DEVELOPMENT AND ENVIRONMENT

Highlights for discussion on Sustainable Economic Growth and Development

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I. INTRODUCTION

1. Myriads of interactions between all sectors of the economy and natural resources creates the growing pressures on the natural assets and changes the environmental conditions to the lower quality. This phenomena have to be accounted for in the measurement of performance of socio-economic progress of the nation. Conventional national accounts focus on the compilation of domestic product and economic growth as reflected in market activity. To achieve more comprehensive assessment of the sustainability of growth and development, the scope and coverage of economic accounting needs to be broadened to include the use of natural assets, and the losses in income generation resulting from the depletion and degradation of natural capital.

2. The central framework of the System of National Accounts (SNA) present a number of characteristics which gives the advantages of an integrated accounting structure. The analysis of a number of important field 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 possibly alternative concepts and presentations. Those special constructs which are semi-integrated with the central framework, are called satellite accounts. Satellite systems generally stress the need to expand the analytical capacity of national accounting for selected areas of social concern in a flexible manner, without over-burdening the central framework of the SNA. The characteristics of satellite approach allow for: (i) the provision of additional information on particular social concern of a functional or cross-sector nature; (ii) the use of complementary or alternative concepts and classifications when needed to introduce additional dimension; (iii) extended coverage of costs and benefits of human activities; (iv) further analysis of data by means of relevant indicators and aggregates; and (v) linkage of physical data sources and analysis to the monetary accounting system.

3. Adapting the Agenda 21 of the 1992 Earth Summit, in 1993 UNSD published a handbook of National Accounting – Integrated Environmental and Economic Accounting – which was based on numerous approaches to environmental accounting pioneered in a series of workshops. The immediate objective of the handbook was to provide a conceptual basis for implementing System for integrated Environmental and Economic Accounting (SEEA). The SEEA was tested in developed as well as in developing countries to include Philippines, Thailand and Indonesia in ASEAN region. Only parts of the SEEA were actually compiled in those studies. The reasons are lack of data and the

controversiality of certain valuations of nature services and their welfare effects.

4. The SEEA revision process is in its final stages. Started in 1997 when the statistical commission at its 29th session, requested the London Group on Environmental Accounting to collaborate with UNSD in the revision of the interim SEEA handbook published by UNSD in 1993. The revision process was coordinated by the London Group Coordinating Committee. An Extended London Group with the participation of several developing countries met in Voorburg in May 2001. The meeting reviewed the first edited draft and a final draft of the handbook was prepared in January 2002 for revision by the Friends of the Chair Group (FCG) established by the Statistical Commission at its 32nd session in March 2001. The FCG recommended the approval of the revised SEEA subject to the changes proposed in their report to the Statistical Commission.

5. The revision of the UN Handbook of National Accounting, namely Integrated Environmental and Economic Accounting 2003 reach the final draft on July 2003. The handbook commonly referred to as SEEA-2003 will be Jointly published by the UN, IMF, OECD, EUROSTAT, and World Bank. Selected topic derived from the handbook are highlighted below for further discussion.

II. SUSTAINABLE DEVELOPMENT AND THE SEEA

6. Many of the concerns related to resource depletion and environmental degradation are reflected in the concept of sustainable development. In its most widely accepted formulation, that of the Brundtland Commission, it is stated that: "Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." In the time since the Brundtland report, researchers from many disciplines have attempted to operationalize the concept. Their goal has been to understand its implications for the current and future path of development. Broadly speaking, three currents of thought are evident within the range of views, which can be referred to for convenience as the three-pillar approach, the ecological approach and the capital approach.

(1) The three-pillar approach

7. A widely held view of sustainable development is that it refers at once to economic, social and environmental needs. According to this view there must be no single focus (or object) of sustainability, but instead all of the economic, social and environmental systems must be simultaneously sustainable in and of themselves. Satisfying any one of

these three sustainability "pillars" without also satisfying the others is deemed insufficient for the following reasons. First, each of the three pillars is independently crucial. Second, each of the three pillars is urgent and little time is available for debating which one should be addressed first; they must therefore be addressed simultaneously. Finally, the three pillars are interconnected. There is, therefore, a risk of unwittingly causing (or worsening) problems in one system while attempting to correct problems in another. The only sure way to avoid this is to integrate decisions such that effects in all three systems are considered before action is taken.

(2) The Ecological Approach

8. Central to the ecological view of sustainable development is the notion that economic and social systems are sub-systems of the global environment. It follows that sustainability in the economic and social spheres is subordinate to sustainability of the environment. Development, from the ecological viewpoint, is seen to refer to the "capacity of [an ecosystem] to respond positively to change and opportunity" or the "maintenance of [ecosystems'] dynamic capacity to respond adaptively". The key property to be sustained then is the capacity of ecosystems to respond with resilience to external perturbations and changes. A strong current within the ecological viewpoint is the notion that the "health" of ecosystems must be protected and enhanced if they are to exhibit the resilience that is necessary for sustainability. Ecosystem health can be thought of as a "resource" that enables ecosystems to adapt and evolve in the face of changing circumstances. Despite the utility of the SEEA for addressing the data needs of the ecological approach to sustainable development, the system's full power (which lies in the integration of environmental and economic data) is not fully exploited by an approach focused exclusively on ecosystems. This power is best exploited by the last of the three broad approaches to sustainable development noted above, the capital approach.

(3) The Capital Approach

9. The capital approach to sustainable development is most closely associated with the thinking of economists on the subject, although the approach goes well beyond what is typically the domain of economics. It borrows the concept of capital from economics, but broadens it in a variety of ways to incorporate more of the elements that are relevant to the sustainability of human development. In doing so, it takes concepts from the physical sciences (especially ecology and geography) and from the non-economic social sciences and integrates them within a framework based on capital.

10. The advent of sustainable development has altered the way in which many economists think about national income and its relationship to national wealth. In the past, economists tended to focus on produced capital as the underpinning of wealth and, therefore, of income. To the extent that natural resources were considered at all, they were seen to be free gifts of nature in effectively limitless supply. In recent years, with the emphasis of sustainable development on the preservation of the productive capacity of the environment, many economists have argued that the contribution of a nation's natural capital cannot be ignored in discussions of the sustainability of national income and wealth. Others have added that human capital and social capital must also be considered. This has led to the following interpretation of sustainable development from a capital standpoint:

> Sustainable development is development that ensures non-declining per capita national wealth by replacing or conserving the sources of that wealth; that is, stocks of produced, human, social and natural capital.

11. Natural capital is generally considered to comprise three principal categories: natural resource stocks, land and ecosystems. All are considered essential to the long-term sustainability of development for their provision of "functions" to the economy, as well as to mankind outside the economy and other living beings. It is helpful to consider these functions as falling into one of three groups: (i) Resource functions cover natural resources drawn into the economy to be converted into goods and services for the benefit of mankind. (ii) Sink functions absorb the unwanted by-products of production and consumption; exhaust gases from combustion or chemical processing, water used to clean products or people, discarded packaging and goods no longer wanted. (iii) Service functions provide the habitat for all living beings including mankind. Some aspects of habitat are essential, such as air to breathe and water to drink. These are called survival functions. If the quantity and quality of survival functions are diminished, biodiversity of species is threatened, not excluding the human species.

12. According to the capital approach, the long-term sustainability of development is seen to depend upon the maintenance of natural capital (in addition to the other forms of capital). If stocks of natural capital decline to the point where they are no longer able to adequately provide the functions listed above, any pattern of development that relies on these functions is not sustainable. Of course, this is not to say that some other pattern of development is not possible, only that change will be required to either 1) eliminate the need for a particular natural capital

service or 2) find a means of replacing the natural capital service with a service of produced capital.

III. AN OVERVIEW OF THE SEEA

13. The SEEA is a satellite system of the SNA that comprises four categories of accounts. The first considers purely physical data relating to flows of materials and energy and marshals them as far as possible according to the accounting structure of the SNA. The accounts in this category also show how flow data in physical and monetary terms can be combined to produce so-called "hybrid" flow accounts. The second category of accounts takes those elements of the existing SNA which are relevant to the good management of the environment and shows how the environment-related transactions can be made more explicit. An account of expenditures made by businesses, governments and households to protect the environment is an example of the accounts included in this category. The third category of accounts in the SEEA comprises accounts for environmental assets measured in physical and monetary terms. Timber stock accounts showing opening and closing timber balances and the related changes over the course of an accounting period are an example.

14. The final category of SEEA accounts considers how the existing SNA might be adjusted to account for the impact of the economy on the environment. Three sorts of adjustments are considered; those relating to depletion, those concerning so-called defensive expenditures and those relating to degradation.

(1) Category 1: Physical and hybrid flow accounts

15. Many environmental data sets are now available which show the extent to which the precautionary principles listed earlier are respected. Often different data sets are collected and published for different sorts of environmental resources. The physical flow accounts bring a set of common measuring tools to bear on these presently disparate data sets. The objective is to see the extent to which the economy is dependent on particular environmental inputs and the sensitivity of the environment to particular economic activities.

16. Bringing the data together in a framework using common classifications helps to highlight any inconsistencies and gaps in the overall picture. Once the physical data are aligned with economic classifications, an obvious next step is to compare the physical quantities

with the matching economic flows. This is developed in the SEEA by means of hybrid accounts.

17. Hybrid environmental accounting is a means of confronting physical information about the use of environmental resources with information in both physical and monetary terms about the processes of economic production.

(2) Category 2: Economic accounts and environmental transactions

18. The environment is not only used as an input by the economy. Increasingly, activities are undertaken and products are made with the deliberate intention of relieving pressure on the environment. Thus, as well as using the hybrid accounting structure to examine where pressures exist, it is also desirable to identify where expenditure is undertaken to alleviate or rectify these pressures.

19. Direct interventions in the state of the environment via environmental protection expenditure, is increasingly common for more environmentally friendly behaviour to be encouraged by means of economic instruments. These may be taxes to discourage consumption by increasing prices or they may be means of economy of controlling property rights and access to environmental media by means of selling licenses and permits.

20. The relationship of the accounts in this category to the measurement of sustainability is somewhat indirect. Clearly, expenditures made to reduce the pressure on the environment are an important measure of the human response to the sustainability challenge.

(3) Category 3: Asset accounts in physical and monetary terms

21. The environment can be thought of in natural capital terms as a collection of assets of various types. As noted earlier, natural capital falls into three broad categories; natural resources, land and ecosystems. Category 3 of the SEEA includes asset accounts in physical and monetary terms for each of these three broad categories.

22. The asset accounts of the SEEA are highly relevant to the measurement of sustainable development from the capital perspective. Natural resources, land and ecosystems represent the stocks that provide the many environmental inputs required to support economic

activity. If such activity is to be sustainable, the capacity of natural capital stocks to furnish these inputs must be maintained over time or the economy must find a substitute for the natural capital which is capable of delivering an equivalent input.

23. The asset accounts are also relevant to the intra-and intergenerational equity issues of sustainable development. In a number of countries, natural resources are owned and controlled by the government on behalf of the population at large. It is thus important to be able to see where income arises from the use of the resource and how it is apportioned between the extractor and the owner.

(4) Category 4: Extending SNA aggregates to account for depletion, defensive expenditure and degradation

24. The final category of the SEEA deals with the extension of the existing SNA aggregates to account for depletion and degradation of natural capital, as well as for so-called defensive expenditures related to the environment.

25. The use of resource functions raises the question of whether the resource is being depleted and if so whether the allowance in the economic accounts to maintain produced capital intact (the consumption of fixed capital) should be augmented by a term which might be called the consumption of natural capital.

26. Some of the expenditure in the economy relates to attempts to avoid using the sink function of the environment. This includes environmental protection expenditure and may include other expenditure of a type which might be described generally as defensive expenditure.

IV. GENERAL FRAMEWORK OF ENVIRONMENTAL ACCOUNTING

Basic Structure of the SEEA

27. The flow and stock items of the SNA are shown in the shaded area of table 21.6. 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 exports (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 (Ig); 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) for asset balances of produced assets includes the opening and closing stocks of produced assets ($Ko_{p.ec}$&$K1_{p.ec}$) and the elements explaining the change between the two, i.e., net capital formation (I=Ig-CFC), holding gains/losses on produced assets ($Rev_{p.ec}$) and other changes in volume of produced assets ($Vol_{p.ec}$).

28. The asset 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 ($Ko_{np.ec}$ & $K1_{np.ec}$) are "explained" in the SNA as holding gains/losses ($Rev_{np.ec}$) and as other changes in volume of assets ($Vol_{np.ec}$).

29. The non-shaded areas of table 21.6 include the additional elements that are needed to supplement the SNA concepts with data in physical terms on environmental cost and capital, ot amend the SNA concepts by valuing the physical data and incorporating the values in environmentally 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 rows (vii) 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 accounting when additional SEEA elements are specified in value terms.

30. 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 ($-Use_{np.ec}$) and the degradation of other natural assets that are non economic assets ($-Use_{np.env}$). The use of non-produced economic assets ($-Use_{np.ec}$) 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 fishstocks 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 species habitat.

31. Other accumulation in row (vii) records in physical or monetary terms the transfer of natural assets to economic uses as change in the stock of non-produced economic assets ($I_{np.ec}$). The counterpart of this increase in economic assets is the reduction of natural assets other than economic assets ($-I_{np.env}$). $I_{np.ec}$ would include the transfer of 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 that 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 ($Use_{np.ec}$).

32. 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 changes is reduced in the SEEA as compared with the SNA.

33. 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 effect EDP. If the additional SEEA elements are expressed in physical terms, row (viii) is not relevant; in that case the additional information in rows (vi) and (viii) is only used to supplement NDP with information on environmental cost caused by economic activities.

34. 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 ($A_{p.ec}$), non-produced economic assets ($A_{np.ec}$) and other natural assets ($-A_{np.env}$). For produced assets, it is the same as net capital formation (i.e., $A_{p.ec}=I$). 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., $A_{np.ec} = -Use_{np.ec} + I_{np.ec}$). 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., $-A_{np.env} = -Use_{np.env}-I_{np.env}$). If no monetary valuation is used, the additional elements (i.e., $-Use_{np.ec}$, $I_{np.ec}$, $-Use_{np.env}$ and $I_{np.env}$) would supplement the SNA information on investments 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.

35. If net accumulation replaces net capital formation 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 table 21.6, is:

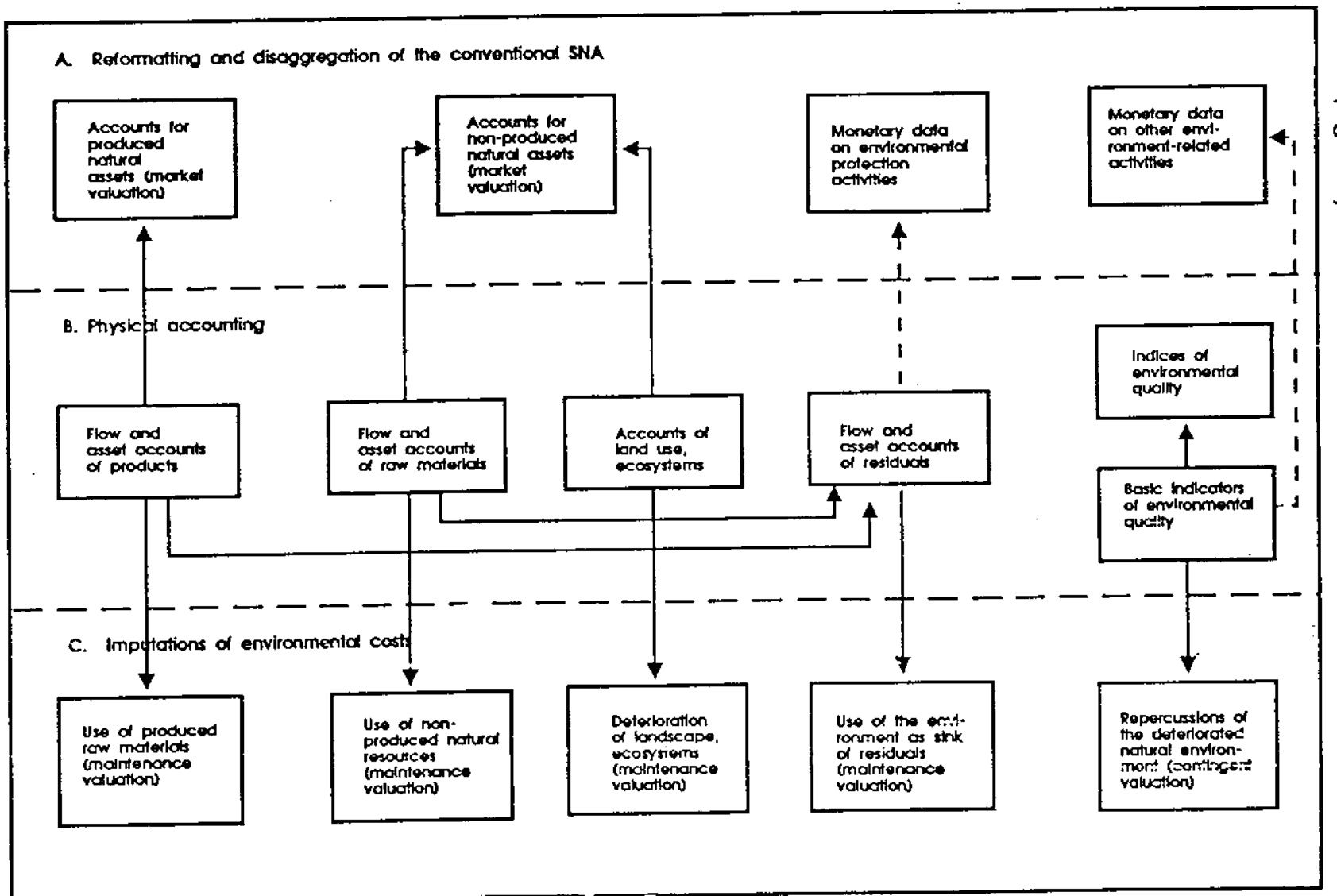
$$\mathbf{NDP = C + I = (X-M)}$$

If net capital accumulation in economic assets (A p.ec + A np.ec) replaces net capital formation (I), the identity as reflected in row (viii) becomes:

$$\mathbf{EDP = C + (\ A_{p.ec} + A_{np.ec}) - A_{np.env} + (X-M)}$$

	Economic activities			Economic assets		Environment
	Production 1	Rest of world 2	Final consumption 3	Produced assets 4	Non-produced natural assets 5	Other non-produced natural assets 6
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				$K1_{p.ec}$	$K1_{np.ec}$	

Figure 1.. Building blocks for implementing the SEEA



V. INDONESIA EXPERIENCE

- Table 1a up to table 1d shows the time series data on stock (reserve of 8 mineral deposit) and production of mining (depletion of natural resources) during 1990-2002. Commodities covered in the study are: coude oil, natural gas, coal, tin, bauxite, nickel, gold and silver.

- Table 2 shows the time series data on stock and depletion of forest resources during 1990-2002.

- Table 3 presents the physical and monetary accounts of selected resources in 1990, 1994, 1998 and 2002.

- Table 4 up to table 7 present the SEEA of selected minerals and forest resources of Indonesia during 1990; 1994; 1998 and 2002.

- Table 8 shows the comparison of GDP, NDP and EDP from the SEEA of Indonesia in 1993; 1998 and 2002.

Tabel 1a: CADANGAN DAN PRODUKSI BEBERAPA JENIS SUMBER DAYA MINERAL

TAHUN	MINYAK BUMI			GAS ALAM		
	Cadangan (Juta barel)	Produksi (Juta barel)	Rasio C:P	Cadangan (Ribu MSCF)	Produksi (Ribu MSCF)	Rasio C:P
1990	10 648.0	533.7	19.95	115 134.0	2 158.9	53.33
1991	11 294.0	581.2	19.43	100 392.0	2 461.8	40.78
1992	10 414.0	550.7	18.91	114 241.0	2 582.6	44.23
1993	9 473.0	549.9	17.23	114 842.0	2 661.9	43.14
1994	9 098.0	588.4	15.46	123 576.0	2 941.6	42.01
1995	8 983.0	586.3	15.32	135 922.0	2 999.3	45.32
1996	9 092.0	582.7	15.60	137 794.0	3 164.0	43.55
1997	9 692.0	577.0	16.80	160 460.0	3 193.5	50.25
1998	9 826.0	568.8	17.27	158 272.0	2 978.8	53.13
1999	9 613.0	545.6	17.62	170 310.0	3 067.8	55.52
2000	9 753.0	517.5	18.85	168 168.0	2 901.4	57.96
2001	9 747.0	489.3	19.92	176 588.0	2 807.1	62.91
2002	9 727.0	455.7	21.34	174 111.0	3 036.3	57.34
Rata-rata	9 796.9	548.2	17.90	142 293.1	2 842.7	50.10

Catatan :

- Cadangan yang dimaksud disini adalah cadangan terbukti dan cadangan potensial.
- Produksi yang dimaksud disini adalah produksi sektor pertambangan dan penggalian yang merupakan penyusutan (deplesi) sumber daya alam.
- Rasio disini menggambarkan jangka waktu (dalam tahun) sampai kapan cadangan diperkirakan habis.

Tabel 1b: CADANGAN DAN PRODUKSI BEBERAPA JENIS SUMBER DAYA MINERAL

TAHUN	BATU BARA			TIMAH		
	Cadangan (Juta ton)	Produksi (Juta ton)	Rasio C:P	Cadangan (Ribu ton)	Produksi (Ribu ton)	Rasio C:P
1990	3 221.6	10.5	306.82	1 420.9	30.2	47.05
1991	4 745.1	14.2	334.16	1 385.5	30.1	46.03
1992	4 722.0	23.1	204.42	1 379.9	29.4	46.94
1993	4 800.0	27.7	173.29	1 402.6	28.6	49.04
1994	5 085.8	33.0	154.12	1 437.2	30.6	46.97
1995	5 044.0	41.8	120.67	1 477.9	38.4	38.49
1996	5 170.1	50.3	102.79	1 625.4	51.0	31.87
1997	4 905.8	54.8	89.52	1 631.8	54.6	29.89
1998	5 250.7	61.2	85.80	1 631.7	54.0	30.22
1999	5 368.2	73.8	72.74	1 618.2	47.8	33.85
2000	5 391.1	77.1	69.92	1 598.7	51.6	30.98
2001	7 080 1	92.5	76.54	1 560.1	56.3	27.71
2002	6 976.7	103.4	67.47	1 481.2	79.0	18.75
Rata-rata	5 212.4	66.4	78.50	1 511.6	44.7	33.80

Catatan :

- Cadangan yang dimaksud disini adalah cadangan terbukti dan cadangan potensial.
- Produksi yang dimaksud disini adalah produksi sektor pertambangan dan penggalian yang merupakan penyusutan (deplesi) sumber daya alam.
- Rasio disini menggambarkan jangka waktu (dalam tahun) sampai kapan cadangan diperkirakan habis.

Tabel 1c: CADANGAN DAN PRODUKSI BEBERAPA JENIS SUMBER DAYA MINERAL

TAHUN	BAUKSIT			NIKEL		
	Cadangan (Juta ton)	Produksi (Juta ton)	Rasio C:P	Cadangan (Juta ton)	Produksi (Juta ton)	Rasio C:P
1990	8.7	1.21	7.19	-	-	-
1991	7.3	1.41	5.18	-	-	-
1992	6.5	0.80	8.12	-	-	-
1993	5.1	1.31	3.89	-	-	-
1994	102.4	1.34	76.42	840.3	2.31	363.76
1995	116.1	0.90	129.00	844.5	2.51	336.45
1996	117.5	0.84	139.88	845.3	3.43	246.44
1997	119.9	0.81	148.02	844.8	2.83	298.52
1998	126.1	1.06	118.96	904.6	3.23	280.06
1999	131.8	1.12	117.68	906.9	3.23	280.77
2000	135.8	1.15	118.09	976.1	3.04	321.08
2001	146.9	1.24	118.47	975.2	3.62	269.39
2002	159.5	1.28	124.61	977.6	4.41	221.68
Rata-rata (1995-2002)	131.7	1.05	125.43	901.7	3.18	283.55

Catatan :

- Cadangan yang dimaksud disini adalah cadangan terbukti dan cadangan potensial.
- Produksi yang dimaksud disini adalah produksi sektor pertambangan dan penggalian yang merupakan penyusutan (deplesi) sumber daya alam.
- Rasio disini menggambarkan jangka waktu (dalam tahun) sampai kapan cadangan diperkirakan habis.

Tabel 1d: CADANGAN DAN PRODUKSI BEBERAPA JENIS SUMBER DAYA MINERAL

TAHUN	EMAS			PERAK		
	Cadangan (Juta kg)	Produksi (Juta kg)	Rasio C:P	Cadangan (Ribu kg)	Produksi (Ribu kg)	Rasio C:P
1990	81.10	0.133	607.9	886.00	2.158	410.6
1991	81.00	0.102	793.3	884.00	2.003	441.3
1992	80.92	0.075	1 073.3	882.80	1.202	734.4
1993	80.73	0.191	423.7	881.14	1.661	530.3
1994	79.63	1.176	67.7	869.27	13.068	66.5
1995	83.83	1.805	46.4	934.13	17.138	54.5
1996	90.00	1.827	49.3	944.40	14.732	64.1
1997	106.89	2.114	50.6	1 088.66	15.745	69.1
1998	168.18	1.852	90.8	1 768.14	13.370	132.2
1999	164.95	3.227	51.1	1 745.77	22.370	78.04
2000	176.70	4.209	41.98	1 902.78	28.585	66.6
2001	189.57	4.021	47.64	2 110.49	28.079	74.0
2002	207.12	3.813	54.32	2 379.10	25.397	93.7
Rata-rata (1995-2002)	148.41	2.859	51.92	1 609.18	20.677	77.82

Catatan :

- Cadangan yang dimaksud disini adalah cadangan terbukti dan cadangan potensial.
- Produksi yang dimaksud disini adalah produksi sektor pertambangan dan penggalian yang merupakan penyusutan (deplesi) sumber daya alam.
- Rasio disini menggambarkan jangka waktu (dalam tahun) sampai kapan cadangan diperkirakan habis.

Tabel 2: SUMBER DAYA HUTAN

TAHUN	DEPLESI (Juta M^3)	PENAMBAHAN (Juta M^3)	CADANGAN AKHIR (Juta M^3)	RASIO C:D
1990	44.22	42.77	8 642.98	195.45
1991	46.97	44.24	8 640.25	183.95
1992	66.70	44.45	8 619.01	129.22
1993	77.15	47.22	8 589.08	111.33
1994	68.26	48.37	8 569.18	125.54
1995	70.68	50.27	8 548.71	120.95
1996	70.17	57.08	8 535.62	121.64
1997	114.48	57.30	8 478.43	74.06
1998	118.77	58.44	8 418.11	70.88
1999	134.93	62.20	8 345.38	61.85
2000	126.60	63.95	8 282.72	65.42
2001	151.16	67.75	8 199.30	54.24
2002	188.63	70.96	8 081.62	42.84
RATA-RATA	98.36	55.00	8 457.72	85.99

Catatan :

- Deplesi yang dimaksud disini terdiri dari konversi, kerusakan dan penebangan
- Penambahan artinya adanya pertumbuhan pohon dan penanaman baru
- Cadangan disini merupakan persediaan akhir (end year stock).
- Rasio disini menggambarkan perkiraan jangka waktu sampai kapan cadangan akan habis.

Tabel 3.1.: NERACA PHYSICAL DAN MONETER MINYAK BUMI

	1990	1994	1998	2002
I. NERACA FISIK				
(Juta Barel)				
1.Stok Awal	10 899.0	9 473.0	9 692.0	9 747.0
2.Penambahan	282.7	175.8	702.8	435.2
3.Deplesi	533.7	550.8	568.8	455.7
4.Perubahan Neto	-251.0	-375.0	134.0	-20.5
5.Stok Akhir	10 648.0	9 098.0	9 826.0	9 726.5
II. NERACA MONETER				
(Rp. Miliar)				
1.Stok Awal	264 110.3	208 258.0	302 041.7	1 176 850.1
2.Penambahan	6 874.4	3 836.1	46 570.7	50 609.9
3.Deplesi	12 978.0	12 018.8	37 690.1	52 993.8
4.Perubahan Neto	-6 103.6	-8 182.7	8 879.3	-2 384.0
5.Revaluasi	920.2	-1 551.3	340 186.4	-43 361.4
6.Stok Akhir	258 927.0	198 524.0	651 107.4	1 131 104.7

Tabel 3.2.: NERACA PHYSICAL DAN MONETER BATU BARA

	1990	1994	1998	2002
I. NERACA FISIK				
(Juta Ton)				
1.Stok Awal	3 232.2	4 800.0	4 905.8	7 080.1
2.Penambahan	-0.1	318.8	406.1	-0.0
3.Deplesi	10.5	33.0	61.2	103.4
4.Perubahan Neto	-10.6	285.8	344.9	-103.4
5.Stok Akhir	3 221.6	5 085.8	5 250.7	6 976.7
II. NERACA MONETER				
(Rp. Miliar)				
1.Stok Awal	42 269.6	55 366.8	138 150.6	427 304.1
2.Penambahan	-1.3	3 969.9	28 521.4	-0.9
3.Deplesi	140.9	410.9	4 297.6	3 498.2
4.Perubahan Neto	-142.2	3 558.9	24 223.8	-3 499.1
5.Revaluasi	1 105.9	4 405.2	206 404.6	-187 709.7
6.Stok Akhir	43 233.2	63 330.9	368 779.0	236 095.3

Tabel 3.3.: NERACA PHYSICAL DAN MONETER SUMBER DAYA HUTAN

	1990	1994	1998	2002
I. NERACA FISIK				
(Juta M3)				
1.Stok Awal	8 644.4	8 589.1	8 478.4	8 199.3
2.Pertumbuhan	41.9	47.0	56.8	69.5
3.Penanaman	0.8	1.4	1.7	1.4
4.Konversi & Rusak	15.6	38.6	93.2	163.3
5.Penebangan	28.6	29.7	25.5	25.4
6.Stok Akhir	8 642.9	8 569.2	8 418.1	8 081.6
II. NERACA MONETER				
(Rp. Miliar)				
1.Stok Awal	74 108.9	122 616.5	192 879.0	325 118.9
2.Pertumbuhan	689.6	1 498.0	3 247.6	5 278.0
3.Penanaman	9.7	24.9	50.7	92.6
4.Konversi & Rusak	157.3	618.1	2 688.6	6 493.3
5.Penebangan	349.1	631.1	945.8	1 270.3
6.Revaluasi	9 500.8	14 435.1	53 635.5	7 856.1
7.Stok Akhir	83 802.6	137 325.3	246 178.4	330 582.0

Tabel 4. Neraca Lingkungan dan Ekonomi Terpadu Tahun 1990; Komoditi Hutan dan Mineral (Miliar Rp)

Komponen Neraca	Kegiatan Ekonomi					Kapital lingkungan yang tidak diproduksi
	Produksi	Perdagangan Luar Negeri	Konsumsi Akhir	Kapital		
				Buatan Manusia	Buatan Alam	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Stok awal						
a. Barang Modal				424354.0		
b. Hasil hutan					74109.0	
c. Minyak bumi					264110.0	
d. Gas alam					298669.0	
e. Batubara					42270.0	
f. Bauksit					84.0	
g. Timah					7035.3	
h. Emas					197.0	
i. Perak					32.0	
2. Persediaan	373750.0	50046.0				
3. Penggunaan	162884.0	54376.0	142833.0	63702.0		
4. Penyusutan	10543.0			-10543.0		
5. PDN	200322.0	4330.0	142833.0	53159.0		
6. Deplisi	23172.9				-23172.9	
a. Hasil hutan	506.4				-506.4	
b. Minyak bumi	12978.0				-12978.0	
c. Gas alam	9427.0				-9427.0	
d. Batubara	141.0				-141.0	
e. Bauksit	11.0				-11.0	
f. Timah	109.0				-109.0	
g. Emas	0.4				-0.4	
h. Perak	0.1				-0.1	
7. Penambahan					121646.0	-121646.0
a. Hasil hutan					699.3	-699.3
b. Minyak bumi					6874.4	-6874.4
c. Gas alam					114073.6	-114073.6
d. Batubara					-1.3	-1.3
e. Bauksit					0.0	-0.0
f. Timah					0.0	-0.0
g. Emas					0.0	-0.0
h. Perak					0.0	-0.0

Lanjutan Tabel 4

Komponen Neraca	Kegiatan Ekonomi					Kapital lingkungan yang tidak diproduksi
	Produksi	Perdagangan Luar Negeri	Konsumsi Akhir	Kapital		
				Buatan Manusia	Buatan Alam	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
8. PDN I	177149.1	4330.0	142833.0	53159.0	98473.1	-121646.0
9. Revaluasi				3589.0		
a. Barang Modal					9500.8	
b. Hasil hutan					920.2	
c. Minyak bumi					99433.3	
d. Gas alam					1105.9	
e. Batubara					7.4	
f. Bauksit					-1817.5	
g.Timah					47.4	
h.Emas					0.0	
i. Perak						
10. Stok akhir				481102.0		
a. Barang Modal					83803.0	
b. Hasil hutan					258927.0	
c. Minyak bumi					502748.0	
d. Gas alam					43233.0	
e. Batubara					81.0	
f. Bauksit					5109.0	
g.Timah					244.0	
h. Emas					32.0	
i. Perak						

Tabel 5. Neraca Lingkungan dan Ekonomi Terpadu Tahun 1994:
Komoditi Hutan dan Mineral (Miliar Rp)

Komponen Neraca	Kegiatan Ekonomi					Kapital lingkungan yang tidak diproduksi
	Produksi	Perdagangan Luar Negeri	Konsumsi Akhir	Kapital		
				Buatan Manusia	Buatan Alam	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Stok awal				864.112,8		
a. Barang Modal					122.616,5	
b. Hasil hutan					208.280,0	
c. Minyak bumi					451.716,1	
d. Gas alam					55.366,8	
e. Batubara					606,1	
f. Bauksit					3.087,3	
g.Timah					212,9	
h.Emas					34,9	
i. Perak					26.739,5	
j. bujih Nikel						
2. Persediaan	699.523,6	96.952,6				
3. Penggunaan	317.303,9	101.331,9	259.133,3	118.707,1		
4. Penyusutan	19.111,0			-19.111,0		
5. PDN	363.108,7	4.379,3	259.133,3	99.596,1		
6. Deplisi	24.896,2				-24.896,2	
a. Hasil hutan	1.249,2				-1.249,2	
b. Minyak bumi	12.839,3				-12.839,3	
c. Gas alam	10.238,6				-10.238,6	
d. Batubara	410,9				-410,9	
e. Bauksit	7,7				-7,7	
f. Timah	97,3				-97,3	
g. Emas	3,3				-3,3	
h. Perak	0,6				-0,6	
i. Bijih Nikel	49,0				-49,0	
7. Penambahan					51.040,6	-51.040,6
a. Hasil hutan					1.522,9	-1.522,9
b. Minyak bumi					4.634,7	-4.634,7
c. Gas alam					40.641,8	-40.641,8
d. Batubara					3.969,9	-3.969,9
e. Bauksit					125,0	-125,0
f. Timah					207,4	-207,4
g. Emas					0,0	0,0
h. Perak					0,0	0,0
i. Bijih Nikel					131,2	-131,2

Komponen Neraca	Kegiatan Ekonomi					Kapital lingkungan yang tidak diproduksi
	Produksi	Perdagangan Luar Negeri	Konsumsi Akhir	Kapital		
				Buatan Manusia	Buatan Alam	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
8. PDN 1	338.212,5	4.379,3	259.133,3	99.596,1	26.144,4	-51.040,6
9. Revaluasi						
a. BarangModal				45.211,3		
b. Hasil hutan					14.435,1	
c. Minyak bumi					-1.551,5	
d. Gas alam					-51.998,5	
e. Batubara					4.405,2	
f. Bauksit					-135,8	
g.Timah					1.372,0	
h.Emas					14,5	
i. Perak					2,6	
j. Bijih Nikel					-8.994,5	
10. Stok akhir						
a. Barang Modal				1.008.920,2		
b. Hasil hutan					137.325,2	
c. Minyak bumi					198.524,0	
d. Gas alam					430.120,8	
e. Batubara					63.330,9	
f. Bauksit					587,6	
g.Timah					4.569,4	
h. Emas					224,1	
i. Perak					36,8	
j. Bijih Nikel					17.827,1	

Tabel 6. Neraca Lingkungan dan Ekonomi Terpadu Tahun 1998 Komoditi Hutan dan Mineral
Atas Dasar harga Berlaku (Miliar Rupiah)

Komponen Neraca	Kegiatan Ekonomi					Kapital Lingkungan yang Tidak diproduksi
	Produksi	Perdagangan Luar Negeri	Konsumsi akhir	Kapital		
				Buatan Manusia	Buatan Alam	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 Stok Awal						
a. Barang Modal				1.637.078,4		
b. Hasil Hutan					192.879,0	
c. Minyak Bumi					302.041,7	
d. Gas Alam					932.886,1	
e.Batubara					138.150,6	
f. Bauksit					817,6	
g. Timah					12.667,0	
h. Emas					89,7	
i. Perak					39,0	
j. Bijih Nikel					27.845,0	
2 Persediaan	1.753.446,7	413.058,1				
3 Penggunaan	751.113,7	506.244,8	717.875,5	191.270,8		
4 Penyusutan	49.478,7			-49.478,7		
5 PDN	952.854,3	93.186,7	717.875,5	141.792,1		
6 Deplesi	92.290,2				-92.290,2	
a. Hasil Hutan	3.634,4				-3.634,4	
b. Minyak Bumi	37.690,1				-37.690,1	
c. Gas Alam	44 573,5				-44.573,5	
d.Batubara	4.297,6				-4.297,6	
e. Bauksit	77,9				-77,9	
f. Timah	1.736,6				-1.736,6	
g. Emas	37,3				-37,3	
h. Perak	1,3				-1,3	
i. Bijih Nikel	241,5				-241,5	
7 Penambahan					98.536,5	-98.536,5
a. Hasil Hutan					3.298,3	-3.298,3
b. Minyak Bumi					46.570,7	-46.570,7
c. Gas Alam					11.833,2	-11.833,2
d.Batubara					28.521,4	-28.521,4
e. Bauksit					533,9	-533,9
f. Timah					1.732,0	-1.732,0
g. Emas					1.272,5	-1.272,5
h. Perak					69,0	-69,0
i. Bijih Nikel					4.705,5	-4.705,5
8 PDN 1	860.564,1	93.186,7	717.875,5	141.792,1	6.246,3	-98.536,5
9 Revaluasi						
a. Barang Modal				119.615,3		
b. Hasil Hutan					53.635,5	
c. Minyak Bumi					340.186,4	
d. Gas Alam					1.468.168,1	
e.Batubara					206.404,6	
f. Bauksit					8.031,5	
g. Timah					39 851,7	
h. Emas					2.064,4	
i. Perak					69,4	
j. Bijih Nikel					35.253,7	
10 Stok Akhir						
a. Barang Modal				1.898.485,8		
b. Hasil Hutan					246.178,4	
c. Minyak Bumi					651.107,4	
d. Gas Alam					2.368.313,9	
e. Batubara					368.779,0	
f. Bauksit					9.305,0	
g. Timah					52.514,0	
h. Emas					3.389,2	
i. Perak					176,1	
j. Bijih Nikel					67.562,8	

Tabel 7. Neraca Lingkungan dan Ekonomi Terpadu Tahun 2002 Komoditi Hutan dan Mineral
Atas Dasar harga Berlaku (Miliar Rupiah)

	Komponen Neraca	Kegiatan Ekonomi					Kapital Lingkungan yang Tidak diproduksi
		Produksi	Perdagangan Luar Negeri	Konsumsi akhir	Kapital		
					Buatan Manusia	Buatan Alam	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Stok Awal						
	a. Barang Modal				2 716 561,4		
	b. Hasil Hutan					325.118,9	
	c. Minyak Bumi					1.176.850,1	
	d. Gas Alam					4 700.018,7	
	e.Batubara					427.304,1	
	f. Bauksit					7.682,0	
	g. Timah					32.600,1	
	h. Emas					4.379,3	
	i. Perak					204,7	
	j. Bijih Nikel					169.888,1	
2	Persediaan	2.908.021,4	459.631,1				
3	Penggunaan	1.298.009,8	569.941,9	1.269.981,2	229.719,6		
4	Penyusutan	80.500,6			-80 500,6		
5	PDN	1 529.511,0	110 310,8	1.269 981,2	149 219,0		
6	Deplesi	131.657,7				-131 657,7	
	a. Hasil Hutan	7.763,6				-7.763,6	
	b. Minyak Bumi	52.993,8				-52.993,8	
	c. Gas Alam	65.162,2				-65.162,2	
	d.Batubara	3.498,2				-3 498,2	
	e. Bauksit	120,4				-120,4	
	f. Timah	1.341,9				-1.341,9	
	g. Emas	63,7				-63,7	
	h. Perak	2,5				-2,5	
	i. Bijih Nikel	711,4				-711,4	
7	Penambahan					70.776,6	-70.776,6
	a. Hasil Hutan					5.370,6	-5 370,6
	b. Minyak Bumi					50.609,9	-50 609,9
	c. Gas Alam					12.003,2	-12 003,2
	d.Batubara					-0,9	0,9
	e. Bauksit					1 304,2	-1 304,2
	f. Timah					0,0	0,0
	g. Emas					357,1	-357,1
	h. Perak					28,7	-28,7
	i. Bijih Nikel					1 103,8	-1 103,8
8	PDN I	1 397.853,3	110 310,8	1.269.981,2	149 219,0	-60 881,1	-70 776,6
9	Revaluasi						
	a. Barang Modal				176.114,9		
	b. Hasil Hutan					7.856,1	
	c. Minyak Bumi					-43.361,4	
	d. Gas Alam					-910.258,7	
	e.Batubara					-187.709,7	
	f. Bauksit					6 092,0	
	g. Timah					-6.087,9	
	h. Emas					-1.210,8	
	i. Perak					1,4	
	j. Bijih Nikel					-12.439,7	
10	Stok Akhir						
	a. Barang Modal				3.041.895,3		
	b. Hasil Hutan					330.582,0	
	c. Minyak Bumi					1.131.104,7	
	d. Gas Alam					3.736.603,0	
	e.Batubara					236.095,3	
	f. Bauksit					14 957,9	
	g. Timah					25.170,3	
	h. Emas					3 481,9	
	i. Perak					232,3	
	j. Bijih Nikel					157.840,8	

Tabel 8: PERBANDINGAN PDB, PDN & PDNI
TAHUN 1993, 1998 DAN 2002

	1993	1998	2002
1.PDB (Rp. Miliar)	329 776.0	1 002 333.0	1 610 011.6
2.PDN (Rp. Miliar)	313 287.0	952 854.3	1 529 511.0
3.PDNI (Rp. Miliar)	289 133.0	860 564.1	1 397 853.3
a. PDN / PDB X 100%	94.99	95.06	95.00
b. PDNI / PDB X 100%	87.68	85.86	86.82

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