

Chapter 7.0 NATIONAL ACCOUNTING AND ENVIRONMENTAL CONCERNS

7.1 Environmental Concerns

During the past decades increasing concern has been expressed about the deteriorating state of the natural environment, as a result of human activities. These activities are to a large extent economic in nature: production, consumption and other.

The main ways in which the natural environment can be affected by economic activities are the following:

1) Depletion of natural resources

Some examples:

- Use of biological assets to provide food; raw materials for clothing; fuel; etc.
- Use of land for the provision of nutrient flows;
- Use of subsoil to provide raw materials for economic production and energy sources;
- Use of water for drinking purposes; cooling purposes; irrigation etc.;
- Use of air for physiological purposes.

The above examples of uses of the natural assets reflect the resource function of the natural environment.

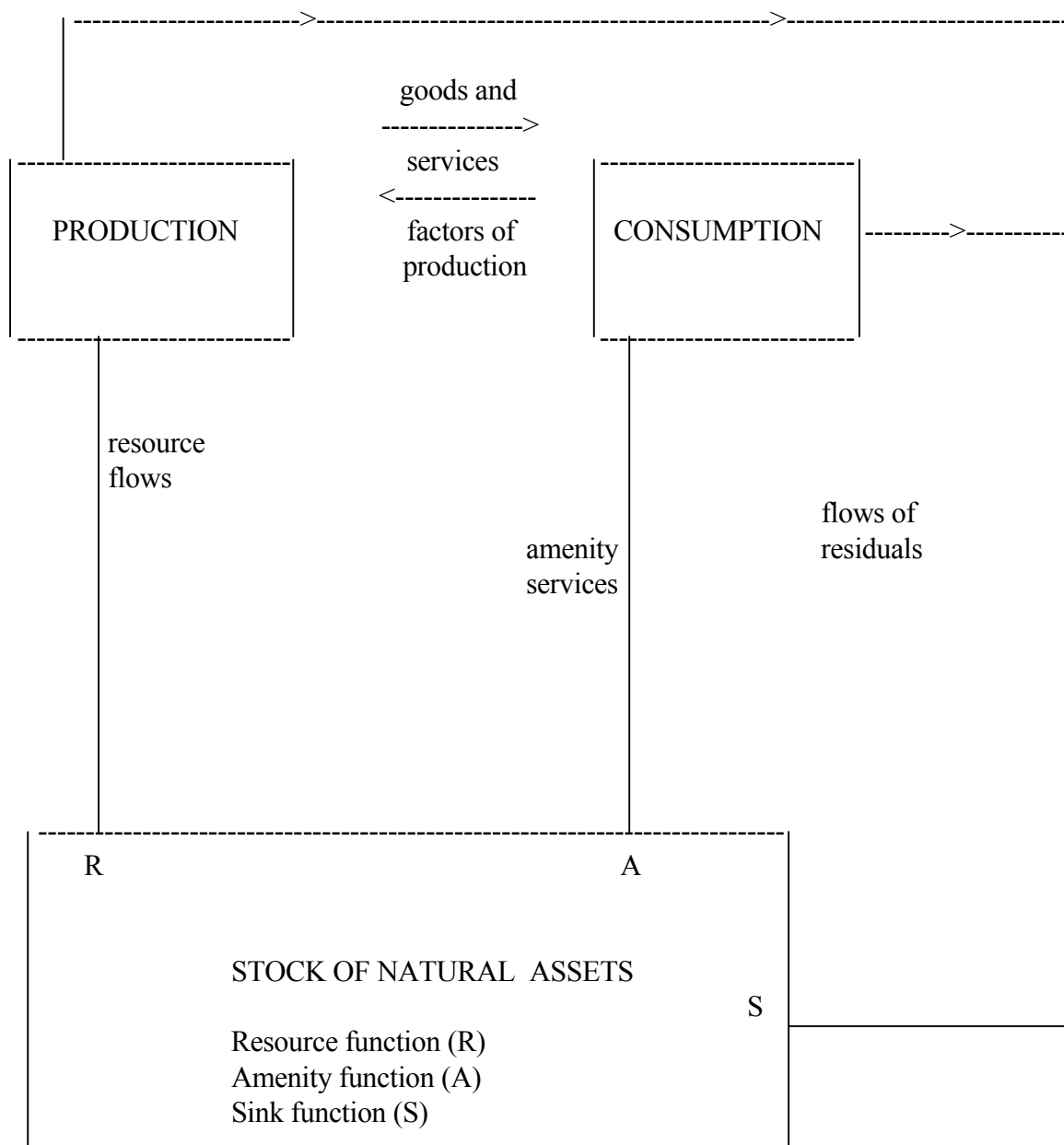
2) Degradation of the natural environment

Some examples:

- Use of land for purposes of erecting buildings, construction of roads;
- Use of land for recreational purposes (amenity function);
- Use of land/soil for storing/absorbing residuals (sink function);
- Use of subsoil for storing nuclear wastes (sink function);
- Use of water for recreational purposes (amenity function); for navigation purposes;
- Use of water for storing/absorbing residuals (sink function).

Some of the examples given above in relation to degradation reflect the amenity function of the natural environment, some other examples its sink function.

The scheme on the next page illustrates in a simplified manner the use of the environment (=stock of natural assets) for economic purposes(i.e. production, consumption, capital formation etc.) as implied by the above.



NB 1:

The use of the natural environment (= stock of natural assets) as a result of economic activity may be seen as a flow of environmental goods and services which is used in production and consumption activities, and which decrease the volume/quality of the stock of natural assets.

Depletion: the stock of natural assets is affected (i.e. reduced) in quantitative terms: this kind of use may be interpreted as a flow of goods from the environment to the economy.

7.2 National Accounts and the Environment

In the previous section it has been suggested that the interrelationships between the economy and the environment imply, among other things, the following: (1) the use of goods and services rendered by the natural environment for purposes of production and consumption; (2) decline in the wellbeing of people as a result of environmental deterioration; (3) the taking of preventive and corrective actions.

Conventional national accounting systems such as the SNA view the relationship between the environment and the economy from an **economic perspective** only. As was indicated in an earlier chapter, valuation is normally restricted to **market values**. Production in the SNA covers all goods, whether sold in the market or not, and selected non-market services (own-account production of housing services, and production of non-market government services). Non-market goods and services are valued either on the basis of prices of similar products that are marketed (agricultural products that are output of subsistence farming) or at cost (government services).

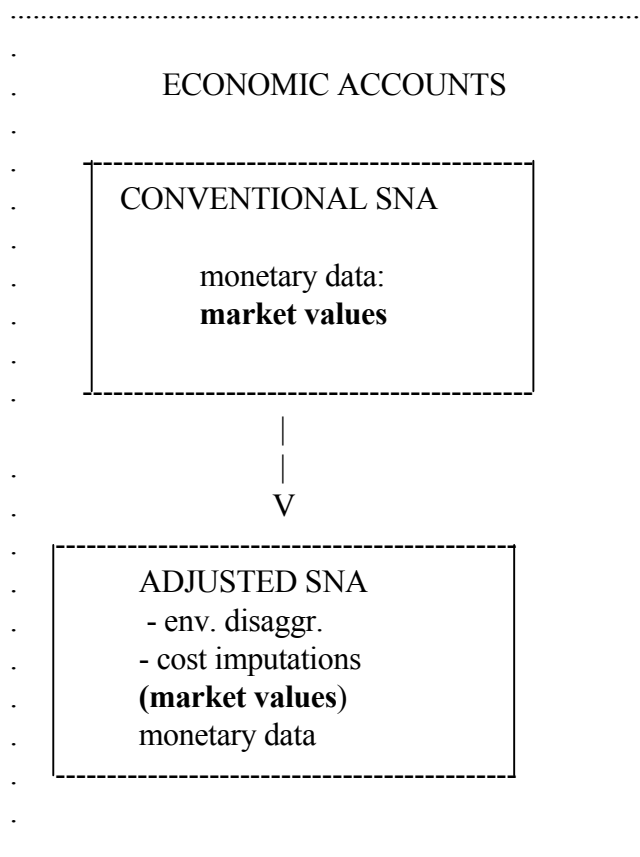
The use of the natural environment for economic purposes is not taken into account in the calculation of cost (i.e. as an input in the production process) in the SNA, and is therefore not reflected in important aggregates of the national accounts such as GDP and NDP. Although use of natural resources is not recorded as cost incurred in production, it may nevertheless be recorded in the SNA, at least partially, under 'other changes in assets'. This account among other things reflects changes in the market value of natural assets, if any, e.g. as a result of depletion or degradation. Thus the losses of income-generation capacity for future production periods and generations caused by extractive activities are not taken into account in the production accounts, but may be recorded under 'other changes in assets'; this, however, has no effect on value added or on GDP. Only the actual extraction costs associated with these depletion activities are included in the production accounts. In a similar vein, if land is used as a sink for wastes, only the transportation costs of the wastes to the sink are recorded as cost in the SNA. The decreasing quality of land may be reflected under other changes in the value of land if the market price of land reflects such changes. The environmental effects on human health may be recorded in the SNA, if actual expenditures are made for health restoration, but these also are not treated as cost.

However, many natural/environmental assets have no market price at all. Consequently, no market price can be identified for changes in the quantity/quality of these assets (i.e. the flows of environmental goods and services) either. As data in the SNA are based on market prices, those goods and services that have no market price are (apart from a few, earlier-mentioned exceptions) being left entirely outside the scope of the system, in other words the use of these assets is even not reflected in the 'other changes in assets' accounts.

In the light of the widely felt need to account in a more adequate way for different aspects associated with the interrelationships between the economy and the environment, various kinds of approaches have been suggested to extend or adjust the conventional accounting systems accordingly (e.g. the UN SEEA system; the NAMEA system of CBS Netherlands).

Below we present in a schematic fashion three possible options in an attempt to summarize the main directions into which adjustments/extensions have been proposed in this connection.

Option I: Adjustments based on the conventional SNA



This option is characterized by adjustments of the conventional SNA as follows:

A. Environment-related disaggregations.

More in particular this involves the disaggregation of the monetary flows of the SNA with respect to environment-related activities, while in addition the accounts related to natural assets may be presented in a more disaggregated way.

The disaggregation of the flows of the conventional SNA framework focuses on the identification of actual costs incurred to prevent or to restore the immediate negative impacts of economic activities on the natural environment and to prevent or compensate for further or indirect negative impacts of the repercussions of a deteriorated natural environment. These actual environmental costs include expenditures for environmental protection and expenditures for mitigating the damage (for example, to health) caused by the deterioration of environmental

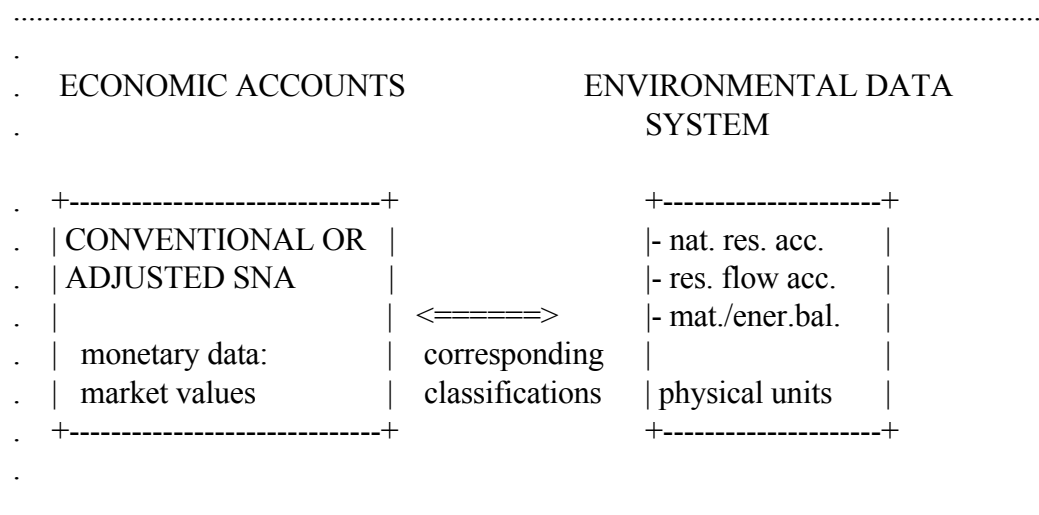
media. Such costs represent a prominent part of environment-related flows in the conventional SNA accounts.

The disaggregation of the asset and liability accounts of the SNA concern more in particular the disaggregation of the stocks of natural assets. These stocks of natural assets form part of the total stock of non-financial assets. The disaggregation to be applied to the stocks of natural assets will also be applied with respect to the different flows which are responsible for the changes in the values of the stocks of natural assets.

B. Imputations

A second kind of adjustment concerns the imputation of additional production costs to production activities as associated with depletion and degradation of natural assets. This is done on the basis of what has been recorded already in the 'other changes in assets' accounts of the conventional SNA. In other words, instead of recording the decline in (market) value of natural assets due to depletion and degradation in the 'other changes in assets' accounts, it is recorded as additional costs to production. As a consequence value added and domestic product will change. This adjusted domestic product concept may be called **Eco Domestic Product (EDP), at market values**. It should be stressed however, that on the basis of this approach only that part of the actual environmental deterioration which is reflected in a decline in the **actual market values** of natural assets, is captured in the imputed costs!

Option II: SNA linked with environmental data in physical terms.

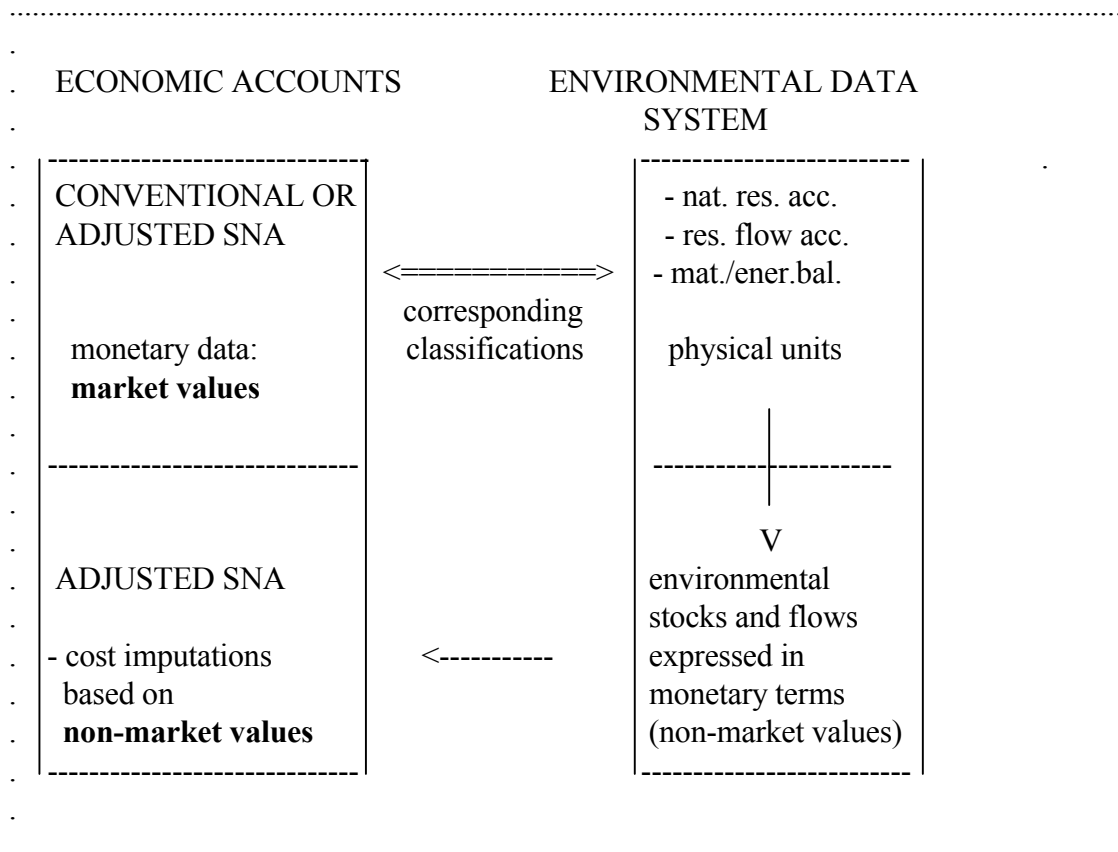


This option is characterized by bringing together in one common framework the SNA accounts (in conventional form, or in the adjusted form as described above) and environmental statistics (as presented in for example so-called natural resource accounts, residual flow accounts,

material/energy balances etc.). In this framework use is among other things being made of uniform definitions, classifications and dis-aggregations (e.g. re production activities, consumption activities etc.). While the SNA data are expressed in monetary terms, the environmental data are expressed in physical units. In practice an extended SAM framework is often made use of for this purpose.

By linking SNA type of data and environment-related data in a systematic manner (i.e by applying uniform definitions and classifications) it will be possible to describe in quantitative terms the impact of economic activity on the natural environment. More in particular this kind of framework will enable the quantitative analysis of the relationship between different kinds of production and consumption activities on the one hand, and on the other natural resource depletion, discharge of residuals and other kinds of environmental deterioration, as reflected in different types of physical measures and indicators. The parameters that may be derived from this framework may be used in different kinds of modelling exercises.

Option III: SNA linked with environmental data; extended imputations.



This option may be considered an extension of the previous one. It includes among other things monetary estimates expressed in **non-market values** of the use of natural/environmental assets (resulting in depletion, degradation etc.) for economic purposes. These estimates are used in making alternative cost imputations to production activities. These imputations yield again an adjusted domestic product concept (**i.e EDP at non-market values**), which is, however different from the one referred to earlier. Cost imputations based on non-market values will normally be larger than those based on market values, since the latter kind of imputations ignore changes in the economic value of natural assets that is not reflected in actual market prices.

While cost imputations based on non-market values will therefore be more comprehensive, they are at the same time more controversial. This because no unanimity exists about the appropriateness of the alternative valuation methods currently being used. In this connection two main kinds of methods may be distinguished, i.e. direct, and indirect non-market valuation techniques.

(1) Direct non-market valuation techniques (contingent valuation)

This method could be applied especially in the case of the qualitative (and quantitative) use of the natural environment as a public consumption good. Examples are the value of air and water use or the value of the recreational services provided by natural assets. Often, it is not possible to value natural assets as a whole but only to determine a monetary amount corresponding to a decrease or an increase in those services. One example is the valuation of the decrease in air quality. People could be asked what annual amount they would be willing to pay to avoid the observed quality change. This amount could be interpreted as the decrease in the quality of the air as perceived by the population. The best-known direct valuation methods are the willingness-to-pay and willingness-to-sell approaches. Other methods use hedonic property prices, wage-risk studies and travelcost approaches. It should be mentioned that these methods can be applied to valuing not only the different functions of natural assets but also man-made assets (for example, historical monuments) that have no market value.

The direct non-market valuation method is not undisputed. Many economists doubt whether it is really possible to determine monetary values for preferences in the absence of markets. Difficult conceptual problems and a rather poor database are the usual arguments. On the other hand, these valuation methods frequently present the only possibility of approximating the value of a wide range of functions of the natural environment.

(2) Indirect non-market valuation:

This method uses actual or hypothetical cost data. Actual costs comprise expenditures incurred for maintaining the services of the natural environment. Examples are environmental protection costs or expenditures for the mitigation of damage (for example, to human health and materials (corrosion)) caused by decreased environmental quality. An increase in environmental

protection activities that prevent degradation of natural assets or restore their degraded nature could be an indication of a reduction in the quality of environmental assets and their functions as a consequence of economic activities that was avoided or restored.

The valuation based on avoidance or restoration cost may not be an adequate one: environmental protection activities might not be sufficient to balance the negative impacts of economic activities on the environment. The actual damage costs incurred are thus in general only a lower limit for valuing the decrease in environmental quality. People may be assumed to be willing to pay at least the amount of their actual expenditures to ward off the effects of deteriorating air and water quality. In this sense, those expenditures could be interpreted as the (minimum) value of the decrease in environmental quality.

Another indirect non-market valuation technique, is the one based on hypothetical cost data. The cost of using the natural environment is extended to include costs that would have been incurred if the environment had been used in such a way as not to have affected its future use. Those costs are of course hypothetical because in reality an actual use occurred that did affect the environment. The inclusion of hypothetical costs is an attempt to value comprehensively actual environmental depletion or degradation.

Environmentally-adjusted GDP - Numerical illustration

In the above reference has been made to imputations, in order to arrive at an adjusted GDP, reflecting the use of natural assets in production activities. Two kinds of imputations are considered, namely: (1) imputations based only on the actual decline in market values of natural assets; (2) imputations of a more extensive character, i.e. reflecting the "full" decline in value of natural assets.

The two kinds of imputations may be numerically illustrated with the help of a highly simplified example for a fictitious economy. The illustration is presented with the help of three tables. The first table is based on the conventional SNA concepts and summarizes in aggregate terms and in a consistent manner the data relevant for our purposes. The second table has been derived from the first one, and shows an adjusted GDP using imputations based on market values. The third table, derived from the second one, gives among other things an adjusted GDP using imputations based on non-market values. By way of further explanation the following may be said about the three tables.

Table 21

In table 21 the following kinds of data are presented: the use (rows 2 and 3) of products (i.e. produced goods and services) as coming from domestic supply and from imports; the inputs (column 3) in the domestic production process including the value added generated (identical to the Net Domestic Product, NDP); the opening and closing stock values of non-financial assets (rows 1 and 12 intersecting with columns 4 to 6); and the transactions and other factors which explain the difference between the opening and closing stock values (rows 4, and 7 to 11 intersecting with columns 4 to 6). Note, that the non-financial assets have been broken down into three categories:

- a) produced man-made assets (= fixed assets, inventories etc.); b) produced natural assets (= livestock, orchards etc.);
- c) non-produced natural assets (land, subsoil assets, non-cultivated biological resources, water resources).

Differences between the opening and closing stock values of produced man-made assets may be explained by: new investments; depreciation (= use of produced fixed assets); other changes in volumes different from degradation, depletion, or discoveries, like for example destruction due to war; revaluations (i.e. changes in the market price levels).

Differences between the opening and closing stock values of produced natural assets may be explained by: new investments; depreciation; other changes in volumes different from degradation, depletion, or discoveries; revaluations.

Differences between the opening and closing stock values of non-produced natural assets may be explained by: new investments (e.g. land improvement); other changes in volumes related to degradation, depletion, and discoveries; revaluations.

The total supply of products in the economy comprises the gross output of domestic producers (517.4) and imports (74.6). The use of those products (rows 2 and 3) is as follows: intermediate input in the domestic production process

Table 21 Basic SNA table

	Dom. Prod.	Final Cons. Priv.	Final Cons. Gov.	Prod. Ass. Manm.	Prod. Ass. Nat.	Nprod. Ass. Nat.	Exp.	Dom. Supp.	For. Supp.
	1	2	3	4	5	6	7	8	9
1 Opening stocks				991.3	83.1	1756.4			
Use of products									
2 Domestic production	184.1	148.7	42.5	61.8	1.4	7.3	71.6	517.4	
3 Imports	39.9	28.5		6.2	0				74.6
4 Use of produced fix. ass.	26.3			-26.3					
5 Dom. Prod. 267.1 net									
6 Gr output	517.4								

Dom. Prod. Priv.	Final Cons. Gov.	Final Cons. Manm.	Prod. Ass. Nat.	Prod. Ass. Nat.	Nprod. Ass.	Exp.	Dom. Supp.	For. Supp.
1	2	3	4	5	6	7	8	9

Other Vol.
Changes

7 Due to degeneration			-	-	-20.5			
8 Due to depletion			-	-	-37.8			
9 Due to discoveries			-	-	12.3			
10 Due to other causes			-5.0	0	0			
11 Revaluation			27.6	2.6	82.4			
12 Closing stocks			1055.6	87.1	1800.1			

(184.1 + 39.9); private final consumption (148.7 + 28.5); government final consumption (42.5), investments in produced man-made assets (61.8 + 6.2), investments related to produced natural assets (1.4); investments related to non-produced natural assets (7.3); and exports (71.6).

The inputs of domestic production (column 1) are intermediate inputs (184.1 + 39.9), consumption of fixed capital i.e. depreciation (26.3), and net value added = NDP: 267.1. Obviously, this last item is equal to the difference between gross output (517.4) on the one hand, and the sum of intermediate inputs and depreciation on the other. Columns 4 to 6, which refer to the three categories of non-financial assets, show that the opening stock values amounts to 991.3, 83.1 and 1756.4 respectively; and the closing stock values to 1149.1, 93.8 and 1800.1 respectively. As mentioned earlier, the differences are caused by investments (61.8 + 6.2; 1.4; and 7.3); depreciation (26.3, for produced man-made assets); other volume changes related to degradation (-20.5), depletion (-37.8), and discoveries (12.3) for non-produced natural assets; other volume changes due to other causes (-5.0) for produced man-made assets; revaluations due to market price changes during the accounting period (27.6; 2.6; and 82.4).

Table 22

This table is similar to the previous one, with a few important differences however. The other volume changes related to degradation (-20.5) and depletion (-37.8) have been presented higher up in the table (rows 4 and 5), and have at the same time been included among the inputs in domestic production (column 1).

An adjusted domestic product, **i.e Eco domestic Product (EDP) at market values**, is obtained as the difference between gross output on the one hand, and the sum of intermediate inputs, depreciation and the (market value based) imputations related to degeneration and depletion on the other. In the example the EDP at market values amounts to 208.8 (row 7).

The difference between the EDP at market values and the NDP (267.1) is the so-called Ecomargin (58.3; row 8). This margin reflects the loss in actual market value of environmental assets as a result of production activities.

Table 22 Imputations - market values										
	Dom. Prod.	Final Cons. Priv.	Final Cons. Gov.	Prod. Ass. Manm.	Prod. Ass. Nat.	Nprod. Ass. Nat.	Exp.	Dom. Supp.	For. Supp.	
	1	2	3	4	5	6	7	8	9	
1. Opening Stocks				991.3	83.1	1756.4				
Use of Products										
2. Domestic Production	184.1	148.7	42.5	61.8	1.4	7.3	71.6	517.4		
3. Imports	39.9	28.5		6.2	0				74.6	
Use of National Assets										
4. Degener.	20.5					-20.5				
5. Deplet.	37.8					-37.8				
6. Use of produced fix. Ass.	26.3			-26.3						
7. ECO DP Market V.	208.8									
8. ECO Marg.	58.3									
9. Dom. Prod. Net	267.1									
10. Gr. Output	517.4									
Other Vol. Changes										

Table 23

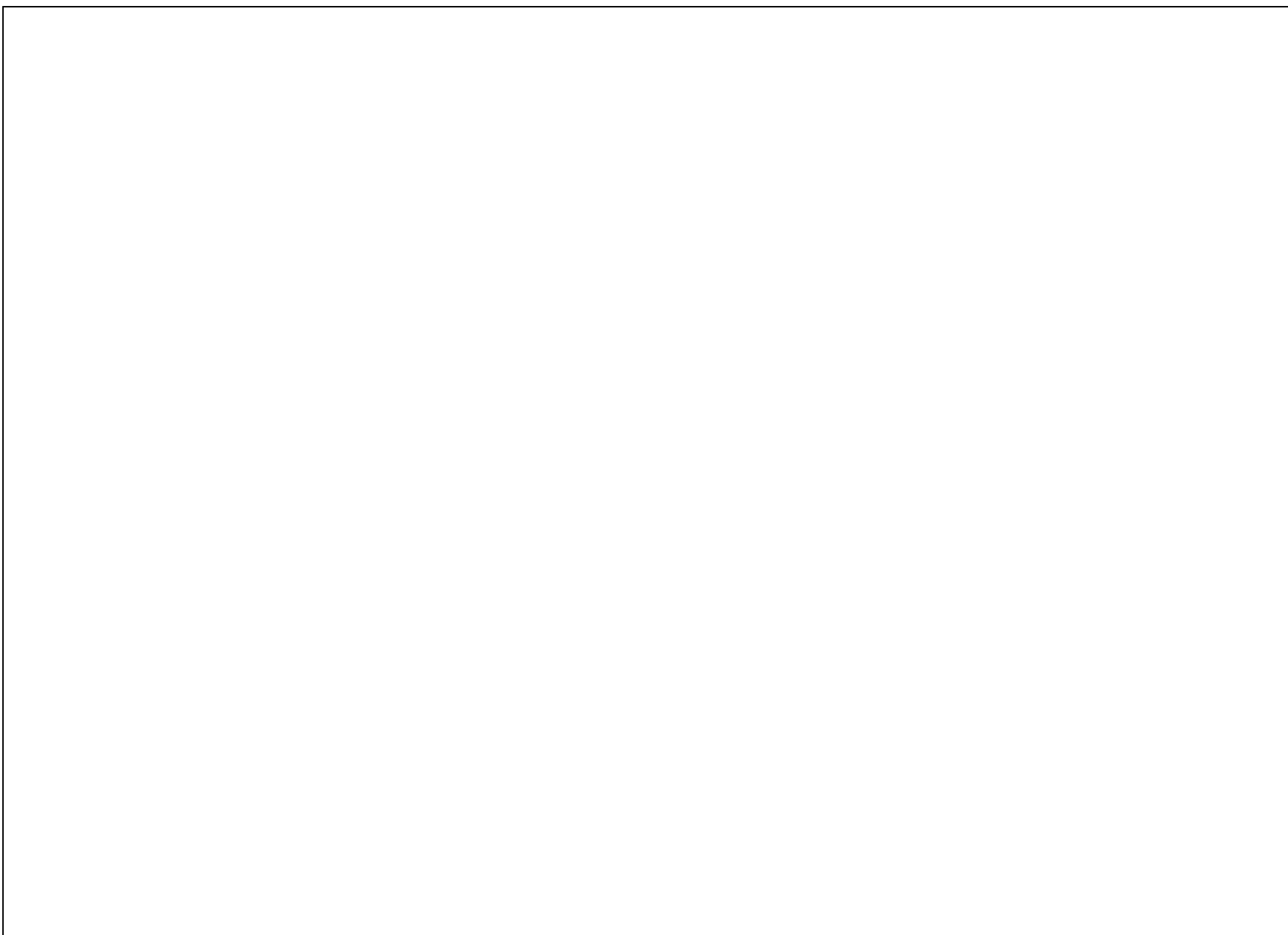
This table, which is similar to table 22, present again an adjusted domestic product. However, in this case it involves cost imputations, as related again to degradation and depletion, of which the value is not based on actual market prices, but on estimates of a more comprehensive character, i.e. reflecting the "full" decline in value of natural assets. Such kinds of estimates may have been obtained by application of one of the non-market valuation techniques as referred to earlier.

In table 23 the values for the other volume changes related to degradation and depletion (shown, as in the earlier table, in rows 4 and 5 at the intersection with column 6) are equal to

-50.5 and -47.8. In absolute terms they are larger than the market price values used in table 2 (i.e. -20.5 and -37.5). Inclusion of these values as costs (rows 4 and 5 at the intersection with column 1) leads to an adjusted domestic product equal to 168.8 (row 7, column 1). This is the **Eco Domestic Product (EDP) at non-market values**.

In row 8, column 1 the aggregate difference between the cost imputation in market value terms (58.3) and in non-market value terms (98.3) is shown: it equals 40. By adding this difference ('Adjustment to market values') to the EDP at non-market values, one obtains the EDP at market values (row 9, column 1). By doing the same in column 6, valuation of the closing stocks in terms of market prices will be secured.

As was said earlier, the above example is highly simplified. A realistic case would show, among other things, one or more of the following elaborations: (1) production activities would have been disaggregated, while imputations would have been activity-specific; (2) different categories of non-produced natural assets would have been distinguished; (3) different kinds of degradation would have been distinguished; (4) imputations would have been made not only in relation to production activities, but also in relation to consumption activities. Details about the ways in which these elaborations are dealt with in practice are, however, beyond the scope of this chapter.



SOME FURTHER TEXTS ON NATIONAL ACCOUNTING,
INPUT-OUTPUT FRAMEWORKS AND SOCIAL ACCOUNTING
MATRICES

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