements. The first group is included in an additional column (6) which records the effects of economic activities on non-produced natural assets such as air, water and virgin forests that are not included as economic assets in the SNA. The second group of elements is included in two additional rows (vi-vii) that include elements for the use of non-produced natural assets by depletion and

degradation, and for other accumulation of non-produced natural assets, which covers the transfer of natural assets to and between economic uses. The SEEA elements in the additional column (6) and row (vi) and (vii) can be interpreted in physical as well as monetary terms. Another row (viii) is included to derive an environmentally adjusted net domestic product (EDP and other environmentally adjusted concepts. This row is only relevant in the case of monetary environmental according when additional SEEA elements are specified in value terms.

In row (vi) related to the use of non-produced natural assets, an additional element (Use np) has been included in the column for production. This reflects the use of non-produced natural assets in production: it is the sum of the counterpart items in columns (5) and (6) representing, respectively, the use of non-produced natural assets that are economic assets in the SNA sense (Use np.cc) and the degradation of other natural assets that are not economic assets (Use np.env). The use of non-produced economic assets (Use np.cc) includes the depletion of minerals, the extraction of timber from forests that are economic assets and the effects on productivity of those forests and agricultural land of soil erosion, acid rain, etc. The deteriorating effects of air pollution on buildings and structures and the effects of soil erosion on roads and other degrading effects on produced assets are not included as they are assumed to be reflected in CFC. The use of natural assets that are not economic assets (Use np.env) covers the non-sustainable extraction of fishstock from oceans and rivers, extraction of firewood and lumber from tropical and other virgin forests or hunting of animals living in the wild and also the effects of emission of residuals on the quality of air, water, fishstocks, wild forests, and the effects of other economic activities (recreation, agriculture, transport, etc.) on eco-systems and special habitat.

Other accumulation in row (vii) records in physical or monetary terms the transfer of natural assets to economic uses as a change in stock of non-produced economic assets (Inp. cc). The counterpart of this increase in economic assets is the reduction of natural assets other than economic assets (Inp.cnv). The (Inp.cc) would include the transfer to land to economic uses, the net additions to proven mineral reserves, the conversion of wild forests to timber tracts or agricultural land, and the conversion of fishstocks to economic control. If deterioration takes place at the same time as natural assets are incorporated as economic assets, the deterioration is not recorded in the other accumulation row, but is included as part of uses of natural

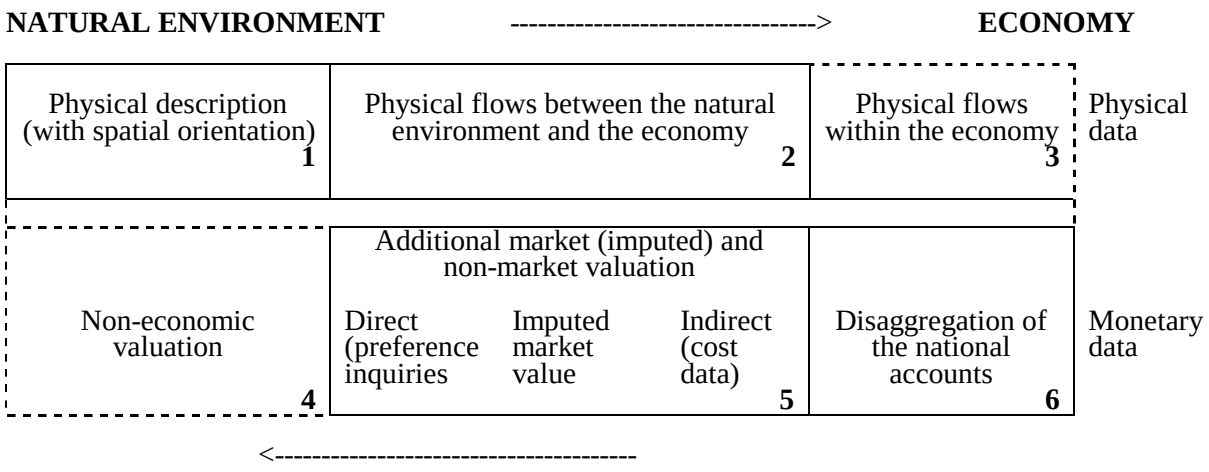
resources. If this deterioration takes place before the transfer, it is recorded as the use of an asset in the environment (Use np.env) and if deterioration takes place after, it is recorded as uses of natural resources that are economic assets (Use np.cc). As the elements of row (vi) for use (i.e., depletion or degradation) of non-produced natural assets, and row (vii) for other accumulation are included in the SNA in other volume changes, the content of other volume change is reduced in the SEEA as compared with the SNA.

If the additional SEEA elements are valued in monetary terms, the incorporation of the use of non-produced natural assets (Use np) as additional cost in the column for production results in an EDP, presented in row (viii), which is lower than NDP. The elements in row (vii) for other accumulation do not affect EDP. If the additional SEEA elements are expressed in physical terms, row (viii) is not relevant; in that case, the additional information in row (vi) and (vii) is only used to supplement NDP with information on environmental cost caused by economic activities.

Corresponding to the monetary valuation of the additional SEEA elements, on the expenditure side, a new concept called net accumulation is introduced in the SEEA to replace net capital formation in the SNA. It is presented in row (viii), separately for produced assets (Ap.cc), non-produced economic assets (An.cc) and other natural assets (Anp.env). For produced assets, it is the same as net capital formation (i.e., Ap.ec=I). For non-produced economic assets, it reflects the net effects of negative depletion and degradation and positive additions of natural assets that are transferred to economic uses (i.e., Anp.cc=Use np.cc+Inp.cc). For natural assets other than economic assets, it could be considered as the economic valuation of the impact of economic activities on the environment and it is the sum of negative depletion and degradation effects (Use np.env) and negative effects of incorporating natural assets as economic assets (i.e.- Anp.env=Use np.env, Inp.env). If no monetary valuation is used, the additional elements (i.e., Use np.ee, Inp.cc, Use np.env and Inp.env) would supplement the SNA information on investment in produced assets (I) with information in physical terms on changes in natural non-produced assets that together with investments (I) support the generation of economic activities.

If net accumulation replaces net capital formulation when the additional SEEA elements are valued in monetary terms, the national accounts identity between NDP and final expenditures changes. In the SNA this identity, as reflected in row (v) of Figure III, is:

FIGURE I. DATA SOURCES FOR INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING



1 : Environment statistics system in a narrow sense
6 : Economic accounting system (SNA)

2+3+5+6+part of 1 : (Satellite) system of integrated environmental and economic accounting (SEEA)

1 + 2 : Natural resource accounts and environment statistics in a broader sense
2 + 3 : Material/energy balances
5 + 6 : Extended economic accounting system

FIGURE II. SNA (SATELLITE) SYSTEM OF INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING (SEEA)

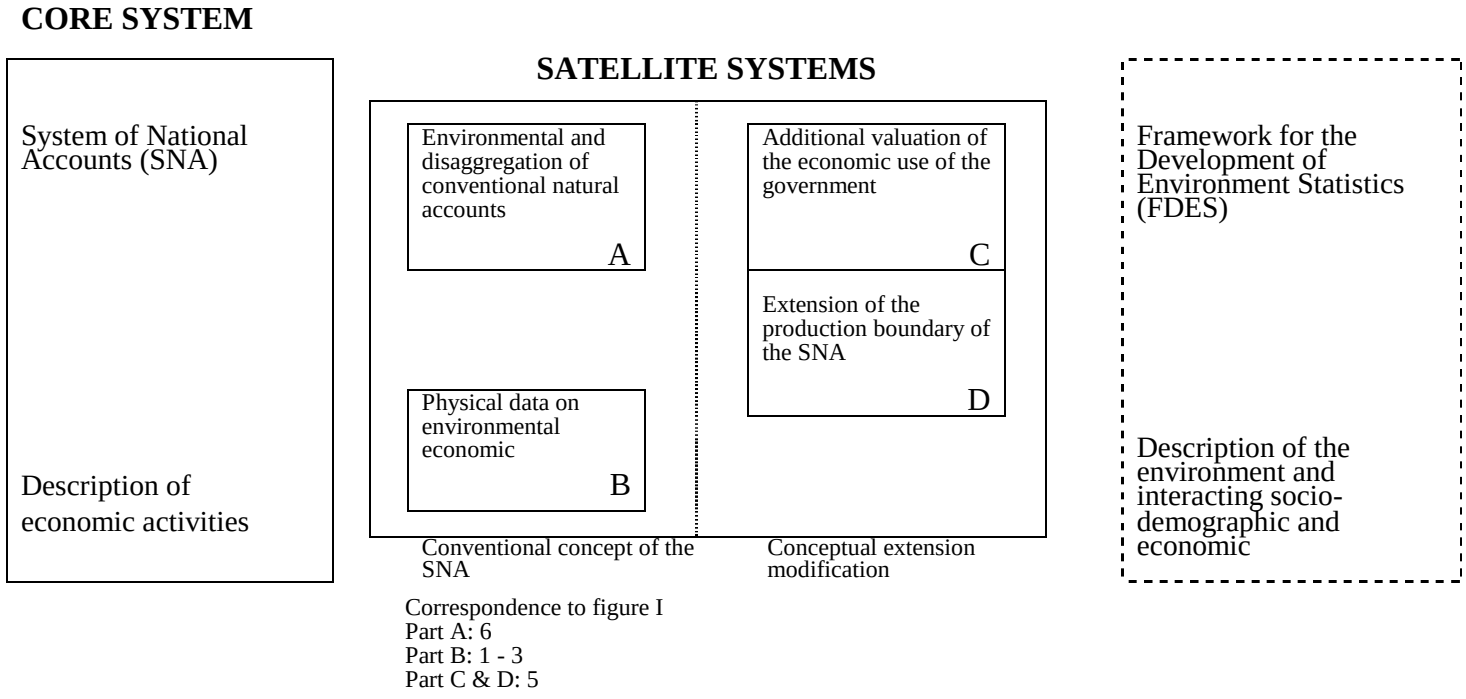


FIGURE III. BASIC STRUCTURE OF THE SEEA

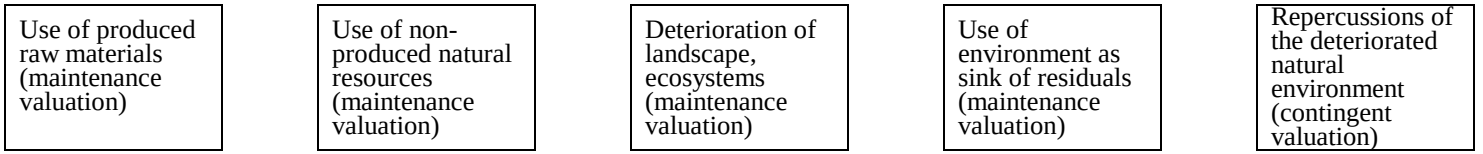
		Economic activities					Environment
					Economic assets		
		Production	Rest of world	Final consumption	Produced Assets	Non-produced natural assets	Other non-produced natural assets
Opening stock of assets	i				$K0_{p.ec}$	$K0_{np.ec}$	
Supply	ii	P	M				
Economic uses	iii	Ci	X	C	Ig		
Consumption of fixed capital	iv	CFC			-CFC		
Net domestic product	v	NDP	X M	C	I		
Use of non-produced natural assets	vi	Use_{np}				$-Use_{np-ec}$	$-Use_{np.env}$
Other accumulation of non-produced natural assets	vii					$I_{np.ec}$	$-I_{np.env}$
Environmentally adjusted aggregates in monetary environmental accounting	viii	EDP	X-M	C	$A_{p.ec}$	$A_{np.ec}$	$-A_{np.env}$
Holding gains/losses	ix				$Rev._{p.ec}$	$Rev_{np.ec}$	
Other changes in volume of assets	x				$Vol_{p.ec}$	$Vol_{np.ec}$	
Closing stock of assets	xi				$Kl_{p.ec}$	$Kl_{np.ec}$	

FIGURE IV: BUILDING BLOCKS FOR IMPLEMENTING THE SEEA

A. Reformatting and disaggregation of the conventional SNA (Versions I and II)

B. Physical accounting (version III)

C. Imputations of environmental costs (version IV)



$$NDP = C + I + (X - M)$$

If net capital accumulation in economic assets (Ap.ec + Anp.ec) replaces net capital formulation (I), the identity as reflected in row (viii) becomes:

$$EDP = C + (Ap.cc + Anp.ec) - Anp.env + (X - M)$$

In order to maintain the identity, the negative element for the economic counterpart of changes in natural assets other than economic assets (Anp.env) is added. This implies that expenditures and, in particular, net capital accumulation of economic assets are only partly derived from non product of economic activities reflected in EDP; an important part of the expenditures may reflect the transfer of environmental assets and/or their services to economic activities. This can be shown more clearly be re-arranging the terms in the above EDP identity as follows:

$$EDP + Anp.\ env = C + (Ap.ec + Anp.ec) + (X - M)$$

5. INDONESIAN EXPERIENCE

5.1. Institutional Framework for Natural Resources and Environmental Management

Indonesia has already established important elements of a policy and regulatory framework for environmental protection. As in other countries, however, the institutions responsible for environmental management face a variety of constraints in carrying out their mandates effectively. Hence, environmental concerns are not yet effectively integrated into development planning and implementation. Fulfilling the gap between policy and implementation calls for strengthening the institutional framework and capacities for environmental management. Where feasible, reliance on market-based instruments in further developing the environmental policy framework would economise on the scarce administrative capacity. In building institutional capacities, stepped-up efforts would be needed on three main fronts: improving the systems for environmental information and analysis to inform priority-setting and policy design; strengthening the institutions responsible for environmental management, including clarifying their roles and improving co-ordination; and enhancing local participation on policy-making, monitoring and enforcement.

Accurate and timely information about environmental conditions and trends is essential for an understanding of the risks they may pose to human health,

productivity and future growth. For development planning and implementation, area specific information and project-specific environmental impact analysis are required, with subsequent monitoring of actual result. Examples are the environmental data being complete and published by the Central Bureau of Statistics (CBS) and the State Minister for Environment (LH), environment-related information developed by concerned line agencies such as Forestry and Agriculture Ministers, the AMDAL program which requires environmental impact assessments (EIAs) to be prepared for projects expected to have significant environmental effect, and the public education and awareness campaign under the PROKASIH (Clean Rivers) program. These, however, are only parts of a foundation that Indonesia will need to build on considerably in the future.

Strengthening the environmental information systems will require concerted and sustained multi-agency efforts. Main areas for attention include: the expansion of efforts to collect field data on environmental conditions; the development of environmental indicators by the relevant line agencies; improvements in the capability of government laboratories; the computerisation of data combination, analysis and management; and the improvement of public access to data on environmental conditions and trends. Improvement of the environmental information needs to be complemented by stronger policy analysis capabilities.

There are various reasons for integrating environmental and economic accounting. The first reason has to do with analysis. Estimation of environmental costs in environmental accounting are often done in a detailed breakdown, for instance, to distinguish different types of lumber or different species of fish when computing environmental adjustments to value added in forestry and fishing. Similar calculations are carried out in the context of national accounting. Obviously, the two types of calculations need to be compatible, as otherwise it would be difficult to assess how environmental adjustments will affect economic variables such as capital and output. The other reasons for integrating work on environmental and national economic accounting is institution- and organisation-related. Detailed environmental analysis preceding environmental accounting are often carried out by specialists who are very different from those dealing with national accounts. Integration would require a new organisational structure that permitted inter-institutional and interdisciplinary co-operation.

5.2. Case Study on Several Resources Accounts

A joint effort in a project entitled Natural Resources and Environmental Accounting for Indonesia was started in September 1990. A working team was set up consisting of staff from the Central Bureau of Statistics, State Ministry of Population and Environment, and Environmental Management Development in Indonesia (EMDI) Project. During the first stage of the study, concepts and methods for Natural Resources Accounting were developed and a book entitled "Concepts and Methods for Natural Resources and Environmental Accounting" was published (Jakarta 1992). The second stage of the study was to apply the concepts and methods in compiling the resource account for oil, gas and forest.

The following tables are empirical evidence and data reported from the study on oil and natural gas resources accounts of Indonesia.

Table 1

Oil reserves and production 1981-1990

Million Barrels

	Proven & Potential Reserves		**Production**				**Reserves to Production Ratio**
Year	Beginning year	Ending year	Work contract	Product. sharing	Pertamina	Total	(3):(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1981	7 850.0	8 011.1	270.4	284.7	29.7	584.8	15
1982	8 011.1	8 301.3	190.6	270.0	27.6	488.2	17
1983	8 301.3	7 913.3	234.0	238.8	27.7	500.5	16
1984	7 913.3	8 223.4	5.8	479.5	31.7	517.0	16
1985	8 223.4	8 192.9	6.5	446.7	30.6	483.8	17
1986	8 192.9	7 470.8	7.3	470.4	29.5	507.2	15
1987	7 470.8	10 298.7	9.8	444.3	25.0	479.1	22
1988	10 298.7	11 054.5	14.8	444.8	24.5	484.1	23
1989	11 054.5	10 899.1	15.3	474.9	25.6	515.8	21
1990	10 899.1	10.919.8	12.5	491.9	24.1	582.5	21

Source: Columns (2) and (3): Department of Mining and Energy.

Columns (4) and (7): Indonesian Oil Statistics.

Table 2

Natural gas reserves and production 1981-1990

(Thousand mmcf)

	Proven & potential reserves		**Production**				**Reserves to production ratio**
Year	Beginning year	Ending year	Work contract	Product. sharing	Pertamina	Total	(3):(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1981	44 797.0	42 397.0	79.8	902.3	141.6	1 123.7	38
1982	42 397.0	69 870.0	68.9	859.0	184.0	1 111.9	63
1983	69 870.0	71 102.0	74.8	912.3	199.3	1 185.4	60
1984	71 102.0	83 820.0	20.1	1 286.4	214.9	1 521.4	55
1985	83 820.0	88 683.0	20.7	1 337.9	221.4	1 580.0	56
1986	88 683.0	96 950.0	20.1	1 337.9	229.3	1 628.9	60
1987	96 950.0	96 904.0	20.7	1 470.9	240.6	1 732.0	56
1988	96 904.0	91 449.0	14.8	1 576.5	248.4	1 864.9	50
1989	91 449.0	91 168.0	15.3	1 710.0	253.2	1 988.0	50
1990	91 168.0	104 252.0	12.5	1.864.8	165.7	2 159.0	48

Source: Columns (2) and (3): Department of Mining and Energy.

Columns (4), (5), (6) and (7): Indonesian Oil Statistics.

Table 3

Oil account

PHYSICAL ACCOUNT (in millions of barrels)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average Change (%)
1. Opening stock	7 850.0	8 011.1	8 301.0	3 791.3	822.4	8 192.9	7 470.8	10 298.7	11 054.5	10 899.1	3.7
2. Growth	745.9	778.4	112.5	827.1	453.3	-214.9	3 307.0	1 239.9	360.4	549.2	-3.3
3. Depletion	584.8	488.2	500.5	517.0	483.8	507.2	479.1	484.1	515.8	528.5	-1.1
4. Net change	161.1	290.2	-388.0	310.1	-30.5	-722.1	2 827.9	755.8	-155.4	20.7	-20.4
5. Ending stock	8 011.1	8 301.3	7 913.3	8 223.4	8 192.9	7 470.8	10 298.7	11 054.5	10 899.1	10 919.8	3.5
1 and 5	= proven and potential reserves										
4	= 5 - 1										
2	= 4 + 3										
Price per barrel (Rp.)	22 329.0	22 926.0	28 139.0	30 146.0	30 175.0	17 644.0	28 389.0	29 467.0	30 767.0	40 468.0	6.8
Cost per unit (Rp.)	2 802.2	6 019.4	6 455.6	4 898.0	5 985.1	5 596.9	5 840.2	9 225.1	6 592.6	6 872.6	10.5
Profit per unit (Rp.)	19 526.8	16 942.6	21 683.4	25 248.0	24 729.9	12 047.1	22 548.8	20 241.9	24 174.4	33 595.4	6.2
Unit rents (85% profit)	16 597.8	14 402.2	18 403.9	21 460.8	21 020.4	10 240.0	19 166.5	17 205.6	20 548.2	28 556.1	6.2
MONETARY ACCOUNT (in billions of Rp.)											
6. Opening stock	105 692.1	132 966.6	119 556.9	145 635.5	176 480.7	172 218.0	76 500.9	197 390.0	190 199.3	223 956.8	17.2
7. Growth	12 380.3	11 210.6	2 070.4	17 750.2	9 528.5	2 200.5	63 383.6	21 333.2	7 405.5	15 683.0	1.0
8. Depletion	9 706.4	7 031.1	9 211.1	11 095.2	10 169.6	5 193.7	9 182.4	8 329.2	10 598.7	15 091.9	16.1
9. Net change	2 673.9	4 179.5	-7 140.7	6 654.9	-641.1	-7 394.3	54 200.9	13 003.9	3 193.1	591.1	-0.5
10. Revaluation	2 513.9	-17 589.1	33 219.3	24 190.1	3 621.6	-88 322.7	66 688.0	20 194.7	36 950.7	87 278.9	16.0
11. Ending stock	132 966.6	119 556.9	145 635.5	176 480.7	172 218.0	76 500.9	197 390.0	190 199.3	223 596.8	311 826.9	19.4

Table 4
Natural gas account

PHYSICAL ACCOUNT (in millions of barrels)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average Change (%)
1. Opening stock	44 797.0	42 397.0	69 870.0	71 102.0	83 820.0	88 638.0	96 950.0	96 904.0	91 449.0	91 168.0	8.2
2. Growth	-1 276.0	28 585.0	3 468.0	14 239.0	6 398.0	9 941.0	1 687.0	-3 608.0	1 707.0	15 244.0	-7.5
3. Depletion	1 124.0	1 112.0	2 236.0	1 521.0	1 580.0	1 629.0	1 733.0	1 847.0	1 988.0	2 160.0	7.5
4. Net change	-2 400.0	27 473.0	1 232.0	12 718.0	4 818.0	8 312.0	-46.0	-5 455.0	-281.0	13 084.0	-7.5
5. Ending stock	42 379.0	69 870.0	71 102.0	83 820.0	88 638.0	96 950.0	96 904.0	91 449.0	91 168.0	104 252.0	10.5
1 and 5	= proven and potential reserves										
4	= 5 - 1										
2	= 4 + 3										
Price per barrel (Rp.)	2 268.0	2 492.0	3 030.0	2 509.0	2 808.0	3 417.0	3 467.0	3 479.0	3 491.0	4 587.0	8.1
Cost per unit (Rp.)	80.0	33.1	384.3	246.0	230.5	192.4	225.5	496.1	188.2	206.2	11.1
Profit per unit (Rp.)	2 188.0	2 158.9	2 645.7	2 263.0	2 577.5	3 224.6	3 241.5	2 982.9	3 302.8	4 380.8	8.0
Unit rents (85% profit)	1 422.2	1 403.3	1 719.7	1 471.0	1 675.4	2 096.0	2 107.0	1 938.9	2 146.8	2 847.5	8.0
MONETARY ACCOUNT (in billions of Rp.)											
6. Opening stock	46 861.7	60 297.0	98 048.5	122 274.1	123 299.2	148 504.1	203 207.2	204 176.7	177 310.4	195 719.4	
7. Growth	-1 814.7	40 114.3	5 963.9	20 945.5	10 719.2	20 836.3	3 554.509	-6 995.5	3 664.6	43 407.3	
8. Depletion	1 598.5	1 560.4	3 845.2	2 273.4	2 647.1	3 414.4	3 735.7	3 581.1	4 267.8	6 150.6	
9. Net change	-3 413.3	38 552.8	2 118.6	18 708.2	8 072.0	17 421.9	-96.9	-10 576.7	-603.2	37 256.7	
10. Revaluation	16 848.6	-801.3	22 106.8	-17 683.0	17 132.8	37 281.1	1 066.4	-16 289.5	19 012.2	63 881.4	
11. Ending stock	60 297.0	98 048.5	122 274.1	123 299.2	148 504.1	203 207.2	204 176.7	177 310.4	195 719.4	296 875.5	

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