

# Environmental-Economic Comprehensive Accounting (UGR) – A New Tool for Decisions in Environmental Policies –

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**Abstract:** The main objective of Environmental-Economic Comprehensive Accounting by the Federal Statistical Office is to quantitatively cover the condition of the environment and its development and to present these data in connection with economic activities. The major elements of the basic concept are: measuring the removal of resources, covering the emission of substances, their disposal and destination, and the situation of emissions, covering by sectors the measures and expenditure concerning environmental protection as well as presenting selected uses of the environment as a location. A research programme has been

defined according to the information fields of the UGR; the first projects are being carried out at present.

An overall valuation in monetary terms and the computation of an "ecological national product" are objectives that cannot be achieved for the time being; for this reason, they are not in the centre of the activities of the Federal Statistical Office of the Federal Republic of Germany.

**Key words:** Environmental protection; natural resources; emissions; immissions; environmental expenditure; monitoring; GIS; sustainability; physical indicators.

## 1. Introduction

The damage done to the environment and its far-reaching consequences for the entire planet are more and more becoming the centre of discussion in society. The "Summit of Rio" in Brazil in June 1992 is just one example. Objectives of environmental policy are of increasing importance also for other political fields, in particular for economic policy.

Political decision-making requires comprehensive information on changes in the condition of the environment, the causes as

well as items where political action may be appropriate. However, in the Federal Republic of Germany, data obtained from economic and population statistics, from environmental measuring networks and from ecological monitoring of the environment have so far been collected in isolated form; so they inform only about individual phenomena.

This is where the concept of Environmental-Economic Comprehensive Accounting (UGR) of the Wiesbaden-based Federal Statistical Office comes in.

It is closely connected with the further development of German environmental statistics, to supplement and further develop the

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national accounts as well as to participate in various international projects.

For illustrating the UGR approach and its delimitation, it is at this point necessary to briefly outline the development of these three fields:

### *1.1. Further development of environmental statistics*

Basically, the origin of the existing environmental statistics of the Federal Republic of Germany is the Environmental Statistics Law of 1974. These statistics provide data on waste removal, water supply and waste water disposal, on accidents as a result of the storing and transportation of water-endangering substances as well as on investments for environmental protection.

Since the first version of the Environmental Statistics Law was adopted, the demand for data on the environment has rapidly grown along with the increased importance of environmental policy. Accordingly, intensive efforts have for quite some time been made to amend the Environmental Statistics Law; such an amendment is first to provide for an improvement of the coverage of existing items (e.g., environmental protection industry) and second to create the possibility of covering new spheres (e.g., declarations and emissions). In addition, there are entirely new methodological approaches within official statistics concerning the supply of information with regard to the environment, such as the space-related information system STABIS based on aerial photographs (Radermacher 1992 a and b).

### *1.2. Supplementation of national accounts*

The main objective of national accounts is to provide reliable data for short and medium-term decisions in economic policy. It is however increasingly doubted whether the gross national product and the other ag-

gregates of national accounts are equally well suited for long-term economic analysis. Criticism centres on the question of whether improvements in the supply of goods and services, which result in an increase in the gross national product, also entail an increase in the economic welfare of the population if at the same time environment is "consumed." To the extent that the utilization of the environment and the consumption of natural resources occur without any particular payment, these processes are not included in national accounts and thus their welfare-reducing effect is not taken into account. In order to live up to the manifold tasks of national accounts it would be an obvious choice to continue the traditional computations of the national product and supplement them with an accounting framework presenting the connections between the economy and the environment. This would have to be done by means of an independent data system, a so-called satellite system which would have to be closely linked to the traditional national accounts which would be the core of the system. An argument supporting this approach is the fact that the results of national accounts can continue to be used for traditional purposes and, at the same time, additional questions on the environment can be dealt with. Such a parallel presentation is further supported by the fact that the methodological problems have so far not sufficiently been solved and that the problems of statistical coverage have largely remained unsettled. Limiting the new calculations to supplementary satellite systems allows for experimenting with new concepts and data which are not yet established in the statistical sciences.

### *1.3. Participation in international projects*

For quite a few years, various international and supranational organizations (UN, EC,

OECD) have worked on improving information on the environment. The objectives have been diverse with regard to the scope of presentation, the question as to how close the linkage with national accounts should be, the conceptual consistency and the inclusion of monetary valuations of natural variables (Ebert, Klaus and Reichert 1991). The concepts worth mentioning are in particular those developed in Norway, Canada, France, and The Netherlands. Therefore the Conference of European Statisticians of the Economic Commission for Europe (ECE) resolved at its 1991 plenary session to set up a task force which is to prepare – on the basis of the French and Norwegian experiences – general methodological concepts of natural resource accounting (United Nations 1991).

In addition to the discussion on the methods of environmental accounting at ECE level, there was a lively international discussion on suitable concepts for an extension of national accounts with respect to environmental aspects. Different conceptual approaches were considered particularly at joint workshops of the World Bank and the UNEP (United Nations Environmental Programme) from 1983 to 1988. At the latest meeting of that working group (November 1988), it was decided that the United Nations Statistical Office should prepare a manual presenting the concepts for a satellite system which would be a supplement to the System of National Accounts (SNA) of the United Nations and would inform about the inter-relationships between the natural environment and the economy. In October 1990, the United Nations Statistical Office presented the first draft of that manual containing the conceptual foundations of an environmental satellite system. A revised version was presented at the World Conference on Environment and Development held in Rio de Janeiro in June 1992. In the

manual, the satellite system is referred to as System for Integrated Environmental and Economic Accounting (SEEA – Bartelmus, Stahmer and van Tongeren 1991).

The idea of setting up a system of environmental economic accounting goes back to an expert hearing at the Committee for Economic Affairs of the Deutscher Bundestag in May 1989. As a result of that hearing, the Federal Statistical Office decided to draw up the system of the Environmental-Economic Comprehensive Accounting (UGR). The main objectives, the structure and the contents of the concepts will be outlined in the following chapter.

## **2. The UGR Concept**

Basically, the UGR is an approach to combine elements from the systems of environmental monitoring with elements of environmental or economic statistics in such a way as to permit to draw conclusions concerning the relationship between socioeconomic processes and the condition of nature and the environment.

Figure 1 illustrates the approximate position of UGR and the influencing factors.

From the objectives outlined above, the requirements to be met by a statistical information system on the environment can be derived as follows:

- Open system, easy to change,
- Clearly defined building blocks which can be treated separately, but may also be linked up,
- Possibility of alternative and parallel approaches,
- Data collection according to harmonized classifications,
- Statistical concentration and aggregation of data,
- Storing the information in the form of a data bank,

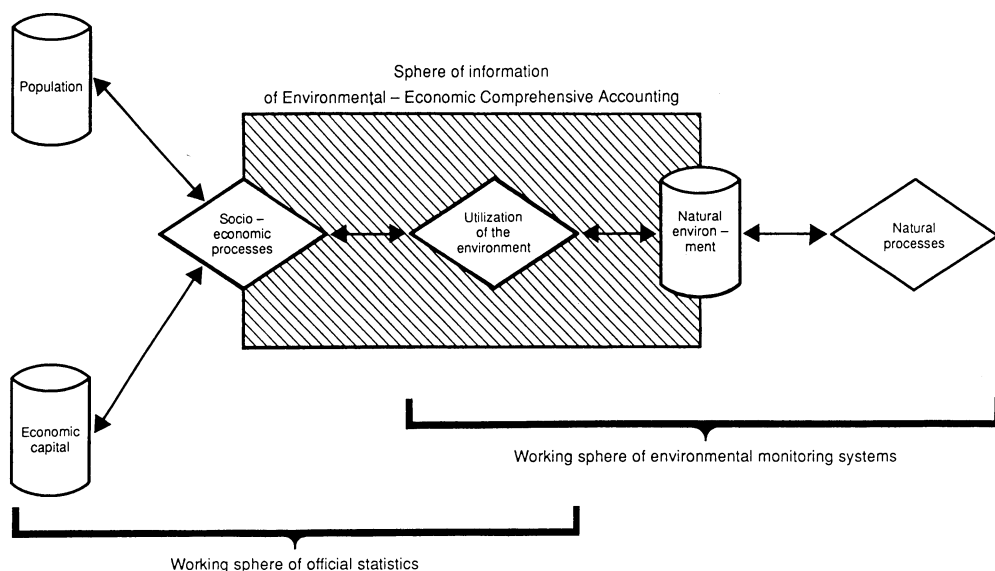


Fig. 1. Position of environmental-economic comprehensive accounting

- Software programs for the major analyses,
- Continuous reporting on important results.

### 2.1. Delimitation of the contents

The concept of UGR contents provides for a division into five spheres of information (see Figure 2):

- Environment-related economic activities (environmental protection measures and the like),
- Use of natural resources,
- Use of the natural environment as a sink for residuals,
- Use of the natural environment as a location for human activities,
- Qualitative condition of the environment, in particular with respect to its pollution load.

The above three types of use of the natural environment correspond to three major functions of the environment: the functions of production, uptake, and location.

#### 2.1.1. Environment-related economic activities

In this field, the emphasis is on the question for the current costs of environmental protection in a broader sense. The sphere comprises information on the expenditure made by the sectors and economic branches in connection with the different types of environmental protection (air quality control, waste disposal, waste water treatment and the like). In addition to the monetary asset and flow variables in connection with environmental protection, there are included – despite the difficulties concerning causal allocation – other expenditures in the environment-related defensive activities (e.g., damage to material or health, caused by the environment). The data on defensive activities shall be identified as partial variables of traditional national accounts.

#### 2.1.2. Use of natural resources

This field of information comprises data on the extraction and consumption of biotic and abiotic natural resources and elementary goods (such as solar energy,

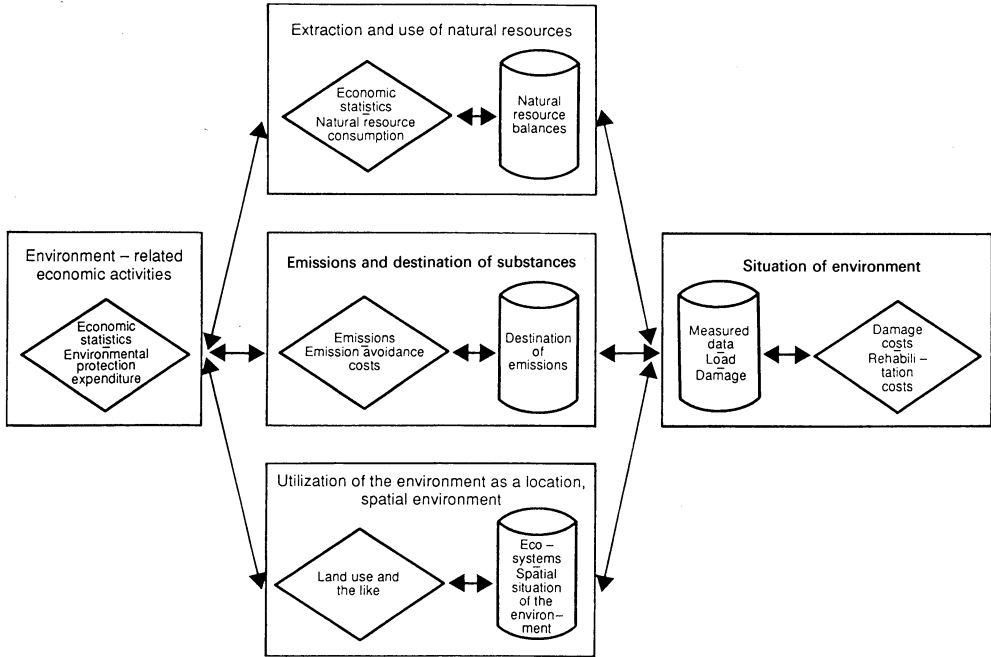


Fig. 2. Informational fields of environmental-economic comprehensive accounting

water, air and the like); this refers both to the extraction of domestic resources and to the consumption of domestic and foreign resources. It is also planned to include a “set-off” in this part, i.e., to account also for expenditure made for basic research on alternative technologies and a better utilization of resources as well as for new finds of deposits. In addition to the overall variables for natural resource extraction and consumption, asset accounts of the types of natural resources are to be performed in the form of resource balances. This approach will include an allocation of the volume to the spheres of extraction (sectors of production of the input-output accounts). Moreover, goods balances are planned as a link between the presentation of the natural resource consumption and the emission of residuals. These goods balances are shown as part of input-output tables.

### 2.1.3. Emission and destination of residuals (emissions)

This field of information deals with emissions and their connection with the processes of production and consumption that set them free. This model is not based on the emission data actually measured at the emitting installations – collecting these data would be very expensive – but on data that can be obtained using a model which combines production data with (average) emission coefficients (quantity of emission per output unit). The results of this emission model are supplemented by data on the destination of the emissions which are either disposed of, recovered by recycling processes, or emitted freely into the environment. In addition to the destination of pollutants the destination and the disposal of consumer durables have to be monitored. The residual emission is broken down by sectors of polluters, while the destination is broken

down by sectors of recipients (e.g., for recycling or further treatment by environmental protection measures) or by absorption into the environment.

#### 2.1.4. Use of the environment as a location

It is planned that the data on economic sectors or environmental media be supplemented by a space-related description of the environment, i.e., its use, spatial conflicts, and integrated descriptions of ecosystems. A particularly important role will be played by the Statistical Information System on Land Use (STABIS) mentioned before.

#### 2.1.5. Qualitative condition of the environment (situation of emissions)

Such data show the qualitative condition of the environmental media and their changes over time by means of specific environmental measures for land, water, air, radiation, noise and the like, as well as through data obtained by monitoring various species. There is always a wide range of data to be taken into account, part of which indicate just quantitative concentrations of pollutants, while others inform about loads or even complex damages. The wealth of emission data that can serve for describing the condition of the environment has to be concentrated statistically in order to obtain temporal and regional averages as well as series of index numbers. The presentation of the situation of emissions is of particular importance because, if taken by itself, the (rather theoretical) ascertainment of emissions might lead to wrong conclusions concerning the environmental effect of processes of production and consumption.

### 2.2. *Valuation of physical data*

The work to be done in the short and medium term will clearly focus on the system-

atic collection, processing and presentation of variables in physical units. The main objective to be achieved by UGR in the long term, however, is the concentration of the considerable wealth of environmental data in order to obtain meaningful overall indicators. One of the most elegant ways to achieve this is the conversion into a uniform measure, especially into monetary units. This part of environmental accounting is particularly controversial in the popular and technical debates; depending on the issue to be treated, it can be approached by using different methodological concepts. As is shown in Figure 3, a general distinction must be made – except for a number of other aspects – between an expenditure-oriented approach and a depreciation-oriented approach. Using the expenditure-oriented approach means ascertaining the performance required today of the economy in order to finance natural resources consumption, rehabilitations, environmental protection and area consumption. From the aspect of the development over time of environmental problems, this is a lagging indicator and the appropriate method required is the valuation at current market prices.

The depreciation-oriented approach instead refers to the question of the sustainability of current economic activities. Here, the economic activities are combined with the involved utilization and consumption of natural assets. An activity is sustainable if it does not impair future activities, that is if the natural assets are maintained. So what is to be obtained is a leading indicator which accounts for current and future consequences of economic activity. Among the various approaches possible to solve this problem of valuation, the UGR in principle prefers the avoidance cost approach. Using this approach means valuating at the relevant marginal costs the difference between the current level of loads caused by economic

| Type of issue | Variable  | Dimension   | Breakdown  |
|---------------|---|---|--|
| Expenditure   | Natural resources consumption, environmental protection, rehabilitation, area consumption | Market prices                                       | Period-related by type of variable and by sectors  |
| Causes        | Natural resources consumption, emissions, area consumption                                | Physical units                                      | Period-related by type of variable and by sectors  |
| Effects       | Space use, load factors, bio-indicators   | Physical units and qualities                        | Irregular intervals, by type of variable, by environmental media/problems and by geographical location |
| Depreciation  | Natural resources consumption, emissions, area consumption                                | Costs of achieving an environmentally safe standard | Period-related by type of variable and by sectors  |

Fig. 3. Levels of information of environmental-economic comprehensive accounting

activities and an environmentally safe standard. As compared with other valuation concepts, the advantage of this approach – from the UGR point of view – is its applicability to environmental problems at the national level, its reference to the activities of a specific period and the consistent implementation of the objective of avoidance pursued by modern environmental policies. The problems involved especially refer to the emission standards to be fixed and strived for. At the same time, it is an advantage of this approach that during the discussion of alternative standards, their cost effectiveness can be illustrated.

Figure 4 summarizes the three different types of monitoring and the aggregated “balances” required for a comprehensive presentation of the relations between economy and ecology:

- The quantitative accounting of individual resources,
- the qualitative-spatial monitoring of environment changes, and

- the monetary accounting of changes in the natural assets.

### 2.3. Structure of the UGR

The current UGR concept is based on the consideration that as a core of a statistical reporting system on the environment a collection of environment-related information in the form of a data bank (UGR Information System – UGRIS) has to be set up. This data bank can then serve for continuous reporting and permit different analyses in the environmental sphere. The analysis results will in turn be stored as information in UGRIS. The UGR concept provides for different modules of analysis. First, they are necessary for closing by estimates the gaps existing in the stock of basic data. Second, these modules of analysis will match basic data and organize them with regard to the particular problems. The means employed will be, in particular: material, energy and resource balances, geostatistical methods, as well as weighting and valuation methods.

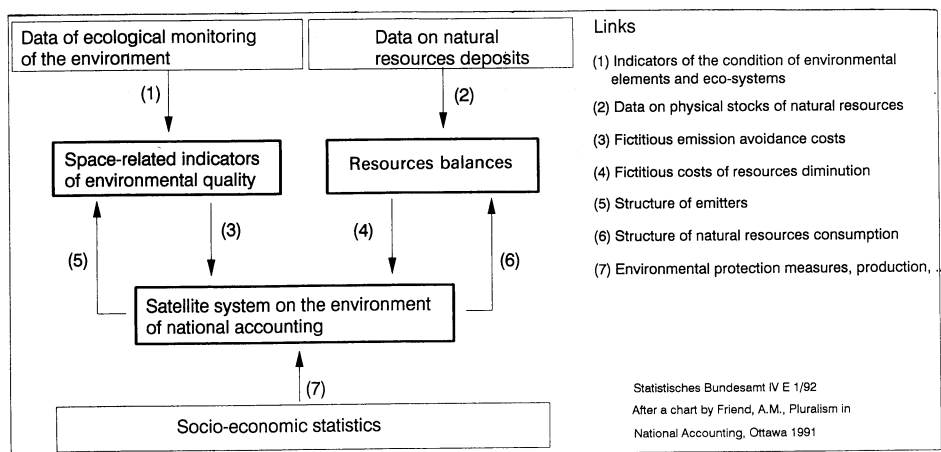


Fig. 4. Environmental-economic comprehensive accounting connections between analysis building blocks

In combination with the fields of information mentioned, the UGR will thus contain three quite different types of data and show them at different levels of the data bank:

- basic data which are rather close to the primary statistical material,
- evaluation and linking of observable statistical data,
- additional hypothetical monetary valuations or weightings of physical indicators.

For compiling these three distinct types of data, different requirements have to be met and, consequently, different periods of time will be needed for compilation, even if the work can in part be performed in a parallel manner at several levels. Especially for the additional valuations and weightings, further conceptual preparatory work seems necessary. Therefore it is not expected in the near future that the Federal Statistical Office will be able to ascertain an ecological national product. It might, however, be possible to perform valuations of some individual economic uses of and loads on the environment. The Federal Statistical Office will continue to take an active part in inter-

national activities and discussions to shape concepts of satellite systems of national accounts with regard to the environment and of other environmental accounting systems.

### 3. State of Progress and Future Activities

The work on the UGR at present concerns two spheres: First, the Scientific Advisory Council on Environmental-Economic Comprehensive Accounting (Federal Minister for the Environment, Nature Conservation and Nuclear Safety 1992) and second, research projects on individual thematic spheres of the above fields of information (cf. Figure 2).

The Scientific Advisory Council was established in spring 1990 by the Federal Minister for the Environment, Klaus Töpfer, in order to support the work of the Federal Statistical Office and put forth proposals for the solution of methodological questions.

In April 1992, the Council presented a first report which clearly underlines that, in the Council's opinion, pushing forward the development of such a system is necessary and meaningful. It strongly supports the further activities of the Federal Statistical



Office, irrespective of the unsettled conceptual questions and their implementation. For the near future, the advisory council recommends, among other things, to focus the work on two major fields: Continuing and intensifying the conceptual considerations and increasing the utilization of research funds for specific projects.

Complying with this latter demand, a research programme on UGR has been developed which, in the different fields of information and development, comprises projects most of which will be, or are already being, carried out by external independent research institutes. These projects also serve for preparing concrete data collection and intensifying the conceptual considerations.

For illustrating the approach chosen, a research project, including its contents, objectives and planned method, will briefly be described in the following.

#### **4. Research Project on "Public Environmental Protection Expenditure as Part of the Measures Concerning Environmental Protection"**

A partial sphere of the field of information "Environment-related economic activities" is characterized by differences in the current availability of data. In the sphere of measures, expenditure and costs concerning environmental protection, there are, in the Federal Republic of Germany, certain sectors whose statistical coverage is rather good (e.g., production industries) and others for which there has so far largely been a lack of official statistical data (private households, commerce, etc.).

The sector "general government" is located between the two extremes. Here, the expenditure for purposes of environmental protection as shown in the annual public budgets is covered. For various methodological reasons, the results are incomplete.

The planned project deals with this problematic sphere and serves for the clarification and improved coverage of government expenditure for environmental protection.

On the basis of a presentation of existing national and international concepts and of the current situation of the possibilities of covering public expenditure for environmental protection, potential further developments are to be pointed out. The core of such further development will be the inclusion of new requirements resulting from the Environmental-Economic Comprehensive Accounting, from new focuses of German environmental policy and from international developments.

The result of this first theoretical stage of the project will be a concept for the improved coverage of public expenditure for environmental protection within the scope of UGR.

The second, i.e., the empirical part of the research project is centred on an analysis of the budgets as well as balance sheets of public enterprises of the different federal levels of the Federal Republic of Germany.

As a consequence of the practical test, it will again be necessary to revise the prior draft concept. The overall result of the study will thus be an up-to-date and operational concept for the statistical coverage of government expenditure on environmental protection in Germany.

First results may be expected for the middle of 1993.

#### **5. Conclusions**

The above approach of Environmental-Economic Comprehensive Accounting needs further conceptual work and intensification. First results on selected thematic fields can be expected for the near future.

Developing an overall presentation of a statistical description will require a considerable period of time. It will not be possible to reconcile the conflicting objectives of completeness and methodological consistency. Presenting completely, exactly and timely in one overall accounting system (similar to national accounts) all relations between people and the environment will thus remain a utopia. It has to be presumed, instead, that the different issues and problems will require a methodological pluralism with different calculations being carried out separately.

Due to the substantial theoretical gaps, a double-track procedure must be followed. It is necessary to push forward both the conceptual work and, at the same time, the empirical, i.e., concrete and coordinated, collection of environmental data. Here the international and supranational coordination and cooperation will more and more gain in importance.

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