ELSEVIER

Environmental Impact Assessment Review
20 (2000) 381–392

Environmental Impact Assessment Review

www.elsevier.com/locate/eiar

A guide to community sustainability indicators

Anke Valentin*, Joachim H. Spangenberg

Wuppertal Institute for Climate, Environment and Energy, P.O. Box 10 04 80, D-42004 Wuppertal, Germany

Abstract

Sustainability as defined by the Brundtland Commission, is a composite and thus ambitious policy target. It comprises environmental, economic, social, and institutional criteria with equal importance. Because of this complexity the first step of a (Local) Agenda 21 process should be to develop a vision of a sustainable society—a "leitbild"—useful as a compass, not a road map (or, even worse, a blueprint), attached by indicators that help to measure progress, distance to target, and failures of plans or their implementations. In the following article a model is proposed how local sustainability indicators can be developed and how they can help to reduce the complexity of sustainability and to concretize a program for the Local Agenda 21. To get a practical impression of the theoretical presentation an example is given in the last part of the article. It shows the experiences made while developing sustainability indicators in the City of Iserlohn.

Keywords: Article 21; Community sustainability indicators

1. Introduction

Indicator development is always a two-way process. Indicators are not only desired from policy aims, but they also help to concretize and mould them. So developing indicators cannot be a purely technical or scientific process; rather, it should be an open communication and policy process.

Indicators suitable for this purpose must be simple and directionally clear: (a) to be *simple*, the number of indicators must be limited and the method of calculating them transparent; (b) *directionally clear* means that

* Corresponding author. Tel.: +0049 202 2492 2; fax: +0049 202 2492 138.
E-mail address: A. valentin@oez-bonn.de (A. Valentin)

0195-9255/00/$ – see front matter
PII: S0195-9255(00)00049-4

they should indicate items and trends obviously relevant in terms of importance for sustainability, and that they are sensitive, i.e., able to signal progress or the absence of it [6].

The major systematic questions under discussion on the local level today are: (1) which interests have to be involved into developing indicators? (2) How broad a participation can be managed? (3) Which indicators are good and which are bad ones? (4) How should a set of sustainability indicators be used in decision making?

Because it is impossible to answer all these questions in a few lines in all necessary detail, this paper will focus on the presentation of the model and the procedure the authors have developed and applied to derive sustainability indicators. The way we have put them into practice is illustrated by means of an example documented in the last chapter of this paper.

2. The dimensions of sustainability

The model we are basing our work on defines sustainability as consisting of four dimensions—the social, economic, environmental, and institutional one—as it is indicated by the *Prism of Sustainability* in Fig. 1 (institutions is meant here to be defined as in political science, including not only organizations, but also mechanisms and orientations, etc.) [11].

The Prism of Sustainability corresponds, for example, to Serageldin's economic terminology of man-made, natural, social, and human capital [8]. One also can find this structure in the set of indicators published by the UN Commission for Sustainable Development, which is thematically based on the chapters of the Agenda 21 [12,15] or, more recently, in the address of the German Government to the 1999 G8 summit in Cologne (www.G8Cologne.de).

The social dimension (human capital) refers to the aggregate of human capabilities, whereas the institutional dimension (confusingly called the social capital) refers to human interaction and the rules by which they are guided [4,16], i.e., to the institutions of the society.

We have linked these dimensions to imperatives—ultimately, the definition of Sustainable Development is nothing but the application of the Kantian "Categorical Imperative" [17] to lifestyle and environmental issues. On the graph they are given for the four dimensions of Sustainable Development. As explained earlier, such "imperatives" as crucial elements of a shared vision cannot be defined by external expert input—the targets and indicators presented here are the result of a number of pilot processes, involving a variety of societal groups and scientific disciplines [9].

The proposed imperatives only define themes of sustainable development. Each community has to develop its individual set of indicators within this common structure. This approach (common structure, different indica-

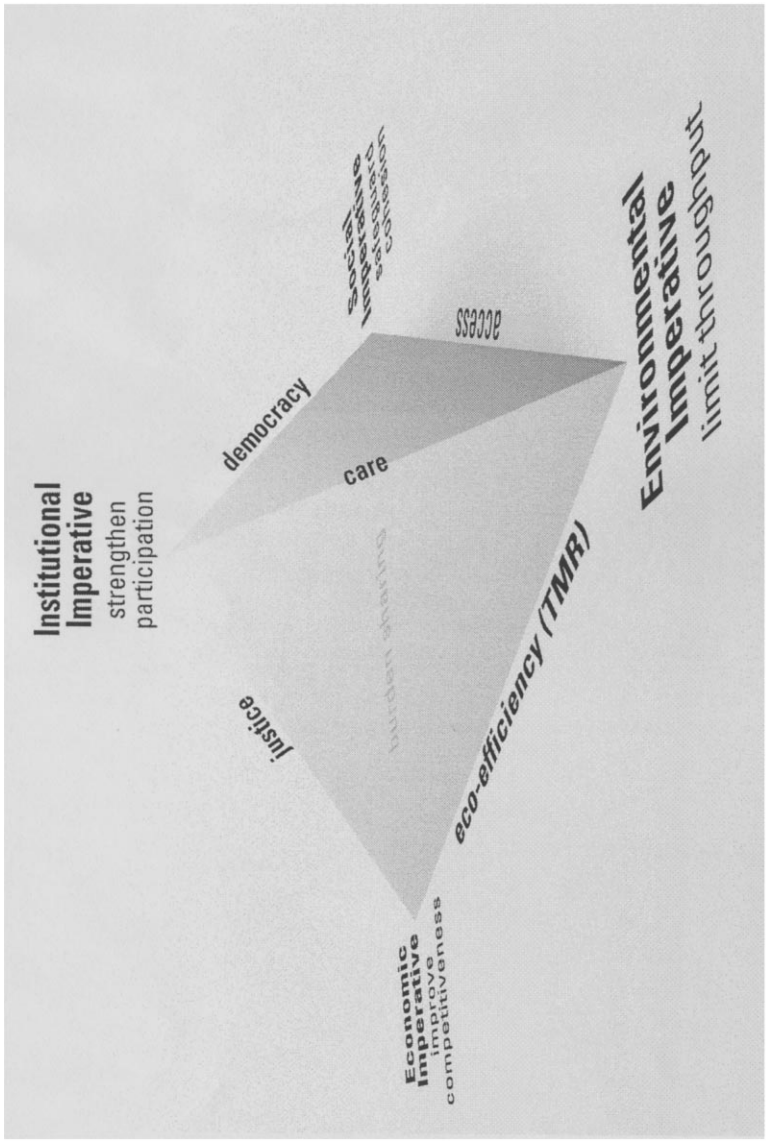

Fig. 1. Prism of sustainability.

tors) provides a possibility to compare communities without ignoring their specific needs and situations.

2.1. Interlinkages

It is, however, not enough to define targets and indicators for the four dimensions of sustainability [14]. They are only expressing some of the necessary preconditions to maintain the self-reproduction cycles of the four interlinked subsystems, without giving any information on the character and effect of the linkages. Therefore, and also because the interlinkages often turn out to be closely linked to the most important fields of policy making, we have to pay due attention to the proper definition of targets and indicators for the interlinkages as well [10]—otherwise any system of indicators would lack operational qualities [3].

1. The environmental limitations to human activities are referring to the total amount of resources extracted from the environment [7], i.e. the throughput of our economies [2]. However, just as important for sustainability is the level of equity in the *distribution of access* to these limited resources. The equality in distribution of access is thus an interlinkage imperative connecting the *social and the environmental* one. This establishes a kind of "human right to resource access."
2. *Democracy*, as interlinkage between the *institutional and the social imperative*, is the basic condition for a society of more tolerance and solidarity. Therefore, participatory democracy is a basic condition for social cohesion as well as for sustainable development in general.
3. The creation of material welfare often comes with a social price to be paid. If the burden as well as the benefits are to be distributed equally, fair *burden sharing* is an inevitable need, and is the basis of the welfare state. This constitutes the interlinkage of the social and the economic dimension.
4. *Care* as interlinkage between *institutional and environmental imperative* is here used to describe a combination of dedication and action. Legal regulations as well as organizations' and individual action are requested to care for the environment. It also represents the more emphatic (as opposed to the technocratic) system of values needed for sustainable development: the limits of societies' caring capacity will probably be as essential as those of nature's carrying capacity.
5. *Total Material Requirement* (TMR) is a physical measure characterizing the resource use for the totality of economic activities in the reference area. When referred to the total amount of wealth created, it is a measure for the physical efficiency of an economy, it represents the environment–economic linkage [1,18a,b].

When defining indicators based on the sustainability model described and its imperatives or normative targets, we prefer not to derive them

from the aggregation of data (because this tends to undermine the crucial transparency), but by selecting indicators characterizing the most relevant trends. Because relevance is a matter of values and preferences, this has to be done again in a participatory process, a kind of applied postmodern science approach [5]. These are measuring the progress made and the way still to go, providing the most important policy information to the public as well as to decision makers: information on successes and challenges, even in a quantified way. By using a set of well-defined indicators it becomes easier to communicate Sustainable Development, and in particular, the Local Agenda process. Finally, it also becomes easier to evaluate measures in favor of a sustainable development over a period of time.

Using the *Prism of Sustainable Development* model in this process enforces prioritizing, by reducing the number of indicators down to 12 to 15 (each connected with targets), while at the same time supporting a broad and balanced coverage of environmental, social, economic, and institutional issues.

3. Towards sustainability indicators

The process of developing and using indicators is schematically outlined in Fig. 2.

3.1. Step 1: Preparing the process

Before starting the development of indicators it is recommendable to define a deadline by which the first report has to be finished. This way the temporary end of the process can be kept in mind and the motivation can be maintained. An overview diagram can be helpful to make clear the step-by-step approach.

The decision of developing indicators (inclusive the period of time) as well as the results of this process have to be codified by any binding means of policy enactment (contract, agreement, etc.).

Furthermore, the elected local and regional council has to be involved, because a political decision is necessary to make support from the resources of administration permanently available. Without the council's involvement, the development of indicators may achieve little in the long term [13].

3.2. Step 2: Forming a working group

After this kind of preparation a steering group can be formed to work together during the whole process. It is best to work with a group that reflects the diversity of the community. Having people from different professional, cultural, and ethnic background, with a wide variety of interests and perspectives, will add a richness and creativity to the process that are

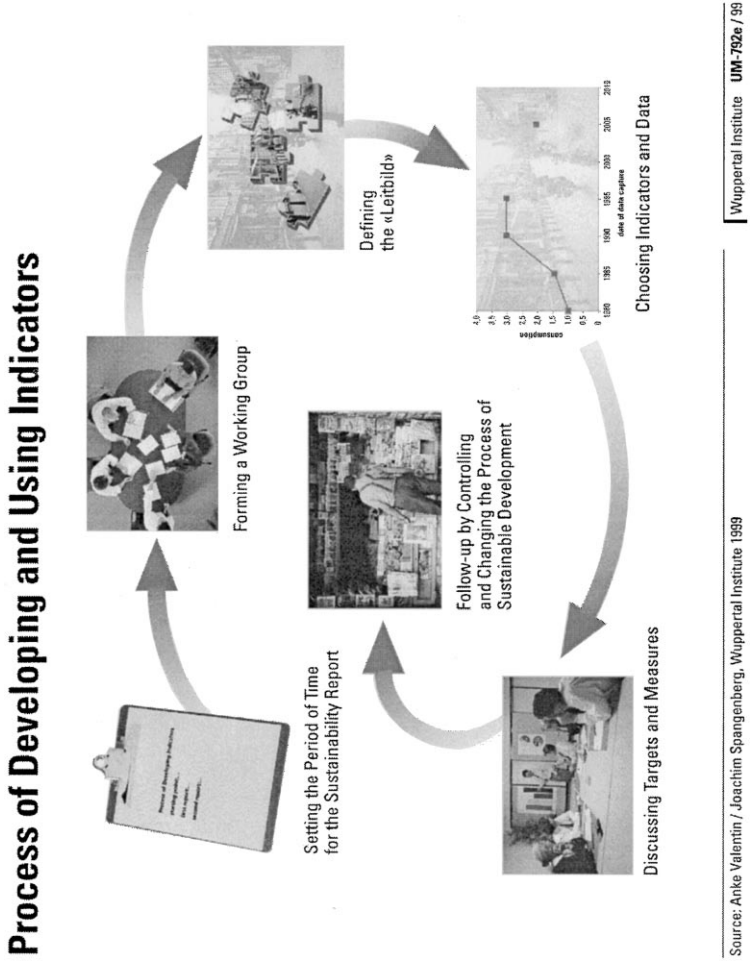

Fig. 2. Process of developing and using indicators.

impossible to get any other way. Some restrictions will result if the process is not aimed at a full-scale Local Agenda, but only at specific issues.

The more diverse the steering group, (a) the greater the knowledge of the local peculiarities; (b) the greater the spectrum of sustainable development; (c) the greater the acceptance of the results by the community at large.

3.3. Step 3: Defining the "leitbild"

Once a steering group has been brought together that is able to guide the process of developing indicators successfully, the participants usually have to spend a long time talking about values and visions of sustainability. For getting a well-balanced "leitbild," defined as 'the perspective of the desirable and the possible' [19], as many conflicting options as possible have to be integrated. If sustainability goals, actions, and statements of local groups already exist, they should be involved.

Once policy goals have been agreed upon, then science has its role to play: it can help to translate these political goals into quantifiable targets, a service provided by science to society at large. Finally, these quantitative goals are the starting point to develop meaningful performance indicators, linked to measurable data: performance indicators do not describe the status quo but rather point to the necessary human activities to move the situation towards a given target.

3.4. Step 4: Choosing indicators and data

There are a lot of indicator reports about sustainable communities that can be used as source of inspiration, but they cannot be copied. Each community is individual and developing indicators on local level provides the opportunity to make this individuality visible in the choice of indicators, thus making then a part of the local/regional identity.

For better public understanding an overview of the goals, together with the indicators and the respective time series of data, should be published. This publication could serve as a draft discussion paper for the following community forums (see below). However, if it is overly developed, the participants may feel that their feedback will not be taken seriously. During the open discussion forums the draft set of proposed indicators should be transformed into a core set of indicators for the sustainable community.

Because the method is based on public participation, indicators and data should always be explained in a clear way so that people with no scientific or administrative background can understand why a certain aspect has priority and why the specific indicators are chosen.

3.5. Step 5: Discussing targets and measures

An important element to generate reference points for monitoring the progress towards sustainability is adopting concrete aims or targets. These

aims must be part of the leitbild, i.e., realistic, measurable, and achievable within a reasonable time limit. Because these are worked out in a broad consensus with citizens and approved by local authorities, they should represent an unambiguous, quantifiable, and comprehensive commitment by major groups and local government to really take action.

The variety of participants usually results in a variety of proposed measures. These should not consist exclusively of political activities, but should as well include different actors and their respective contributions. Each policy field and each project needs someone responsible to supervise the implementation of the proposed measures and to pay attention to the success in her/his field of responsibility.

3.6. Step 6: Follow-up

By the time the process described above has been completed, a solid institutional base for the project should have developed, either in government or in some nongovernmental organization. This is because it has to be ensured that the organizational capacity is available to update and republish the indicator report regularly. Each update needs discussion in open forums and the results have to be integrated into the further work. Certainly, as problems are solved and preferences change, new goals, indicators, and measures have to be found after a number of years that supplement or replace the other: indicators reflect current concerns; they are not cast in iron.

By this time the development of a community and citizens' prioritized values are changing, so the Local Agenda needs to be a dynamic process that is able to integrate new experiences and actual problems. Citizens' feedback of the process, of the "leitbild" and the indicators represent an important information for a successful follow-up based on a broad dialogue process [4].

4. The case of Iserlohn

Iserlohn is a city of 100,000 inhabitants, situated in one of the oldest industrial regions of Europe. The steel industry has been dominating until the 1960s, and still has some influence. However, the transformation to the service and information society is actually shaping Iserlohn like most German cities.

The work on sustainable local development in Iserlohn started with a Local Agenda 21 process in 1997, organized and financially supported (like the development of local sustainability indicators) by the city administration.

The local infrastructure includes an office for coordination and four

working groups, consisting of interested citizens representing different interests and social groups.

When developing indicators, the first step was to bring together the ideas for the future by asking citizens about their wishes for a sustainable city development. This happened during an open conference organized by the city administration showing the official start of the Local Agenda 21 process. The people present were asked to formulate their wishes for: (a) a sustainable nature, (b) a sustainable economy, (c) a sustainable society, and (d) a common procedure to realize together a sustainable development.

In a second step, these ideas and additions of people present were collected in a workshop and composed to a preliminary draft of a "leitbild" based on the "Prism of Sustainability." Then the members of the different working groups have been asked to name representatives. Together with representatives of different interest groups (business, education, environmental groups, etc.) they have put the goals that form the "leitbild" into concrete terms and attached indicators. Because it was not possible to directly involve *all* groups and interests during the discussion about the "leitbild," they were asked to give their opinion to the draft.

The more developed and localized a goal, the easier it is to attach indicators. Once the goals and the "leitbild" had been defined by a large group of citizens, the indicators could be attached by a smaller group of representatives and scientists. They had to take into account the further steps. This meant that the indicators had to be preferably but not necessarily based on existing data given that the cities' possibilities of additional data collection were limited. Therefore, goals were defined at the lowest level possible, with the goal characteristics as detailed and precise as possible (see Fig. 3).

Not for all dimensions and interlinkages have sustainability goals been defined. Nevertheless, it is obvious that the goals are not all directed to only one or two dimensions, but is distributed in a well balanced way.

Because each city is different, the appropriate set of sustainability indicators must be different as well, but as a starting point they may be chosen from any source and combined in the form that most suits the conceptual purposes involved. This is the reason why the already existing lists of indicators can be helpful as examples but never as blueprint for other cities—a common pattern like the Prism of Sustainability, however, seems desirable.

Indicators guide action through the setting of targets, a crucial quality. Part of the way they ensure that commitments are implemented will require explicit targets to be set for all actions, and the responsible actors to be identified, and then monitor and report progress with reference to those targets.

The next steps in the process of developing indicators will be the visualization of existing data and the inquiry of data that is not yet available. For a trend analysis, it would be excellent to have data at hand, which have been collected over the last decade. Linked to concrete targets that should

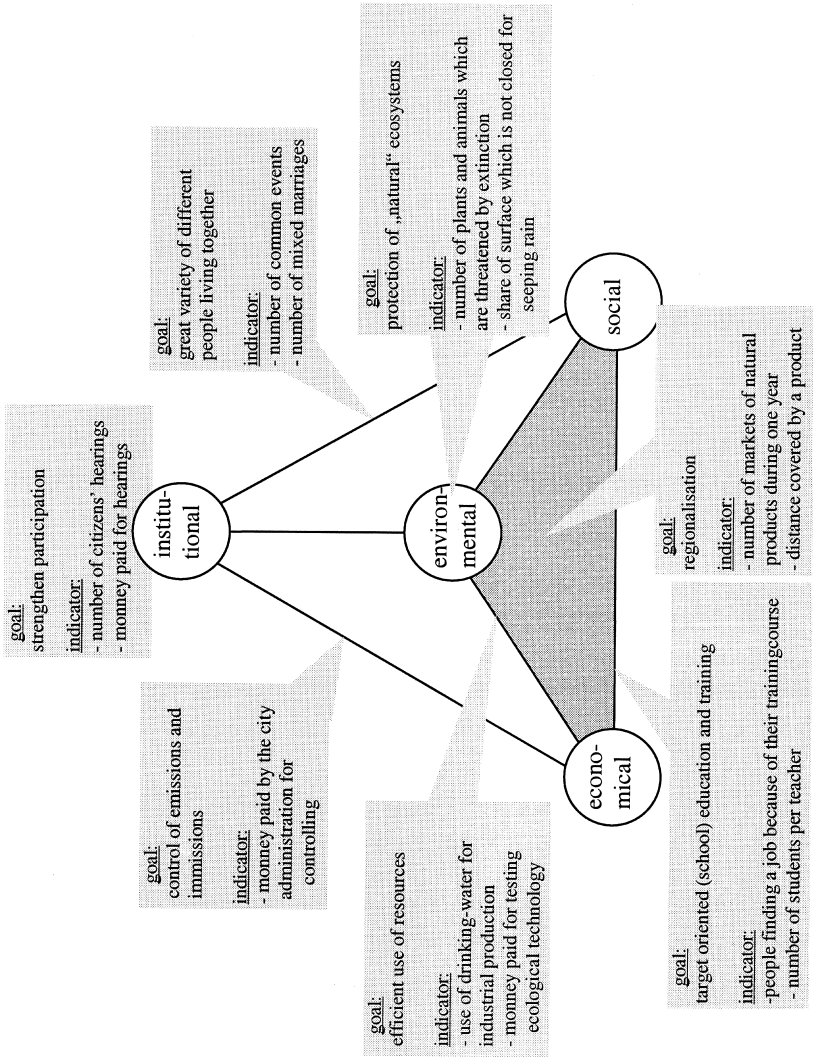

Fig. 3. Some examples of goals and their indicators.

be reached within a given period of time, the indicators can be used to measure sustainable development and to evaluate public and private activities for a sustainable community.

5. Results

The innovative character of the described procedure is based on two features—one conceptual and one procedural: (1) the integration of the different dimensions of sustainability into only one set of indicators helps to achieve a balance without oversimplification, and the representation by the *Prism of Sustainability* structures the presentation and simultaneously illustrates the coherence and the diversity of sustainability visions. This way sustainable development is described in a more operational and appropriate way than by one aggregated index, but just as easy to communicate. (2) The second innovation is the broad and systematic participation of different societal groups during the process. This helps to strengthen the local identity by providing the means for all citizens to better identify with their community and its development.

Each community is individual, and so each process of Local Agenda 21 is individual also. But, nevertheless, there are some similar basics. For getting a system of sustainability indicators that can be used to compare different communities it is important to connect an indicator system of common goals with a more detailed program that shows the specific subjects of each Local Agenda 21.

References

[1] Adriaanse A, Bringezu S, Hammond A, Moriguchi Y, Rodenburg E, Rogich D, Schütz H. Resource Flows: The Material Basis of Industrial Economies. World Resources Institute, Washington, DC: 1997.
[2] Daly H. Steady State Economics. Island Press, Washington/Covelo, 1991.
[3] Deller K, Spangenberg JH. Wie zukunftsfähig ist Deutschland, Entwurf eines alternativen Indikatorensystems. In Bilanz und Perspektiven. Bonn, Germany: Forum Umwelt und Entwicklung, 1997.
[4] Faucheux S. Intergenerational equity and governance in sustainable development policy. Proc. 5th Biennial Meeting, International Society for Ecological Economics, November 15–19, Santiago, Chile, 1998.
[5] Funtowicz S, Ravetz J, O'Connor, M. Challenges in the use of science for sustainable development. Int J Sustain Dev 1998;1.
[6] Gouzee N, editor. Indicators of Sustainable Development for Decision-Making. Ghent, Belgium: Workshop report submitted to the UN Commission on Sustainable Development, 1995.
[7] Schmidt-Bleek F, Bringezu S, Hinterberger F, Liedtke C, Spangenberg J, Stiller H, Welfens JM. MAIA. Einführung in die Material Intensitäts Analyse (Introduction to Material Input Analysis). Birkhaueser, Berlin: 1998.
[8] Serageldin I. Sustainability and the Wealth of Nations, First Steps in an Ongoing Journey. World Bank, Washington, DC: 1996.

[9] Spangenberg JH. Sustainable Europe—a concept and its operationalisation: discourses, indicators, models. Proc. 5th Biennial Meeting, International Society for Ecological Economics, November 15–19, Santiago, Chile.
[10] Spangenberg JH. Environmental space-based proactive linkage indicators: a compass on the road towards sustainability. In: Moldan B, Billharz S, editors. Sustainability Indicators, Scope 1997;58.
[11] Spangenberg JH, Pfahl S, Deller K. Indicators for institutional sustainability. In Malkina-Pykh I, editor. Indices and Indicators of Sustainable Development: A System Approach. Proceedings of the Second Biannual INDEX Conference, St. Petersburg. Oxford: EOLSS Publication, 1999.
[12] United Nations. Indicators of Sustainable Development, Framework and Methodologies. New York: United Nations, 1996.
[13] Valentin A, Gürtler M, Spangenberg JH. Sustainability and urban policy in Germany—retrospect and prospect. In Low N, Gleeson B, Elander I, Lidskog R, editors. Consuming Cities: The Urban Environment in the Global Economy After the Rio Declaration. London, UK: 2000.
[14] von Weizsäcker EU. Earth Politics. Darmstadt, Germany: Wissen schaftliche Buchgesellschaft, 1989.
[15] World Commission on Environment and Development. Our Common Future. Oxford, UK: Oxford University Press, 1987.
[16] Dieren van W, Banki M, van Dam E, Mleke E. Input paper for the workshop: Northern production and consumption patterns in relation to the carrying capacity of the earth in Stockholm. Amsterdam, IMSA, 1994.
[17] Kant I. Kritik der praktischen Vernunft, Königsberg, 1788.
[18a] Spangenberg JH, Hinterberger F, Moll S, Schütz, H. Material flow analysis, TMR and the MIPS concept: A contribution to the development of indicators for measuring changes in production and consumption patterns. In: Int. J. Sustainable Development, Vol. 2, No. 4, pp. 491–505, 1999.
[18b] Spangenberg JH, Femia A, Hinterberger F, Schütz H. Material Flow-based Indicators in Environmental Reporting. European Environment Agency Environmental Issues Series No. 14, Office for Official Publications of the European Communities, Luxembourg, 1999.
[19] Dierkes M. Lietbild und Technik, Edition sigma, Berlin, 1992.