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SYSTEM FOR INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING (SEEA) OF THE UNITED NATIONS

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Introduction

It is a great honour for me to participate in the International Conference in Memory of Sir Richard Stone. I did not have the opportunity to cooperate with

him and to learn from him in direct personal contact. Our relationship was restricted to some talks during international conferences. Nevertheless, his personality deeply impressed me and his spirit of work has influenced to a great extent my own attempts in the field of national accounts. His ideal to extend national accounting to achieve a comprehensive description of social and economic performance was a very important key-note for me in developing concepts of integrated aenvironmental and economic accounts. I am grateful that I coud learn from him and that I have now the opportunity to discuss his work with his former students aand colleagues.

Environmental accounting was not one of the main topics of Sir Richard Stone´s work. Nevertheless, he gave valuable advice with regard to this field, In his Nobel Memorial lecture (8 December 1984) he said: "The three pillars which an analysis of society ought to rest are studies of economic, socio-demographic and environmental phenomena. Naturally enough, accounting ideas are most developed in the economicv context (…) but they are equally applicable in the othe two fields." In 1972, he published the paper "The evaluation of Pollution: Balancing Gains and Losses" in Minerva, vol. X (1972), no 3, pp. 412 -25. This paper is a very important contribution to the question of how to value the economic use of the natural environment. He described in his paper input-output tables with separate pollution elimination activities and discussed the problem valuing pollution. In his conclusions, he proposed that the extent of pollution elimination could be determined neither by consumers nor by the producers but by a public decision based on social welfare functions. With regard to social welfare functions he applied Voltaire´s aphorism about God: "If they did not exist it would be necessary to invent them and, I may add, to act in their light (p. 425)." His aspproach is similar to the concept of prevention costs connected with setting standards which are derived from macro-economic standards rather than individual utilities.

Another very important contribution of Sir Richard Stone to integrating environmental and economic accounting are his considerations on "Supplementing the National Acconts for prposes of Welfare Measurement", a paper prepared for the United Nations and distributed by the United Nations Economic and Social Council for the eighteenth session of the Statistical Commission in Geneva, 7 - 18 October 1974 (E/CN.3/459/Add. 1, 9 August 1974). Inter alia, he proposed in his paper the development of natural asset accounts. "It is important to cover non-reproducible assets in the national

accounts as they are important elements of wealth and are the reserves for production and are the subject of major questions concerning man´s environment (para. 132)." He also stressed the importance of a functional breakdowen of transactions which would also include an explicit record of expenditures connected with environmental protection activities. "The outlays on treatment (of pollution C.S.) are already included in the accounts; the major difference is that an endeavour is made to enumerate the sources and output of pollutants and to detail the outlays on treatment (para.36)". Furthermore, he proposed that environmental statistics containing physical data on the economic-environental interrelationship should be linked to national accounts. "Thus, there are many problems of taxonomy and data collection to be solved, it appears to be possible to cover a number of aspects of pollution in a national accounting framework; in view of the importance of the subject, it is desirable to do so. It is most convenient to deal with this and other aspects of pollution together, in a coherent body of statistics of the environment which is coupled with the nationa accounts (para. 38)."

Twenty years later, we are now able to follow the recommendations of Sir Richard Stone. The revised SNA contains natural asset accounts and a a section on integrated environmental and economic accounting in a satellite system of national accounts (United Nations 1992a). A further elaboration of integrated environmental and economic accounting is given in the System for Integrated Environmental and Economic Accounting (SEEA) which will be published in a SNA Handbook this autumn (United Nations, 1992b). The SEEA contains, as Sir Richard Stone proposed, an environmental-related disaggregation of traditional national accounts, linked physical data and values of the economic use of the natural environment following the concepts of market valuation as well as prevention costs according to environmental standards.

The following paper gives an overview of the present "interim" version of the SEEA. This version has the task to make existing methodologies widely available in order to facilitate a broad consensus on a commonly acceptable integrated framework. At the same time, the feasibility of the concepts and methodes proposed has to be tested by implementing the SEEA in countries at different stages of development. The results of the theoretical discussion

and the empirical work will be used to prepare the "final" version of the SEEA. As I hope, the results of our discussion during this conference could also be unsed to further improve the concepts of the SEEA.

1. Approaches of environmental and economic accounting systems

As actual experience and the conceptual discussion have shown, there is a large variety of approaches in the design of statistical systems describing the interrelationship between the natural environment and the economy (see United Nations, Economic Commission for Europe, 1991). Two extreme positions are the following:

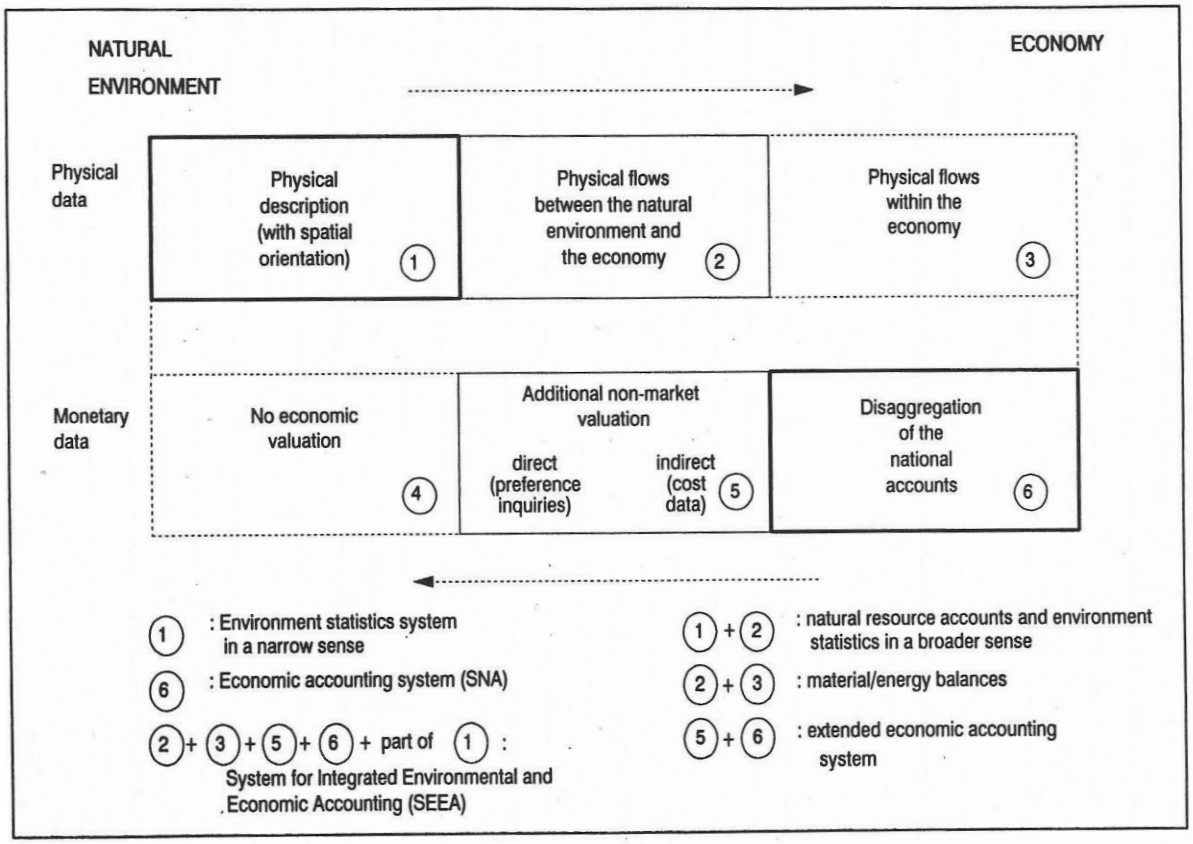
- The description is solely focused on the natural environment. The environmental-economic linkages are described with special regard to economic impacts on the environment. An important part of such a statistical framework is dedicated to a **spatial description** of the natural environment, using for instance maps of the respective region. The information is normally presented in physical units.

- A second extreme type of statistical frameworks for environmental-economic accounting focuses only on the economy and takes into account the environmental-economic linkages only as far as they are connected with **actual economic transactions** (e.g. environmental protection expenditures, actual damage costs). These data systems are normally extensions of the traditional national accounts. They disaggregate the flows and assets of the accounting system with regard to environmental aspects. The results are mainly restricted to monetary data which reflect actually observable market data.

In ***Table 1*** these two concepts are indicated under the number (1) and (6), respectively.

Approaches which are located **between** these two extremes could be classified with regard to the use of statistical units: Some statistical data systems take into account either physical or monetary data, some present a combination of them. Systems which mainly use a **uniform** type of statistical units are the following:

Table 1: Approaches of environmental accounting systems



- The physical description of the natural environment could be extended to include information on the physical flows between the environment and the economy (use of natural resources, flow of residual products). The present systems of **natural resource accounting** and environment statistics comprise mainly these data (in Table 1: (1) and (2) (cf. e.g. United Nations, 1984, 1988, 1991). This description in physical terms could be extended to information on transformation processes within the economy. The approach of **material/energy balances** comprises 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 (in Table 1: (2) and (3) (cf. United Nations, 1976). Natural resource accounting and material/energy balances have statistical areas of overlapping, especially the flows between the economy and the environment (in Table 1: (2).

- The description of economic activities in **monetary** terms could be **extended** to a valuation of the economic use of the natural environment. Comprehensive measurement of costs and benefits of economic activities and their environmental impacts could be the results of such calculations (in Table 1: (5) + (6) (cf. e.g. Bartelmus, Stahmer, van Tongeren, 1991).

These statistical systems do not seem to be sufficient for a complete monitoring framework of the environmental-economic linkages. On the one hand, the suitable statistical unit for giving a detailed picture of the natural environment is the physical unit and, from an ecological point of view, the restriction to monetary valuation indicates a complete dominance of the natural environment by the economy. On the other hand, the interrelationship between the environment and the economy could not be sufficiently described for economists if it could not be translated into money values, the common economic language. This approach not only facilitates the access of economists to environmental problems but also creates a common scale which allows the compilation of results on a highly condensed level. Therefore, the System for Integrated Environmental and Economic Accounting comprises **both monetary** and **physical data**.

A complete system of Integrated Environmental and Economic Accounts would have to contain the traditional System of National Accounts (see United Nations, 1992a) as a data system for describing economic activities, a System of Environmental Accounts and all monetary and physical flows which could describe the interrelationship between the environment and the economy (in Table 1: (1), (2), (3), (5) and (6). This **ideal concept** cannot be implemented at the present time. The main reason is a missing comprehensive data system for describing the natural environment. Ambitious approaches have been employed in several countries, but no overall description of the natural environment has been implemented up to now. This lack of success cannot only be explained by inadequate financial support. It is true that more financial resources would probably have brought about more success in developing environmental statistics and comprehensive statistical systems in this field. However, the main reason for the absence of comprehensive environmental accounting seems to be the extraordinary difficulty encountered in describing the natural environment with its climatic, biological, physical and chemical changes during a reporting period in a model which describes this complex interrelationship adequately. At present it seems possible to describe sufficiently the state of the natural environment at a certain moment. This could be done by mapping or by tables monitoring the situation at a given time. But it has been - at least up to now - nearly impossible

to portray the natural dynamics between two points of time. An example of such complex interrelations is the difficulty in developing weather models. It is relatively easy to draw weathermaps, but it is much more difficult to explain the reasons for the observed weather situation and to describe the changes. A complete integration of existing environmental and economic data systems therefore seems to be impossible at this moment.

It seems necessary to concentrate efforts in this field first of all on improving environmental statistics and to develop consistent systems for describing the natural environment as a second step. The **Framework** for the **Development** of **Environment Statistics** (FDES) of the United Nations and the work of the different regional organizations of the United Nations (e.g. the Economic Commission for Europe) in the field of environmental statistics seem to be a promising starting point (United Nations, 1984, 1988, 1991, and United Nations, Economic Commission for Europe, 1988). The French work in the field of Natural Patrimony Accounting (see INSEE, 1986) could play a prominent role in further conceptual improvements in this field.

Difficulties in describing the natural environment in a comprehensive and sufficiently detailed manner should not prevent the attempts to describe the interrelationship between the natural environment and the economy as completely as possible. Concepts of **natural resource accounting** which focus on describing the natural environment from the point of view of economic use and the experience which has been gained in this field in several developing and developed countries could be used to establish a consistent data system. In this context, the conceptual considerations in the context of **material/energy balances** may also prove to be helpful.

The relatively comprehensive **System for Integrated Environmen-tal and Economic Accounting** (SEEA) comprises four parts:

1. Parts of the established economic accounting system (System of National Accounts (SNA) of the United Nations, see United Nations, 1992a) which are of special relevance to environmental aspects and which will have to be partly disaggregated to identify monetary flows and assets which are related to the use of the natural environment (Table 1: parts of (6)).

2. Additional non-market valuation of the economic use of the environment in monetary terms (in Table 1: (5)).

3. Physical data on the flows from the natural environment to the economy, on their transformation within the economy and on the flows of the residuals of the economic activities back to the natural environment (in Table 1: (2) and (3)).

4. Description of the natural environment as far as it is necessary to analyze the impacts of economic use. This part would not lay claim to comprehensiveness. It would rather have a supplementary character (in Table 1: parts of (1)).

This concept does not pretend to provide an overall accounting system which comprises a complete description of the natural environment, the economy and its interrelations. It only focuses on describing the **interrelationship** between the **environment** and the **economy**. Economic activities as well as events within the natural environment are only taken into account as far as they are necessary to understand the relations between the economy and the environment. Furthermore, the relationships with socio-demographic data systems have not been elaborated.

The fact that an established system for environmental accounting is not available at the present time seems to justify that the planned SEEA takes as **starting point** only the well-established system for economic accounting, the SNA. The non-market valuation of the economic use of the natural environment is introduced in addition to the monetary data of the national accounts. The physical data of environment statistics, the natural resource accounts and of the material/energy balances are connected with the respective data in monetary terms in the national accounting system.

Employing the established economic accounting system does not necessarily lead to a dominance of economic aspects. On the contrary, it can reveal possibilities of stressing ecological aspects. Ecological aspects can be introduced in economic thinking and in economic decisions only if ecologists and economists are using the same language. If ecological aspects could be translated into money terms the possibilities of economic decisions taking environmental problems into account would be much greater. The aim of the SEEA should be to establish a suitable data basis for a policy of sustainable development. This development can only be influenced by economic decisions. There is, therefore, higher priority to introduce ecological aspects into the sphere of economic activities than to monitor only economic impacts on the natural environment without economic valuation.

2. SEEA as satellite system to the national accounts

During the last twenty years, proposals have been made to modify the national accounting system with regard to environ-mental aspects (cf. Baltensperger, 1972; Bartelmus, 1974, 1987 and 1989; de Boo, Bosch, Gorter, Keuning, 1991; Eisner, 1988; Fickl, 1991; Franz, 1988, 1989; Hamer, 1974; Harrison, 1989a, 1989b, 1992; Hueting, 1980; Levin, 1990; Marin, 1978; NNW Measurement Committee, 1973; Nordhaus, Tobin, 1973; OECD, 1971; Olson, 1977; Peskin, 1980, 1989; Richter, 1989; Uno, 1989, 1990; Reich, 1991; Reich, Stahmer, 1983; Thage, 1990, 1991). It has been argued that it is not sufficient to focus the accoun-ting system on market transactions and to describe non-market activities only if they are connected with observable costs (e.g. in the case of government and non-profit institutions' activities). The results of this debate have shown that the majority of experts rejects substantial changes to the traditional national accounts but would prefer to establish a **special system** outside the traditional framework to describe environmental-economic relations (cf. the comprehensive analysis of Chr. Saunders in United Nations, 1977, and Adler, 1982; Carson, 1989; Denison, 1971; Drechsler, 1976; Herfindahl, Kneese, 1973; Stone, 1972; United Nations, 1974, prepared by R. Stone; United Nations, 1979, 1980; United Nations, ECE, 1973).

The **traditional national accounts** seem to be a sine qua non for analyzing problems of a **market economy**. There are many applications for which the restriction to market transactions is not a disadvantage but rather an advantage (see Reich, 1989, 1991). Short-term economic policy needs data on labor, commodity and financial markets. National accounting systems are effective because the data fulfill two preconditions: They are suitable and they are observable. The degree of necessary estimations is low because most data of the national accounts can be directly observed from household and enterprise surveys.

The urgent need to describe the interrelationship between the environment and the economy should therefore not invalidate national accounting systems, but should lead to a special data system which, though being separate, should be closely linked to the traditional national accounts. This approach necessitates two systems, the traditional national accounts used as a **core system** and a special data framework which has the character of a **satellite system** (or satellite accounts) (Hamer, 1986; Lemaire, 1987; Reich, Stahmer, et al., 1988; Schäfer, Stahmer, 1990; Teillet, 1988; Vanoli, 1989; Weber, 1983, 1989). The preconditions for the success of such a construction are twofold:

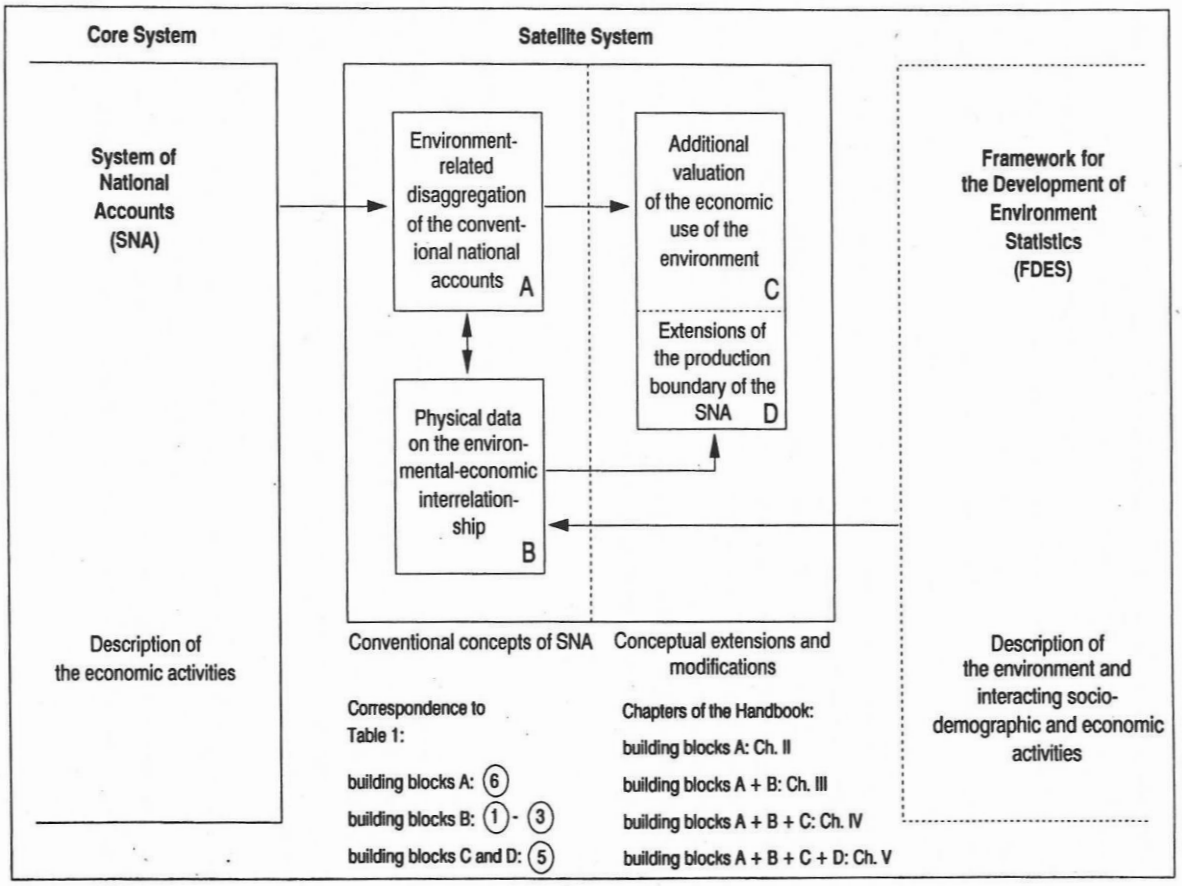
- The concepts of a satellite system should have higher degrees of **freedom** than those of national accounts. They should be chosen in such a way that they can both give a comprehensive picture of the environmental-economic interrelationship and take into account the ecological point of view. It should also be possible to use valuation methods which might have a weaker data basis than the traditional national accounts. Furthermore, the possibility should be offered to test different methods and to describe different options. The complex problems of the use of the environment for economic activities can not be reduced to one specific approach. The most comprehensive measures of economic-environmental relations represent at the same time concepts which have the weakest data basis. The experimental character of possible environmental accounting systems should, therefore, be stressed. A satellite system should certainly present a consistent framework. But such framework should as far as possible take into account different schools of thinking.

- The aim of the accounting system can not be restricted to describing environmental deterioration caused by economic activities. The system should become a data basis for integrated environmental and economic policies. This aim can only be achieved if both the direct and indirect impacts of the economic use of the environment on economic activities can be analyzed. This implies close connections between the traditional economic accounting system and the new satellite system. The **links** between the two data systems could be used to establish comprehensive economic models which comprise not only economic but also environmental data.

At first sight the two preconditions for developing a suitable concept for the SEEA seem to be mutually exclusive. Close linkages to the national accounts seem to prevent an ecological orientation and an experimental design of the satellite system. It is obvious that this possible conflict can only be solved by developing a system with a high degree of **flexibility** (cf. the considerations of the "Dutch school": Bochove, Tuinen, 1986). The system should comprise modules or building blocks which are linked to the traditional accounting system in differing degrees, (see e.g. Friend, 1991). As far as possible, the same concepts should be used for both the core system and the satellite system. In cases where different concepts are required, bridge tables are necessary which explicitly show the conceptual differences and which could be used as links between the new data sets and the traditional national accounts.

The SEEA (see United Nations, 1992b) comprises four types of **building blocks** which follow the concepts of the SNA (see United Nations, 1992a) to a differing extent (see ***Table 2***):

Table 2: SNA Satellite System for Integrated Environmental and Economic Accounting (SEEA)



- The first type of building blocks for constructing the SEEA is the production part of the SNA which contains a description of production and consumption activities (supply and disposition tables), and the accounts of non-financial assets (building blocks A of the SEEA). The production part of the SNA is sometimes called the **input-output part** because it comprises the data basis for input-output tables with uniform row and column classifications. The input-output framework seems to be the most suitable economic framework for analyzing environmental-economic relations because it could easily be extended by including flows of natural resources from the natural environment as inputs of economic activities and the flows of residuals of production and consumption activities as unwanted outputs delivered back into the natural environment. The starting point for the **natural asset accounts** of the SEEA are the non-financial asset accounts of the

SNA which also comprise non-produced natural assets in the revised version (see United Nations, 1992a).

The SEEA contains the above mentioned parts of the SNA partly in an aggregated version, and partly in a more disaggregated form. **Disaggregation** seems to be particularly necessary to identify the environmental protection activities which should prevent an environmental deterioration or should restore an already deteriorated natural environment, and the repercussion (damage) costs (health expenditures, material corrosion costs) caused by a deteriorated environment. In the case of non-financial assets, further disaggregation of stocks and volume changes of natural assets is required.

- A second type of building blocks of the SEEA (in Table 2: building blocks B) comprises a description of the interrelationship between the natural environment and the economy in **physical terms**. This part of the SEEA which applies the conceptual considerations and empirical experiences of natural resource accounting, material/energy balances, and input-output compilation is closely linked to the monetary flows and assets of the SEEA derived from the production part of the SNA. These extensions could be made without modifying the concepts of the SNA.

- In a third part of the SEEA (in Table 2: building blocks C), different approaches are discussed for estimating the **imputed costs** of the economic use of natural assets. In this context, three different valuation methods are used:

ø market valuation according to the concepts of the non-financial asset accounts in the SNA,

ø maintenance valuation which tries to estimate the costs necessary to sustain at least the present quantitative and qualitative level of natural assets,

ø contingent valuation which could be applied especially for estimating the value of the "consumptive services" of the natural environment.

- A fourth type of building blocks of the SEEA (in Table 2: building blocks D) contains additional information which could be obtained by **extending** the **production boundary** of the SNA. These extensions have been applied especially in the case of household activities whose detailed analysis is necessary for understanding the impacts of household activities on the natural environment and

the welfare aspects of the deteriorated nature. Furthermore, the consequences of treating economic functions of the natural environment as production of "environmental services" are discussed. A third method for extending the production boundary of the SNA refers to treating both internal and external environmental protection activities as production activities.

3. Versions of the SNA in the Handbook

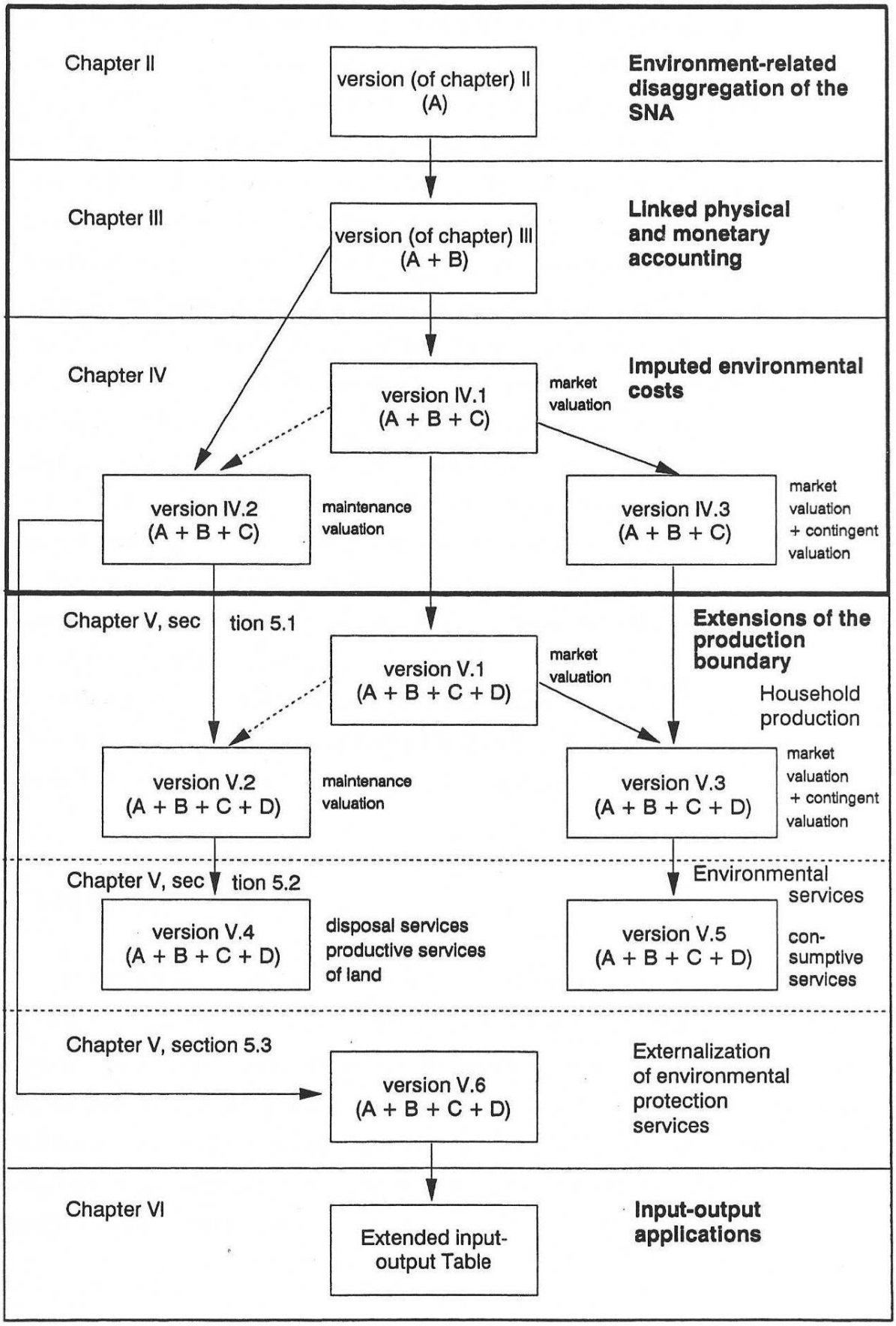
The different types of building blocks of the SEEA are not described as separate entities but as extensions of a **common accounting framework**. Each stage of extension comprises the data of the preceding stages as long as the valuation methods are not mutually exclusive. In ***Table 3***, the dependencies between the different versions of the SEEA are shown. Furthermore, the chapters of the Handbook dealing with the specific SEEA **versions** are also indicated.

- In **Chapter II**, possible environment-related disaggregations of the SNA are described: version (of Chapter) II of the SEEA with building blocks A.

- In **Chapter III**, the monetary data of part A of the SEEA are linked with environment-related information in physical terms: version (of Chapter) III of the SEEA with building blocks A + B.

- In **Chapter IV**, imputed environmental costs (part C) are added: versions (of Chapter) IV of the SEEA with building blocks A + B + C. Three different types of valuation of imputed costs are discussed: market valuation (version IV.1), maintenance valuation (version IV.2) and contingent valuation in addition to market valuation (version IV.3).

Table 3: Versions of the SEEA in the Handbook



- In **Chapter V**, extensions of the production boundary of the SNA are described in combination with differing types of valuation of imputed environmental costs: versions (of Chapter) V of the SEEA with building blocks A + B + C + D. The extended record of household production activities has been applied in combination with the three valuation methods of imputed environmental costs already applied in Chapter IV (versions V.1, V.2 and V.3). Environmental services have been treated as production in the case of disposal services (part of version V.4) which describe the use of the natural environment as sink of economic residuals, in the case of productive services of land, landscape and ecosystems (part of version V.4), and in the case of consumptive services for households (version V.5). Versions V.4 and V.5 take into account not only environmental production but also an extended concept of household production. Thus, they are derived from versions V.1, V.2 and V.3, and represent a further stage of extension. The "externalization" of internal environmental protection activities (version V.6) is described on the basis of the concepts of version IV.2 (maintenance valuation).

- A product-based symmetric input-output table with environment-related extensions is derived from version V.6 and described in **Chapter VI**. This table is used as a conceptual basis for applications of the SEEA in input-output analysis.

4. SEEA Matrix

The SEEA is presented mainly in matrix form comprising a description of both flow and asset accounts. ***Table 4*** shows the **SEEA matrix** in different stages of extension. For facilitating the description, the record of monetary data is described only. Flow data are recorded in rows 2 to 12; the asset accounts, in columns 5 to 7. Flow and asset accounts are linked to each other by the volume changes of assets described in rows 2 to 10 and columns 5 to 7. The classification items refer to the basic row and column classifications used throughout in the Handbook.

The structure of the **columns** has some similarities with the columns in input-output tables. The first three columns comprise different production activities; columns 4 to 8, final uses. Differing from input-output concepts, the record of gross capital formation (columns 5 to 7) has been supplemented by complete asset accounts including stock data

Table 4: SEEA matrix in different stages of extension - monetary data

disaggregation of the SNA (Chapter II) | °° imputed environmental °° costs (Chapter IV) | extensions of the production boundary (Chapter V)

Ser. no.		1. Domestic production			2. Final consumption	3. Non-financial assets			4. Exports	Σ 5. Total uses
		1.1 Industries	1.2 Other household activities	1.3 Environmental services		3.1 Produced assets		3.2 Non-produced natural assets		
						3.1.1 industries	3.1.2 consumer durables			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1. Opening stocks									
2 3	2.1 Use of products of industries 3.3.1 Use of produced fixed assets of industries									
4 5	2.2 Use of other household outputs 3.3.2 Use of consumer durables									
6	2.3 Use of environmental services									
7	3.1 Use of non-produced natural assets	°°°°°°°°			°°°°°°°°	°°°°°°°°		°°°°°°°°	°°°°°°°°	°°°°°°°°
8	3.2 Economic treatment of residuals	°°°°°°°°			°°°°°°°°	°°°°°°°°		°°°°°°°°	°°°°°°°°	°°°°°°°°
9	4.1 Adjustments due to market valuation	°°°°°°°°			°°°°°°°°	°°°°°°°°		°°°°°°°°	°°°°°°°°	°°°°°°°°
10	4.2.1 Eco margin	°°°°°°°°			°°°°°°°°	°°°°°°°°		°°°°°°°°	°°°°°°°°	°°°°°°°°
11	4.2.2 Net value added/Net Domestic Prod.									
12	Σ 5. Gross output									
13	6. Other volume changes									
14	7. Revaluations due to market price changes									
15	Σ 8. Closing stocks									

The structure of the **rows** reflect a combination of items necessary for establishing asset accounts, and items used for recording flows. Rows 1 and 13 to 15 are relevant only in the context of asset accounts. The structure of rows 2 to 12 is again similar to that of input-output tables. It comprises the use of products and assets, net value added (net domestic product) and gross output.

The SEEA matrix is used for describing all versions of the SEEA in different **stages** of **extension.** Three stages are differently hatched in Table 4:

- Version II (see Chapter II of the Handbook) of the SEEA refers to data according to the **conventional concepts** of the SNA. These data are further disaggregated to reveal environment-related activities and the monetary flows and stocks connected. In version II, domestic production activities comprise only the production activities of industries (column 1), and, therefore, produced assets contains only assets of these industries (column 5). The use of products is limited to products of industries (row 2); and the use of assets, to the use of produced fixed assets of industries (row 3). The asset accounts comprise opening stocks (row 1), net capital formation (rows 2 and 3), other volume changes (row 13), revaluation due to market price changes (row 14) and closing stocks (row 15) which are the column totals of the recorded asset accounts.

- The versions of Chapter IV of the Handbook which describe different approaches of valuing **imputed environmental costs** imply a recording of additional costs associated with different economic activities (production, final consumption, use of produced assets), and with reverse sign, costs associated with volume changes of natural assets deteriorated by economic activities (see row 7). Adjustment items are introduced (rows 9 and 10) which balance imputed environmental costs against the conventional figures of Net Domestic Product (column 1) and the corresponding volume changes of natural assets against other volume changes and the closing stocks of natural assets still valued according to the SNA concepts.

- A third stage of development of the SEEA implies **extensions** of the **production boundary** of the SNA (see Chapter V of the Handbook). The extended concept of household production activities is reflected in the SEEA matrix as an additional record of production activities (see "other household activities" in column 2) and products (row 4). The corresponding extension of the concept of produced assets entails the introduction of asset accounts of consumer durables and the record of corresponding user costs (row 5). If environmental services are treated as production activities, a further extension of the concept of domestic production is necessary (see column 3 and row 6). The conceptual implications of externalizing internal environmental protection services are not explicitly shown in Table 4 for sake of simplicity. If externalized such approach would imply modifications of the concepts of industries.

Hatched elements of the SEEA indicate that they could, at least theoretically, contain figures in monetary terms. In Chapters II, IV and V of the Handbook, the different versions of the SEEA matrix are shown in detail.

5. Implementation of the SEEA

In order to adapt the SEEA to different environmental and socio-economic conditions in countries, the SEEA has been designed to be as comprehensive, flexible and consistent as possible.

The aim of **comprehensiveness** refers not only to a variety of different patterns of economic development or categories of environmental deterioration, but also to alternative theoretical approaches which can be applied for analysing the economic and environmental situation. Physical accounting is used as well as differing types of monetary valuation.

Comprehensiveness in the SEEA does not imply the use of the whole range of possibilities to describe environmental-economic interrelations. The specific environmental and economic problems of a particular country have to determine the choice of the main fields which should be taken into account. Furthermore, data availability and possibilities of further improvement of the data base restrict the application of SEEA concepts. These constraints necessitate a **flexible** system which should comprise a variety of building blocks which could be used independent of each other (see the proposals of van Bochove, van Tuinen, 1986).

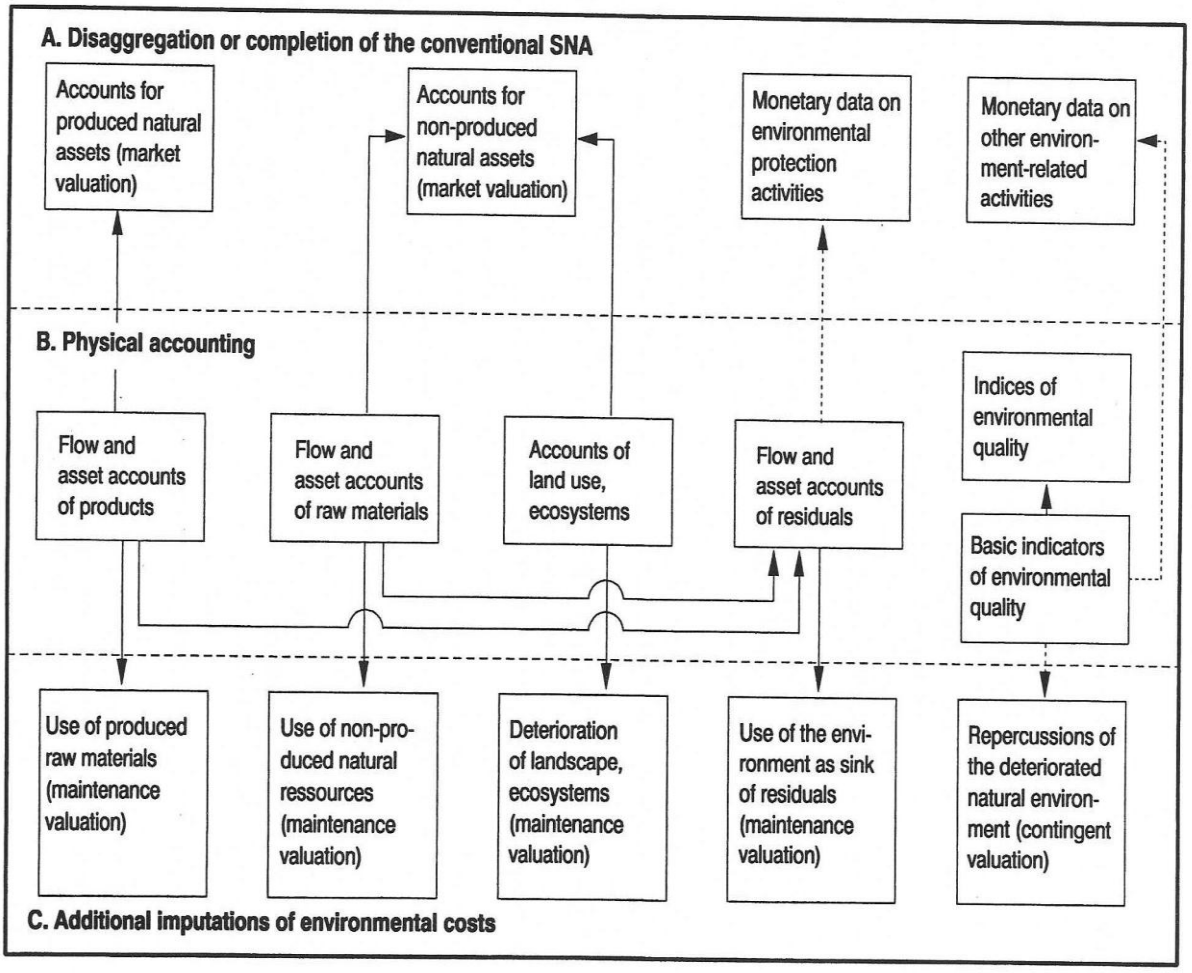
This necessary flexibility of the SEEA should not affect the **consistency** of the system. A consistent data system is guaranteed if the versions of the SEEA remain an extension of the national (economic) accounts and apply the accounting rules of extended accounts. These rules imply for instance that supply and destination of products, natural resources and residuals should be balanced in the flow accounts and that complete asset balances should be established. Therefore, the concept of flexibility permits the selection of high priority flow and asset accounts but should not encourage the development of incomplete accounts.

The implementation of the SEEA should focus on high-priority concerns and related economic activities. Implementation will, however, be limited by **data availability**. Therefore, it seems useful to start with implementing that part of the SEEA which has both high priority and a sufficient data basis. The data basis

should be improved in parallel to the implementation of initial building blocks of the SEEA with a view to achieving a more complete version of the SEEA in the future.

In ***Table 5*** an overview is given of possible statistical building blocks of the SEEA. Of course, each building block comprises a variety of specific items that could be compiled separately (e.g. accounts for different types of products, raw materials or residuals).

Table 5: Building blocks for implementing the SEEA



The building blocks are grouped according to the three mentioned **types** of **data** in the SEEA:

(a) Disaggregation or completion of the **conventional** SNA with regard to environmental issues (building blocks A of version II of the SEEA): This part of the SEEA comprises, in particular, building blocks describing the accounts of natural assets (market valuation), and actual (observable) monetary data

connected with environment-related defensive activities (e.g. environmental protection activities or defensive activities against the repercussions of a deteriorated natural environment);

(b) **Physical accounting** (building blocks B of version III of the SEEA): This part of the SEEA comprises accounts for products, raw materials and residuals, as well as land use accounts, environmental quality indicators and other (more aggregated) indices.

(c) **Imputed environmental costs** with regard to the impacts of economic activities on the natural environment (building blocks C of versions IV of the SEEA): This part of the SEEA comprises estimates of the prevention costs necessary to maintain the qualitative and quantitative level of the natural assets (Bartelmus, Stahmer and van Tongeren, 1991) and the imputed costs of the repercussions of the deteriorated natural environment (using contingent valuation methods, see OECD, 1989; Pearce, Markandya and Barbier, 1989; and Stahmer, 1991).

The arrows in Table 5 show **dependencies** in compiling different building blocks: The empirical implementation of some building blocks require the implementation of other parts of the system. This is especially true of the monetary data (building blocks A and C in Table 5) which - in many cases - can be compiled only on the basis of sufficient physical data (building blocks B). The compilation dependencies between the different building blocks in monetary terms are not so strong. These data can mainly be compiled independently. Nevertheless, imputed environmental costs (building blocks C) can be usefully analyzed only in comparison with actual (observable) data (building blocks A). These compilation dependencies among the different parts of the SEEA support the view that first priority should be given to physical accounting. Monetary data could then be estimated in a second step. This procedure does not exclude the immediate implementation of monetary building blocks which are more or less independent of physical data. This is especially true of the estimation of expenditures connected with environmental protection activities and the, more controversial, application of contingent valuation.

Flexibility of the SEEA would permit an implementation of the SEEA limited to building blocks A and B (version III of the SEEA). This limitation implies that the concepts of the traditional national accounts would remain completely unchanged because building blocks A and B only record a disaggregation and

completion of conventional data or, in the case of physical accounting, additional environment statistics which provide further information without affecting traditional concepts. On the other hand, a limited presentation of details of the environmental-economic interrelationships in physical terms is questionable. If the results of the SEEA are to support an integrated environmental and economic policy, a sort of **weighting procedure** for condensing the details is needed because political decisions are often based on a few highly aggregated figures. The estimation of imputed environmental costs allows such aggregation. Of course, aggregated physical indicators, for instance on changes in quality of specific environmental media, have to supplement this monetary information.

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