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The Use of the Expanded Accounting System for the German National Strategy on Sustainable Development

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Summary

The central subject of a policy for sustainable development is the co-ordination of the different sector policies with the objective of finding a balance between conflicting economical, ecological and social goals. The headline indicators for sustainable development itself are mainly a communication tool directed to the general public and the media. They are used for describing important problems under a sustainability perspective and they serve as an instrument for controlling general performance of political measures. But more detailed data are required for the analysis of the underlying mechanisms and reasons for change of the indicator values as well as for the formulation of measures and the assessment of the effects of these measures. Therefore, the individual indicators should be consistently embedded into an underlying database from which they can an be derived by aggregation. Further, the underlying data for the individual indicators should be part of a comprehensive framework that ideally integrates all relevant topics, in order to take account of the interdependencies between the different indicators. The accounting system with its three principle parts, the National Accounts (SNA) and the satellite systems Environmental-Economic Accounting (EEA) and the Socio-economic Accounting (SEA) provides an ideal framework to meet these data requirements. In Germany a rather high proportion of economic and environmental indicators of the national Strategy on Sustainable Development are embedded into the accounting system. The potential of the accounting data for an integrated analysis of headline indicators of the German strategy on Sustainable Development is illustrated with selected examples. The paper describes the steps for integrating the indicator set and the accounting system.

1. Introduction

In practice almost all countries that have a national strategy on sustainable development are using a multi-dimensional indicator approach for measuring the development of the "**sustainability gap**". The sustainability gap indicates how far the present state of a society differs from a situation that meets the requirements of the sustainability paradigm.

The central subject of a policy for sustainable development is the co-ordination of the different sector policies with the objective of finding a balance between conflicting economical, ecological and social goals. A simple indicator set of a number of selected headline indicators is useful for problem description and performance control. But for the formulation of efficient political measures a systematic and comprehensive data body is required as it can be provided by an expanded accounting system.

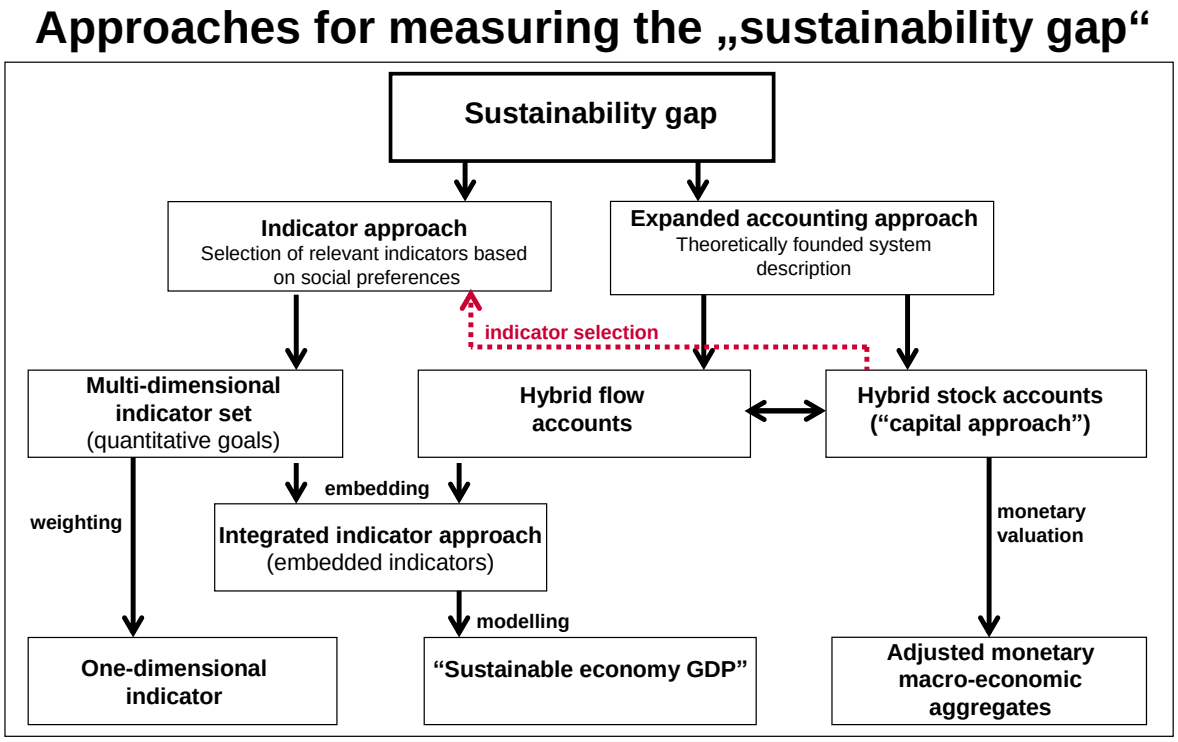
However, work on sustainable development indicator sets is usually carried out more or less independently from the accounting work. Linking these two approaches could yield considerable synergies. It is the aim of this paper, to introduce a concept for linking multi-dimensional SD indicator sets with the accounts, which is based on experiences in Germany. In the proposed system the individual **indicators are systematically embedded** into the **expanded accounting system** which covers economic, environmental and social data.

2. Approaches for measuring the sustainability gap

There are two principle approaches for measuring the sustainability gap, the indicator approach and the expanded accounting approach.

Figure 1 shows schematically the principal concepts for measuring the sustainability gap.

Figure 1



Indicator approach: The indicator approach describes the sustainability gap by a selected number of themes which are considered to be most relevant under a sustainability perspective. The selection of the indicators is based on facts and value judgements which might be more or less supported by a theoretical framework. The framework can be based on different conceptions of sustainable development, like intra-generational or inter-generational equity. In order to establish broad acceptance of the sustainable development indicators as being suitable for describing the state of the society objectively, a consensus (“social preferences”) about the underlying value judgements has to be found among the major protagonists. The indicators can be based on flow (pressures) or on stock (state) indicators. Usually flow indicators are preferred for two main reasons:

1. They can be measured much easier
2. The links of those indicators to political action (measures) are much more straightforward.

Ideally all indicators are linked to quantitative (development) goals. In that case the difference between the present development and the goal indicates the sustainability gap for an individual indicator and subsequently the need for action. To what extent the society as a whole is moving towards a path of sustainable development can only be estimated by a summarising valuation of the development of the individual indicators of the sustainable development indicator set. A further step could be to aggregate the individual indicators of the multi-dimensional indicator set into one single macro-indicator by applying an agreed weighting scheme.

Expanded accounting approach: The System of National Accounts (SNA) forms, together with its satellite systems Environmental-Economic Accounting (EEA) and the Socio-economic Accounting (SEA), an expanded accounting system**.** The SNA is the world wide accepted standard for describing the economic process. The EEA and the SEA extend the economic accounts by a description of the interrelationships of the economy to the environment and the social system and between the environment and the social system. The satellite systems in principle use the same concepts, definitions and classifications as the SNA. That guaranties that the data of all three sub-systems can be combined with each other, i.e. they form an integrated database that covers the three principal topics of a sustainability approach. In principle the expanded accounting system represents a theoretically founded, systematic and comprehensive description of the economy and its interactions with the environment and the social system. The economic relationships are described in monetary terms and the environmental and social dimension are predominantly expressed in physical terms (hybrid accounts). With the System of Environmental-Economic Accounting of the UN there exists a rather well developed satellite system for covering the relationship between the economy and the environment in a systematic manner. However, it has to be stated that as far as the integration of the social system is concerned there exist some experimental approaches, like the "magic triangle"[1] and a number of social aspects are already covered by the economic accounting system and some specific satellite system, like social accounting matrixes. But there is no agreed approach so far for including the social system into the accounts under a sustainability perspective.

The accounts provide hybrid flow and stock accounts. Both types of accounts are related as, at least in principle, the change in stocks can be explained by the flows. For the economic accounts, where the stocks and flows are expressed in monetary units there exists a clear link between stocks and flows. However for most components of the environmental and social asset stock the relationship are more complex, as in many cases it is not possible to establish a straightforward causal relationship between those flows that can be measured (e.g. health expenditure or emission of pollutants) and a change in the quality of related stocks (e.g. health status of the population or ambient concentration of pollutants).

Stock accounts: For the expanded stock accounts the asset boundary of the SNA, which covers only produced assets and other assets that have an economic value, has to be enhanced by including all environmental and social assets. An example for that type of accounts is the "capital approach" presented by Robert Smith in this session[2].

The stock accounts provide a comprehensive set of monetary and physical indicators which describe the state and the change of the economic, environmental and social assets in a comprehensive manner. Those indicators can be used for describing the system under a sustainability perspective. In principal the physical indicators can be converted into monetary indicators by imputing monetary values (monetary valuation). Monetary valuation would yield monetary data that refer to the environmental and social dimension which could be used for calculating a one-dimensional wealth indicator. Such a monetary indicator could be used for denoting the "sustainability gap", e.g. by quantifying the difference between a pure economic and a more comprehensive wealth concept, which covers also the social and the environmental dimension. However that type of monetary valuation is still a highly controversial issue, as it appears almost impossible to provide empirically sound values to a number of important elements of the environmental or social assets.

Due to the comprehensive coverage of all elements of the economic, environmental and social assets the capital approach could also serve as a systematic structure for the predominantly political process of establishing a multi-dimensional indicator set.

[1] Schäfer, D. (2000)
[2] Robert B. Smith (2008)

Flow accounts: Expanded hybrid flow accounts predominantly provide, as far as the social or the environmental dimension are concerned, physical indicators on the pressure on the environmental and social assets that are caused by economic activities. The data body of that system covers relevant monetary flows from the economic accounts and the different environmental and social flow indicators in an integrated and detailed manner.

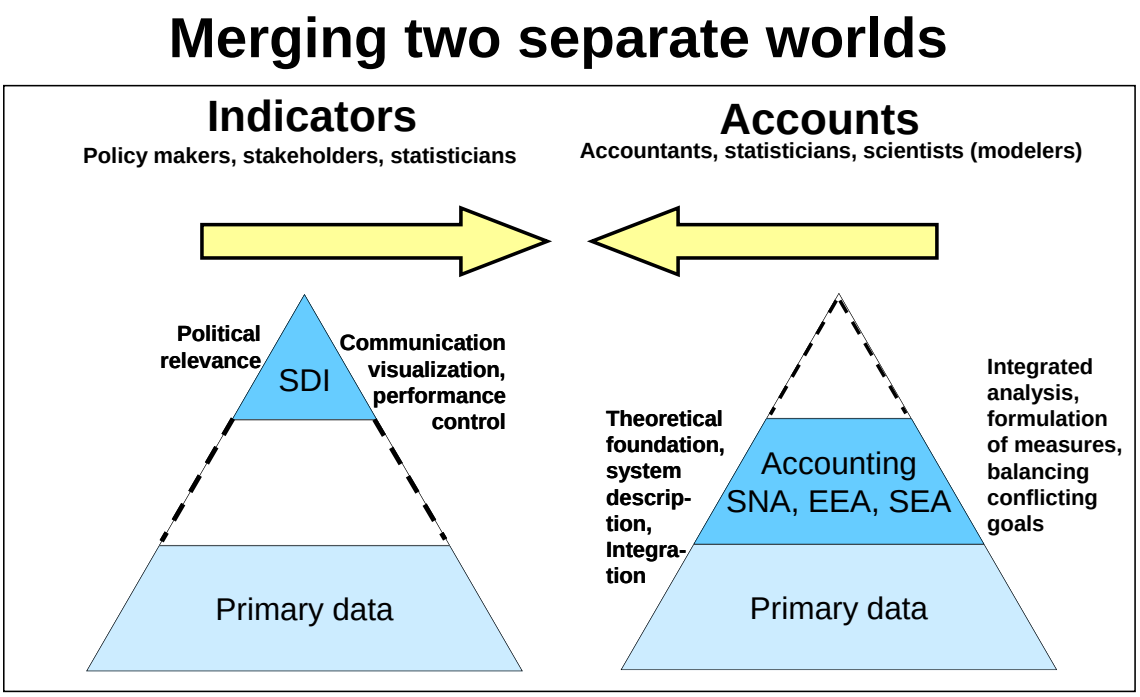
Integrated indicator approach: The integrated indicator approach combines the multi-dimensional indicator set on flows with the expanded flow accounts by using indicators that are derived by aggregation from the accounting data set (embedded indicators). Ideally such an approach combines the properties of both approaches, the foundation by social preferences on the one hand and the system character on the other.

Sustainable economy GDP: The detailed data of the expanded flow accounts can form together with the quantitative goals of the indicators system an input to modelling approaches which estimate a "sustainable economy GDP". That modelling approach simulates how an economy would look like that respects the sustainability goal of the society.

3. Comparison of the indicator approach and the expanded flow accounts

Originally indicators on sustainable development and accounts are approaches with different purposes and characteristics. Four points could be highlighted (see figure 2):

Figure 2



- **Purpose:** Sustainable development indicators – like indicators in general – are intended for the purposes of **communication and performance control**. Very often they cover specific topics of the political agenda for which they shall deliver short-term information. Accounts, on the contrary, aim at the complete and coherent **description of a system** such as a national economy (national accounts) or the relationships between economy and environment (environmental economic

accounting). They are set for the long term and try to respond to more general data needs.

- **Level of detail:** sustainable development indicators are located on the top of the information pyramid; they provide a very condensed or **aggregated kind of information**. Accounts are more detailed, they belong to a **meso-level** between indicators on the top and very detailed basic statistics at the bottom of the information pyramid.
- **Foundation:** Accounting systems have a strong **theoretical foundation**. They are based on a common set of classifications, rules and concepts which define how to describe the system. Indicator selection and formulation is not following such rigid rules. In most cases there is "only" a framework which helps to structure the indicator set. The indicator set should reflect the social preferences of a society and therefore in an ideal case both framework and indicators are the outcome of **negotiation processes** among politicians, experts and stakeholders.
- **Main strengths:** Indicators are an appropriate tool for pointing at **relevant political problems** as well as for **visualising information** in a focussed way. Accounting systems benefit from their coherence and system orientation which **supports further analyses** of interdependencies and underlying causes and subsequently the formulation of political measures.

The primary data are the source for compiling the data for the accounting system. As long as the sustainable development indicator and the accounting worlds are separated, the indicators are derived from primary data as well.

The approach presented in this paper is, to **merge the two pyramids** of figure 2 into an integrated indicator approach. In terms of data that simply means, that the indicators should be embedded into the accounting data base, i.e. they should be derived by aggregation from the more detailed accounting data base. To merge the two pyramids will help to utilise the special advantages of both approaches with respect to political relevance of the data and the suitability as a communication tool, for integrated analysis as well as for formulation of measures. Why and how the two approaches should be linked and how it could be achieved is discussed below in more detail by referring to the German example.

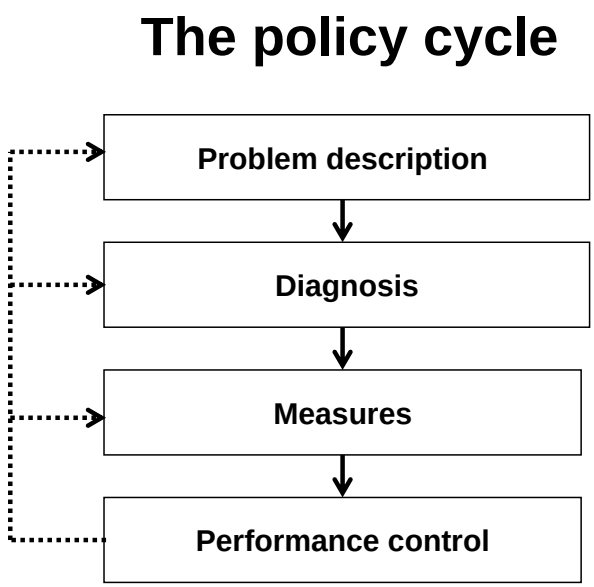
4. Policy for sustainable development and data requirements

The respective advantages of the indicator and the accounting approach are of relevance for different steps of the **policy cycle**, i.e. problem description, diagnosis, measures and performance control (figure 3).

Problem description: sustainable development indicators, which are usually highly aggregated, can reduce the complex reality to a limited number of figures. Therefore they can serve as a rather simple communication tool mainly directed to the general public and the media. They are used for describing important problems under a sustainability perspective and depending on the process of developing the indicator-set, may more or less reflect the political preferences of the society. The sustainability gap is measured indicator by indicator by comparing the observed values with the target values.

Diagnosis: For the diagnosis or analysis highly aggregated indicators alone are generally not sufficient. An analysis of the underlying mechanisms and reasons for change of the indicator values requires detailed disaggregated information. The data-base for further analysis can either be provided by detailed basic statistics or by an accounting system, which is rather situated at a meso-level.

Figure 3



Measures: Political measures for achieving the sustainability goals of the society should be cost efficient and above all should be tailored for balancing conflicting goals. The general objective of sustainable development requires a holistic policy approach, as the issues of a sustainable development policy are closely interlinked. A policy for sustainable development is characterised by not only looking on how far the goals for the individual indicators can be achieved, but has to have in mind the interdependencies between the topics and the simultaneous achievement of different economic, environmental and social goals. Decisions on measures aiming at the improvement of one indicator at the same time have to consider the effects that may occur on the other relevant goals of the overall strategy for sustainable development. The rather complex analytical tools required for that type of policy approach demand a homogeneous and coherent database depicting the interdependencies between the different indicators. For that reason it will usually not be sufficient to deal with the different indicators individually. That is, the underlying data for the individual indicators should be part of a comprehensive framework that ideally integrates all relevant topics. The integrated data which covers the three principal topics of a sustainability approach is an ideal framework to meet the above mentioned requirements.

An integrated analysis and especially the formulation of political measures require rather complex analytical instruments. It is one crucial advantage of the SNA data set that it is being widely used as a basis for already existing and proven analytical tools that are related to the economic process. The extension of those tools for analysing environmental-economic as well as social-economic questions has already been put into practice successfully in Germany and other countries.

Performance control: The indicators, especially if they are combined with quantitative goals, serve as an instrument for general performance controlling of political measures. A reduction of the gap between the observed and the target values indicates improvement of sustainable score keeping for individual indicators.

Modelling can provide a more complex approach of score keeping by comparing the "business-as-usual Gross Domestic Product" (GDP) to a "sustainable economy GDP"[3]. This

[3] See: Meyer, B. (1998) and Radermacher, W. (1998 (2)).

can be achieved by comparing a modelling scenario for the economic-social-environmental system without measures (business-as-usual) with a scenario that simulates the effects of a bundle of measures which are orientated towards respecting the sustainability goals of the society.

5. The German strategy on sustainable development

In Germany the Government adopted the **National Strategy for Sustainable development** in 2002. The approval was preceded by a discussion of the draft with major groups and institutions of the society. The development of the strategy and the selection of the indicators were strongly dominated by the political side. The strategy was developed by the "Committee of State Secretaries for Sustainable Development". It has different elements, like defining the key focus points for sustainable development, selecting indicators, formulating quantitative or qualitative goals related to the indicators and a set of measures related to some of the key focus points. The sustainability indicator set is comprised of 21 indicators.

By the **selection of the indicators** the responsible policy makers defined those issues which are particularly relevant under sustainability considerations. By formulating **target values** the policy side signalised that they are prepared to promote the attainment of the goals by appropriate political measures.

The German approach can to some extent already be classified as an "integrated indicator approach". A rather high proportion of the economic and environmental indicators of the National Strategy for Sustainable development is embedded into the accounting system of the Federal Statistical Office. The detailed accounting data play an increasing role in supporting the analysis of the developments shown by the indicators. Work on the development of a socio-economic accounting satellite system is under progress. Some results have already been published. Important examples are the Social Accounting Matrix for the year 2000 und comprehensive time series of monetary and physical data on characteristics of private households and population[4]. The accounting division of the Federal Statistical Office was in charge of writing the last indicator report for the National Strategy on Sustainable Development[5].

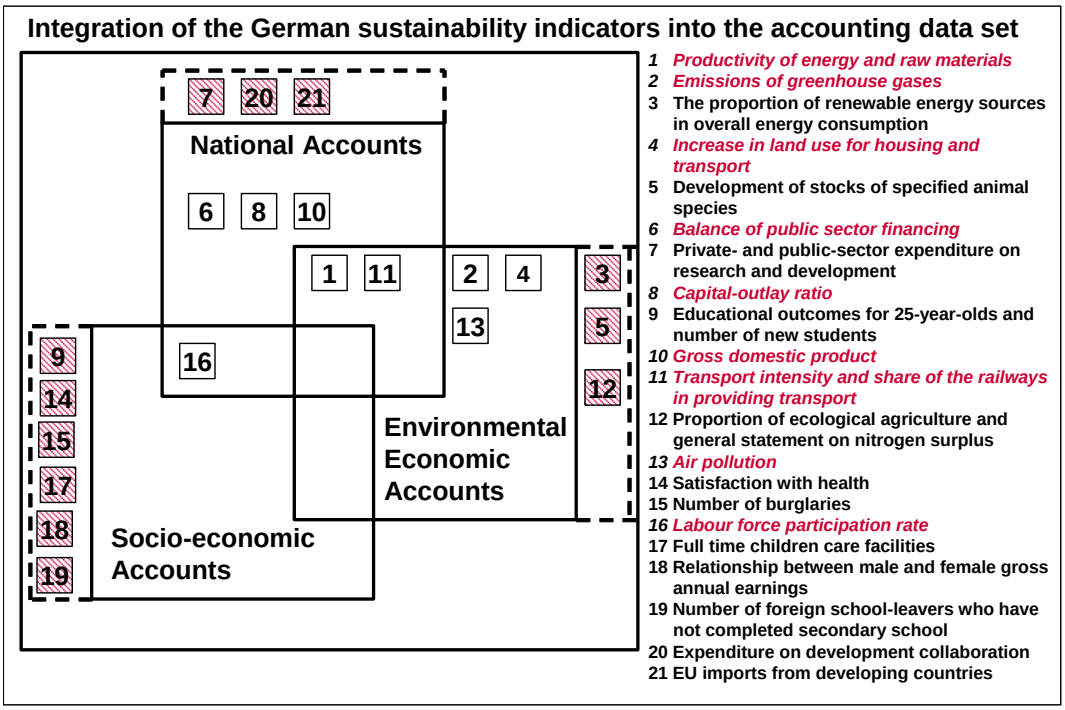
Figure 4 gives an overview over the 21 indicators of the strategy and the degree of **integration of the 21 indicators** of the national sustainable development strategy into the **accounting system**.

With a few examples the indicators are flow indicators. A considerable number of the economic and environmental indicators are already embedded into the data set of the expanded flow accounts. That refers to the following indicators: "public sector financing" (6), "capital-outlay ratio" (8), "gross domestic product" (10), "productivity of energy and raw materials" (1), "emissions of greenhouse gases" (2), "increase in land use for housing and transport" (4), "transport intensity and share of railways in providing transport" (11), "air pollution" (13) "and labour force participation rate" (16). Most of these indicators are rather strongly related to other indicators of the set. The remaining indicators in principle could also be integrated into the accounting data set by supplementing the accounts accordingly. But at least for some of these indicators integration into the accounting system seems to be less urgent.

[4]See Opitz / Schwarz (2004) and Opitz (2006).
[5] Federal Statistical Office of Germany (2007)

One central classification of the accounting system which is shared commonly by all three sub-systems is the detailed **break down of economic activities** (about 70 branches). All embedded indicators (except public sector financing) are available in that breakdown by activities.

Figure 4



6. Use of the German accounting data for sustainable development analysis

The integrated accounting data can be applied for different types of analysis. The examples below refer to environment related physical data which are frequently combined with monetary data in **hybrid analytical approaches**. Very common are descriptive approaches, like the calculation of eco-efficiency indicators on a national or a branch level, decomposition analysis (e.g. decomposition of the development of a variable by factors like economic growth (scale), economic structure and intensity), and input-output analyses (e.g. calculation of indirect use of environmental resources). The most important and powerful application is the utilisation of the database in environmental-economic modelling approaches.

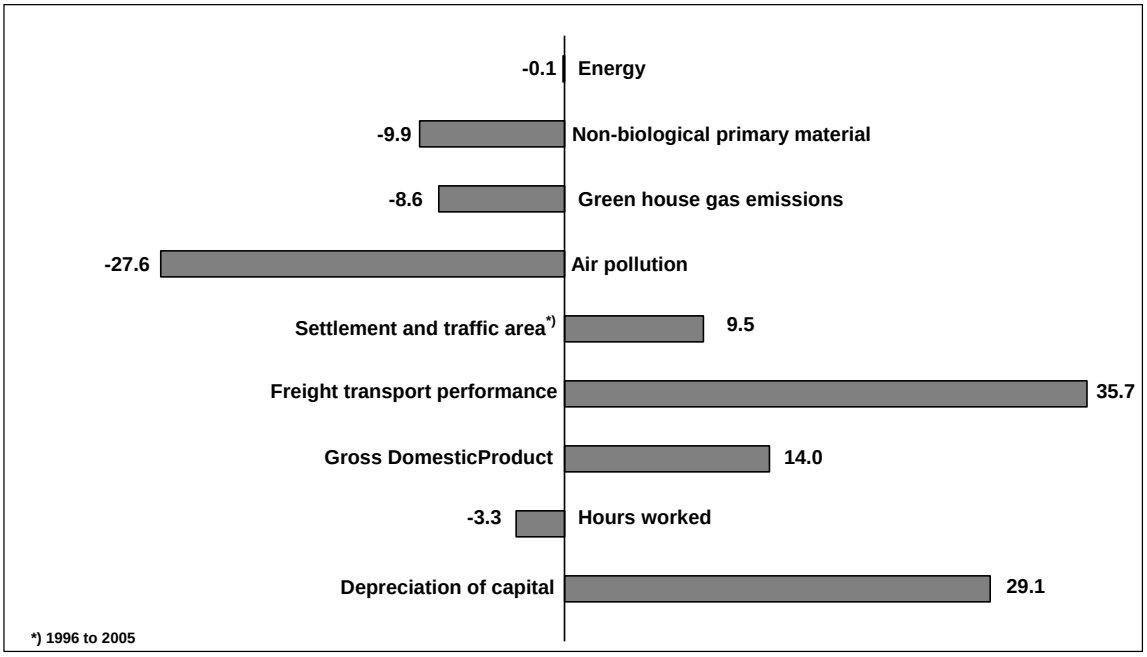
6.1. Descriptive analysis

6.1.1. Economy-wide indicators

Figure 5 shows the development of important economy-wide sustainable development indicators for the period 1995 to 2005, which can be derived from the German expanded accounting system by aggregation.

Figure 5

Environmental pressure factors and economic factors in Germany
Change 1995 to 2005 in percent



In the strategy the environmental pressure factors energy, non-biological primary material and transport performance are defined as efficiency indicators, i.e. they are related to the GDP. The figure shows that only goods transport performance was growing faster than GDP since 1995 in Germany. For the other pressure factors a strong **decoupling from economic growth** (decrease of environmental pressure factor with an increasing GDP) or at least a weak decoupling (increase of the pressure factor is lower than GDP-increase) can be stated.

6.1.2. Branch indicators

An important feature of the expanded accounting system is to provide a detailed and uniform break down by economic activities for various economic, environmental and also social indicators. Thus among others, the sustainable development indicators shown in Figure 5 are available in a detailed breakdown by branches for Germany. For the environmental variables that type of subdivision links the respective pressure indicators to the economic driving forces (causing economic activities) in a rather detailed disaggregation.

As an example Figure 6 shows the indicator use of non-biological primary material in such a disaggregation for selected branches in physical units (tons). Primary material is comprised of domestic extraction of natural resources and of the import of products.

Substantial direct users of primary material are the branches “Construction” with a share of 21.5 % and “Glass, construction materials etc.” with a share of 20.3 % on the total use followed by “Electricity” (18.5 %) and “Metals” (7.3 %). These branches together use about two thirds of the non-biological primary material. This high concentration of the total use of primary material on a few branches indicates that the overall development of that indicator is predominantly influenced by the development of these few branches.

Figure 6

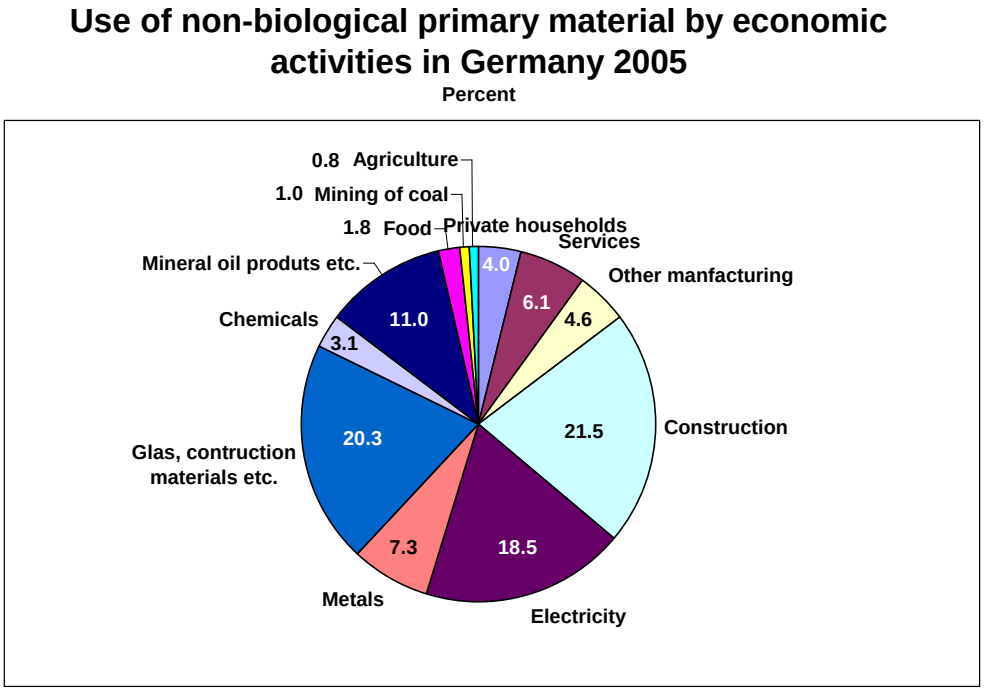
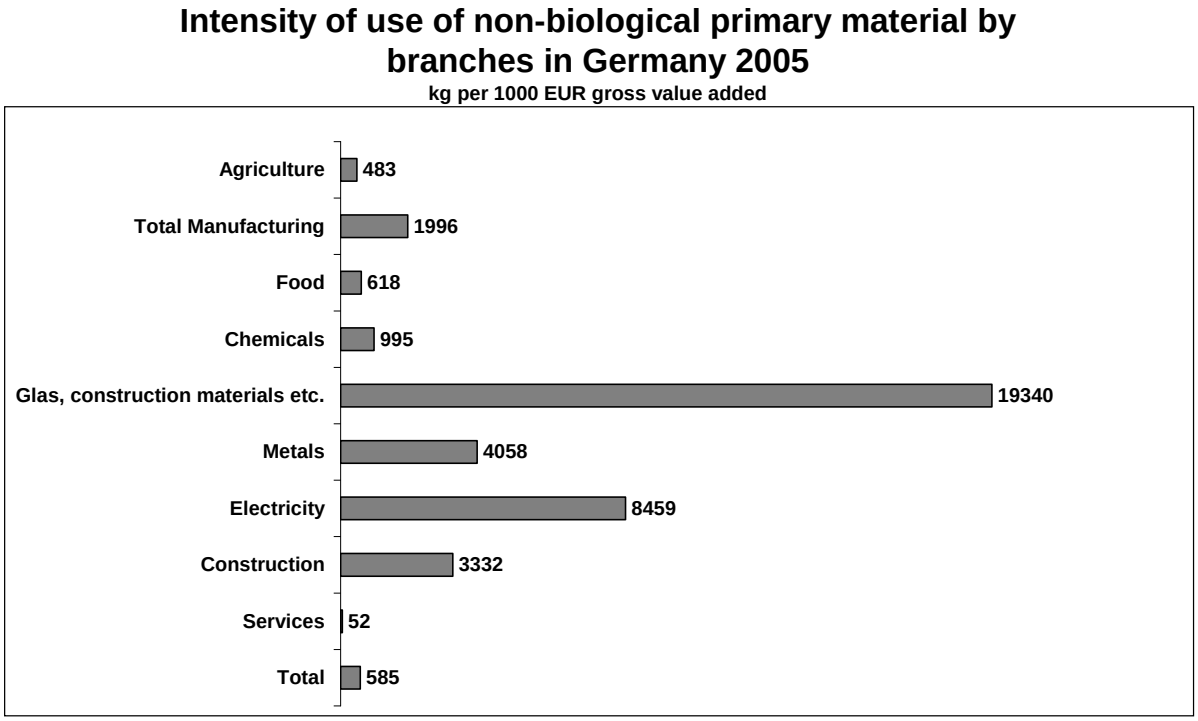


Figure 7 relates the environmental pressure variable to the economic world. As an example it shows the branch-specific intensity of the use of non-biological primary material. Primary material intensity is defined as the ratio between the mass of material used by a branch in proportion to its gross value added.

Figure 7



The primary material intensity in different branches is, depending on different technical conditions, quite heterogeneous. The average intensity over all branches achieved 585 kg

per 1,000 EUR in 2005. Far below average was the intensity for the service branches with 52 kg per 1,000 EUR gross value-added. The average value for the manufacturing and construction was 1996 kg per 1,000 EUR gross value-added. Within manufacturing and construction several branches show rather high primary material intensities. Those branches are: “Glass, construction materials etc.” (19,340 kg per 1,000 EUR), “Electricity” (8,459 kg per 1,000 EUR), “Metals” (4,058 kg per 1,000 EUR) and “Construction” (3,332 kg per 1,000 EUR).

6.1.3. Decomposition analysis

In this chapter results are presented on the **decomposition**[6] of the change of various indicators of the German sustainable development strategy. The pressures go back partly to production and partly to consumption activities. The share of production ranges from 100 percent for goods transport performance, nearly 100 percent for primary material to about 40 percent for settlement and traffic area.

Production: The following examples shown in figure 8 are confined to production related share of the indicators. The total change was decomposed into three effects by a mathematical approach: an **intensity effect**, a **structural** and a **scale effect**. Intensity is defined as the relationship between the respective pressure indicator and gross value added for the individual branches. Structure is depicted by a vector as the share of the individual branches at the total gross value added. The scale component is represented by development of the total gross value added. It should be noted that the calculation of that type of structural effect requires a breakdown by economic branches. The individual effects are calculated under the assumption that the other factors were unchanged over time. The approach transforms the relationship between the factors into an additive equation, i.e. the total change of the variable can be expressed as the sum of the three effects.

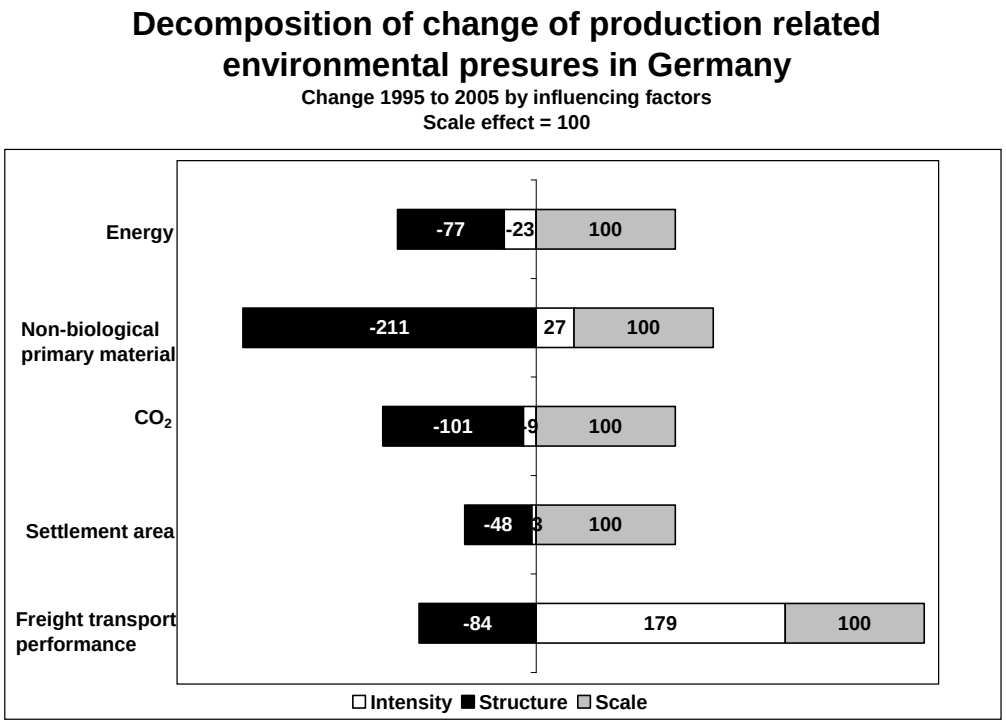
The results of the decomposition analysis for some German environmental sustainable development indicators and the indicator for employment for the period 1995 to 2001 read as follows:

The increase of the total gross value added has a burdening effect for all environmental variables. This reflects the principal conflict of goals between economic growth and reduction of environmental pressures. The structural effect worked for all variables which are included here towards diminishing the environmental burden. I.e. the share of economic branches or products with a high intensity went down over time. The intensity effect had a burdening influence for non-biological primary material and for freight transport, it was almost negligible for settlement area and showed a de-burdening influence for energy and CO_2.

Remarkable are the burdening intensity effects for primary material and transport. For primary material the analysis reveals that the positive trend of a decreasing economy-wide material use goes exclusively back to a strong favourable structural effect. In other words, the decrease in the use of raw material on an average was not the result of efforts to improve the raw material efficiency (which is roughly measured by the intensity) in the individual branches, but goes rather back to a general change in the demand structure. Among others the change of the demand structure in Germany is reflected in an increase of share of the service sector and a sharp decrease of the stake of especially construction activities.

[6] For the methodology of decomposition analysis see Seibel, S (2003)

Figure 8



For transport a high burdening intensity effect can be stated. That effect goes back to an increase in the division of labour as well as an increase in the spatial differentiation of economic activities. Both factors implicate ceteris paribus a growing demand of transport per unit value added.

The results of decomposition analysis can give an idea about important reasons for the change of an indicator in a summarising way, which can be communicated comparatively easy to policy makers and to an interested public.

Households: Beyond the "standard decomposition approach" shown above various types of decomposition approaches with more than three factors are possible. One further example for a decomposition analysis is shown below for the change of **energy consumption of households for room heating** (figure 9) between 1995 and 2004. Following influencing factors were identified for the analysis:

1. Number of population in households
2. Household size structure
3. Living space per household for the individual household size classes
4. Heating energy intensity of living space for the individual household size classes

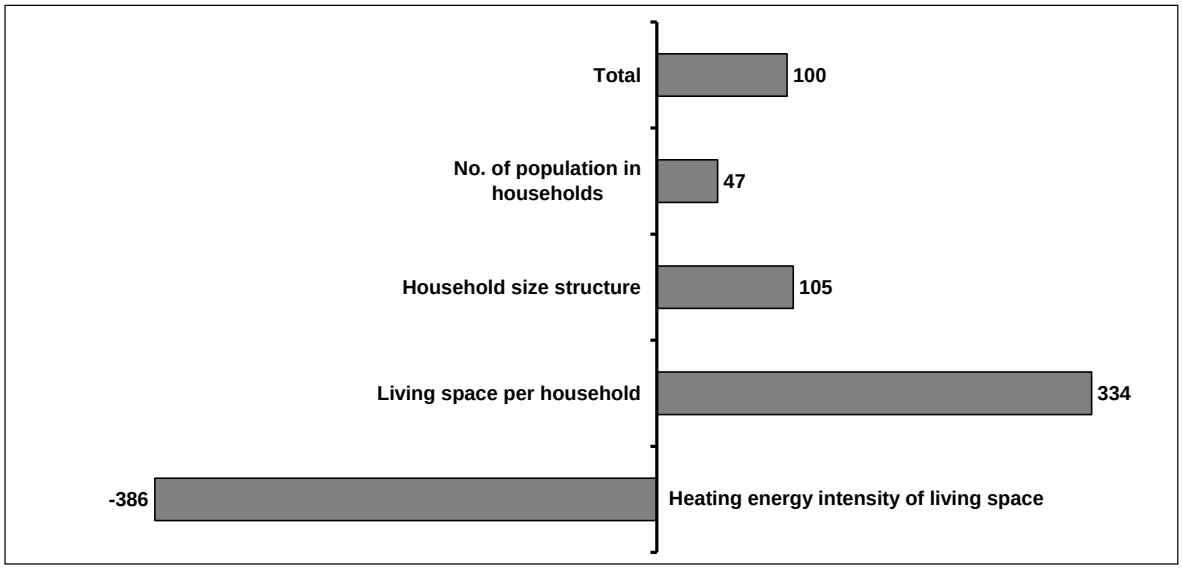
The energy consumption for room heating increased by 2.8 percent from 1995 to 2004. During that period there was a slight increase in the number of population. The household size structure moved towards smaller number of persons per households, which had a burdening effect, as smaller households consume more heating energy per capita. Further the living space per household in the individual size classed increased considerably, which also had a burdening influence. Against that the energy use for heating per square meter went down significantly. The decomposition analysis reveals that the considerable efforts for

using heating energy more efficient and economical - as it is reflected in the decrease of the heating intensity of living space - was outnumbered by the burdening effects of growing population, of decrease in the average household size and especially by the tendency of growing living space per household.

Figure 9

Decomposition of energy consumption of houeseholds for room heating by influencing factors

Change 1995 to 2004 (total = 100)
Contribution to the total change



6.1.4. Indirect effects

The combination of disaggregated physical data on direct environmental pressures with monetary input-output tables can yield further analytical insights. The input-output tables provide information on the intertwining of the economic branches. With that information also the indirect environmental pressures which are related to all steps of the production chain can be assigned to the products of final use with a Leontief-type approach.

Among others the results can be used for analysing the environmental **impact of external trade**. This will be demonstrated below at the example of German CO_2-emissions. The question to be answered will be whether the CO_2-emissions embodied into the imported products are higher than the emissions embodied into the exports.

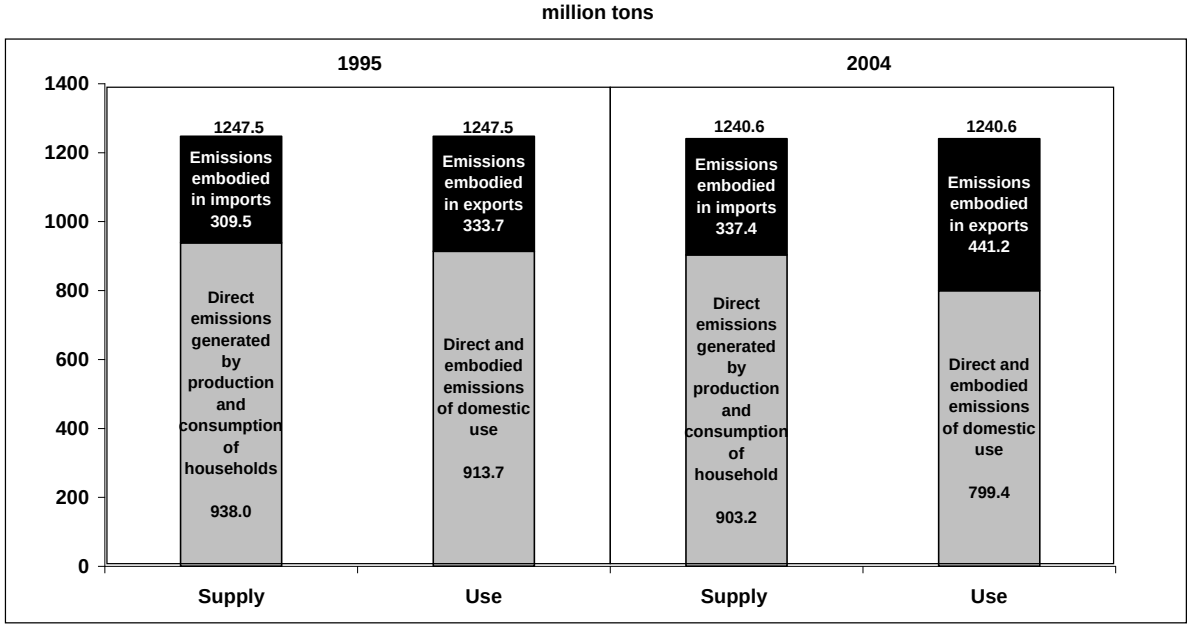
The indicator of the national sustainable development strategy refers to the CO_2-emissions on the territory. I.e. they comprise the emissions related to the production and the consumption activities on the territory. Following that concept the emissions generated by the production of the imported products are assigned to the rest of the world. But on the other hand emissions that are generated by manufacturing the exported products are ascribed to the domestic economy.

The results are shown in figure 10 for Germany for the years 1995 and 2004[7].

[7] Following the concepts of the National Accounts, the monetary data refer to the resident units. The emission data had to be demarcated accordingly. The quantitative difference between the “residence

Figure 10

Direct and embodied CO_2 emisssions related to the supply and use of products in Germany



In 1995 the export related CO_2-emissions (337.7 million tons) were higher than the import related emissions (309.5 million tons). Between 1995 and 2004 the imports and exports were increased considerably. However, the rise in embodied emissions of exports (+107.5 million tons) was substantially higher than the growth of emissions embodied of imports (+29.9 million tons), i.e. the export surplus of embodied emissions increased accordingly (79.6 million tons).

That type of information on the effects of external trade can be a very helpful supplement to the usual indicator for analysis and political decision making.

6.2. Econometric modelling

The approaches for analysing the underlying causes of the development of indicators discussed above are confined to the description of the past (ex post). Additional insights can be obtained by relating the indicators **to empirically founded econometric models**, which can cover the relationship between the economic and the environmental system in a much more systematic and comprehensive manner and in an **ex ante perspective**.

In Germany such instruments for environmental-economic modelling have been developed parallel to the implementation of the German system of environmental-economic accounting (GEEA). The scientific advisory committee of the ministry of environment for GEEA played a leading role in promoting the development and the use of that instrument[8].

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concept" and the "territory concept" can be obtained by adding the emissions of non-resident units on the domestic territory and deducting the emissions of resident units on the territory of the rest of the world. For Germany the difference is comparatively small.

[8] See: The Advisory Committee on " Environmental-Economic Accounting " at the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2002)

The starting points were already existing modelling instruments for the economy. By utilising the data of the EEA these models were extended by including important environmental-economic interactions. Meanwhile the **Panta Rhei** model of the GWS Osnabrück[9] turned out to be the most used model for that purpose. That model is a multi-sectoral approach which can make maximum use of the disaggregated data base.

Such models relate the integrated data of the expanded accounting system to each other by a complex system of empirically based mathematical behaviour equations. The model-relationships can be of economic, environmental-economic or socio-economic nature. The models can be used for forecasting and scenario simulations. Those simulations can be very useful for a sustainable development policy approach, as they can **quantify the effects of political measures** on the target variables but at the same time the side effects on other economic, environmental and social variables, which are relevant for the sustainable development policy. That type of information supports the process of finding cost-efficient solutions and **balancing conflicting goals**.

The examples for the application of environmental-economic models in Germany range from modelling scenarios for rather comprehensive sustainable development policy approaches, to more specialised exercises[10].

An important example is the contribution of those modelling scenarios to the decision making process for the introduction of an eco-tax in Germany. The basic idea of the German eco-tax system is to get a double dividend by reducing environmental pressures and by improving employment. For that purpose energy consumption is taxed and the revenue is used for subsidising the public old age pension system in order to reduce the rate of social contributions on wages. The simulations of the proposed measures demonstrated the effects on energy use, CO_2-emissions and economic variables like GDP, tax revenue and employment.

Similar more specialised exercises have been carried out referring to the situation of individual economic branches (e.g. steel industry or coal mining) or other sustainable development indicators, as area use. The Ministry of Research and the EU also financed more comprehensive approaches, which included a wide range of political measures for improving simultaneously the performance of economic, transport related and environmental variables like energy use, air emissions and area use.

A further example refers to the **simulation of transport related measures** which were formulated by the Federal Environment Agency. The proposed measures were aimed at improving the performance of transport-indicators of the national sustainable development strategy. In addition to the direct effects on the transport indicator values the trends of a number of other environment-related, economic and social sustainable development indicators were simulated with the Panta-Rhei model.

Table 1 shows the forecast for the basic scenario for a number of sustainable development indicators until the year 2020.

As one example of the results of the project the **effect of doubling** the existing **road toll for heavy goods vehicles** is shown in table 2. The table describes the differences between the results of the “measurement scenario” compared to the “basic scenario” for a selected number of variables.

[9] See: Meyer, B. (1998)
[10] See for example Mayer, B. (2004).

Table 1

German sustainability indicators: business-as-usual forecast

Indicator	Unit	1991	2000	2010	2020
Intensity of passenger transport	1999 = 100	102.9	94.7	84.9	77.1
Intensity of goods transport	1999 = 100	90.6	99.8	102.8	106.4
Share of rail transport to total goods transport performance	in %	20.0	15.1	13.3	11.6
Energy productivity	1990 = 100	104.6	122.5	137.7	170.5
Green house gas emissions	1990 = 100	95.6	81.2	78.8	78.1
Air pollution	1990 = 100	85.7	50.2	44.5	38.9
Increase of the settlement and traffic area	Hectare per day	119.7	129.2	93.4	81.5
Gross domestic product per capita	Euro	21 312	23 943	27 034	32 010
Employment ratio	in %	65.8	65.5	67.2	73.2
Increase of budget deficit	in % of GDP	3.0	-1.3	3.3	2.7
Capital formation ratio	in % of GDP	23.8	21.7	17.3	15.6

Source: Gesellschaft für wirtschaftliche Strukturforschung

According to the modelling results it can be expected that the measure will yield an improvement for the indicators values related to goods transport. The intensity of goods transport will go down by 3.6 percent points and the share of rail transport will rise by 1.8 percent points. However, compared to the target values of the strategy the proposed measure alone will not be sufficient. For reaching the target it is necessary to achieve a decrease of the transport intensity by more than 11 percent points and an increase of the share of rail transport by nearly 13 percent points compared to the business-as usual scenario. The side effects of the measure on other sustainable development variables are positive. CO_2-emissions will go down – but only by 2.9 million tons against a current level of total CO_2-emission of more than 800 million tons – and there will be no negative effects on GDP and employment, but a slight increase.

Table 2

Simulation of the effect of doubling the road toll for heavy goods vehicles

	2010	2020
Intensity of goods transport (1999 = 100)	-3.3	-3.6
Share of rail transport to total goods transport performance (%)	1.6	1.8
CO_2-emissions (million tons)	-2.7	-2.9
GDP per capita (Euro 1995)	16.0	34.0
Employment (1 000)	10.0	28.0

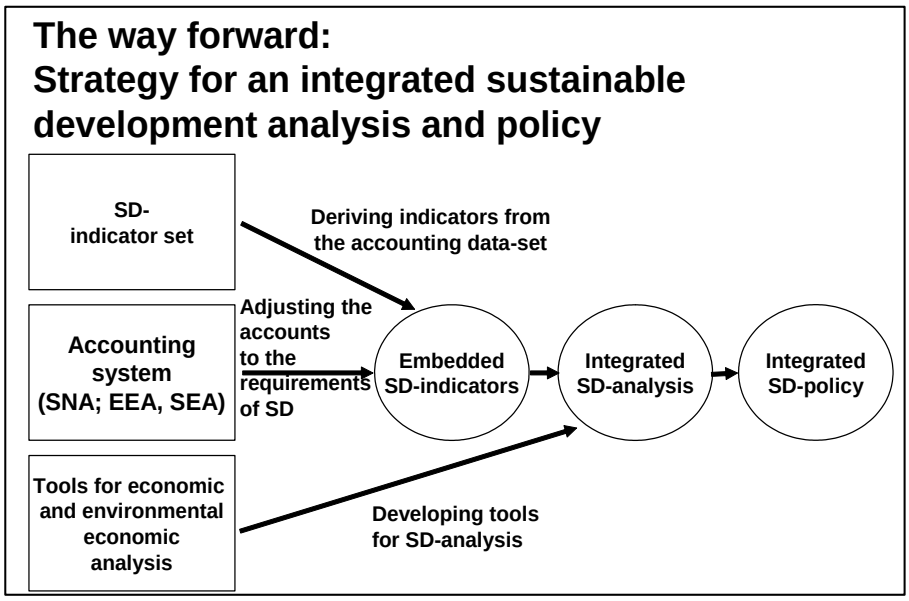
Source: Gesellschaft für wirtschaftliche Strukturforschung

7. A strategy for integrating indicators and accounts

A **strategy** for the development of integrated indicators and accounts as the basis for an **integrated sustainable development policy** consists of three elements to be worked on:

further adjustment of the indicator set, expansion of the accounting system and development of appropriate tools for integrated sustainable development analysis (see figure 11).

Figure 11



The formulation of an indicator set for sustainable development (SD) and the creation of an integrated database necessarily has to be a long-term task. On the one hand policy demands indicators on relatively short notice for describing the sustainability problem. But on the other hand the methodological concepts for approaching the sustainability problem scientifically and politically and, above all, the appropriate database are still under development. This dilemma can be solved only by a stepwise approach.

It is the task of the political side to identify the priority issues to be included into the indicator set for SD. On that basis concrete indicators can be formulated on relative short notice by using already existing data. That was what happened in developing the present national indicator system in Germany. But indicators which were developed in such an ad-hoc manner necessarily run the risk of putting together indicators which are not linked with each other and which therefore can only be of limited use for an integrated policy on SD.

Developing an indicator set for SD that on the one hand perfectly covers the politically important issues and on the other hand is embedded into a coherent and rather comprehensive database can only be an iterative process with a threefold movement:

1. Future revisions of the indicator set should try to **derive** as much **indicators** as possible **from the** existing **accounting data set by aggregation**. In any case, in future it will be necessary to review and improve the existing indicator set in the light of new problems, methodological progress and with the goal of attaining better international harmonisation.
2. The **accounting system** itself **has to be adjusted** to the new data needs. It has to be put high priority on extending the accounting data set **towards the priority issues of a policy for sustainable development**. The accounting framework offers rather good and cost efficient opportunities of generating the required data by reformatting already existing figures. But beyond this, depending on the quality requirement, in the long run it may also be necessary to improve some of the accounting estimates by new primary surveys.
3. At the same time, also further investment in developing appropriate **tools (modelling approaches) for an integrated environmental, social an economic**

analysis will be necessary. The feedback arising from concrete analytical applications of the data have also proven to be very important for a targeted development of the accounting data set

In the economic domain statistical data and especially accounting data as well as the analytical instruments utilising those data are a common basis for dealing with conflicts of interest and for decision finding. A policy for sustainable development can only stand firm in the social discourse against particularistic interest and particularistic policy approaches in the long run, if it is also sufficiently founded on data and facts. Insofar, investment in the development of a data base for a policy on sustainable development and the related analytical instruments is a necessary condition for carrying through that policy approach.

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