SYSTEM TO SUPPORT DECISIONS ON SUSTAINABLE DEVELOPMENT: INTEGRATED ASSESSMENT

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Contents

Summary

In this article, we introduce the integrated approach to sustainable development. The short description of the concepts of activity fields, to express an area of societal needs, and indicators are used to explain the influence of the technology assessment on sustainable development. Then we describe extensively a class of Integrated Assessment models like RAINS, IMAGE2.0, TARGETS and the newly developed M3 project. All these simulation models are used to support decisions on Sustainable Development.

1. Introduction

With its report "Our Common Future" of 1987 the World Commission on Environment and Development, (WCED, 1997) often called the Brundtland Commission, has brought the concept or paradigm of sustainable development in a broader public and scientific debate. Sustainability, however, as a principle of forest management has already a long history and dates back to the 18th century. The term meant that in a certain period wood should only be harvested to the extent it could be expected to grow again in the same period of time through afforestation. With the concept of maximum sustainable yield it

became also a concept of sustainable management of fish resources in the beginning of the 20th century. However, for more than 200 years the concept had only a meaning for forest and fishery management.

It was not until the end of the sixties and beginning of the seventies of the last century when the Club of Rome published its report on the limits of growth, in which the relationship between economic growth and the depletion of resources was dramatically revealed that the term gained in importance as a general principle for the management of resources and for economic development.

Since that time, the issue of economic and societal development and protection of natural resources has been the topic of several international conferences and documents, and the term "sustainable development" or "sustainability" became a catchword in this debate, which, however, did not find much public recognition until the publication of the already mentioned Brundtland Report. This report gained in importance in the following years and was an important basis for the UN Conference on Environment and Development (UNCED) in Rio in the year 1992. On the occasion of this conference around 170 countries in the so-called Rio Declaration and the Agenda 21 committed themselves to translate the concept of sustainable development into concrete policy at a national level as well as at the global level, in close cooperation with other countries.

One way to realize a resource management is given by the tool of Integrated Assessment models. Integrated Assessment has emerged as a new avenue in the quest to explore complex environmentally-related problems. As an intuitive process it is not new. For instance, thousands of years ago Egyptian farmers were already applying it in the sense that they made use of integrated land management techniques, in particular ingenious crop-farming and methods of irrigation in combination with clever weather forecasting schemes. Since the 1970s, the notion of Integrated Assessment has been used within a broad context, in particular in Europe and North America.

However, where in Europe Integrated Assessment has its origins in the population-environment, ecological and acidification research, in North America the focus was mainly on the economic impacts of anthropogenic disturbances. During the last two decades, Integrated Assessment efforts have increasingly focused on climate change. In this article we will concentrate on three classical Integrated Assessment models: RAINS (acidification), TARGETS (global change), IMAGE2.0 (global climate change). In the last years the importance of the sociological component in simulation tools grows very fast. In addition to the traditional simulation framework, the M3 project intends to includes real people as active objects into a Virtual Reality where all objects are coupled by a model-based simulation framework.

2. Definition of Sustainable Development

Despite the high recognition the concept has won in international policies and the scientific debate the meaning of the concept and its perception by different actors at various policy levels is still very ambiguous. When it comes to putting the concept in concrete terms and especially into concrete objectives, strategies and measures the positions of the different groups involved in the scientific and political debate are still strongly divided. There is a large number of definitions of sustainable development, the

most prominent of which is still the definition of the Brundtland Commission. According to the Commission sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). The definition asks for intergenerative and intragenerative justice. These postulates are commonly seen as the basic foundations of the concept. However, the perception of the concept the industrialised countries have for a long time emphasised intergenerative justice by referring to the need to protect and conserve natural resources for current and future generations, whereas developing countries stress the need for intragenerative justice, that means the need for improving their economic and social state of development. In the course of the debate growing consensus can be observed in the perception of the concept as a concept which has to integrate ecological, economic and social issues of development and that these dimensions have to be considered as equally important in putting the concept in societal practice.

See: Brundtland Commission, intergenerative justice, intragenerative justice.

3. Operationalization of the Concept of Sustainable Development

Although the Brundtland Commission's definition is broadly accepted, the high level of acceptance must also be seen as a consequence of its vagueness and thus its operational value is fairly low.

To support decision making towards sustainable development and to implement the concept into political and societal practice operationalization of the concept is needed. Currently, numerous political and scientific activities are undertaken in this regard. Many countries have elaborated national sustainability strategies under the obligation to which they committed themselves in the Agenda 21. Many towns and communities have initiated local Agenda 21 processes. Furthermore, research projects are carried out to operationalize the concept.

If one reviews these activities, a great variety in interpretations of the concept can be observed. However, one has to state, that the efforts to operationalize the concept still focus on the environmental dimension of sustainable development. Therefore, the status of operationalization is most advanced for this dimension.

Already in the beginning of the nineties of the last century Pearce and Turner (1990) and Daly (1991) have formulated so-called principles of sustainable development which refer to a sustainable use of renewable and non-renewable natural resources and the use of the environment as sinks for pollutants. These principles were fairly general or abstract, and in the following, efforts were made to further operationalize these principles through the development of sustainability indicators which can help to identify sustainable and non-sustainable development paths in the use of natural resources. In the meantime, however, these indicator systems have been extended in order to also identify sustainable or non-sustainable paths in economic and social development.

See: Agenda 21, operationalization of sustainability.

4. Sustainability Indicators as a Further Step in Operationalizing Sustainable Development

In general, the development of sustainability indicators has to be regarded as an essential step in the further operationalization of the concept. They are needed to identify sustainable and non-sustainable development paths as well as to evaluate policies, strategies and measures intended to promote sustainable development by measuring.

In more detail, sustainability indicators have the following functions

- to describe the state of development with regard to ecologically, economically and socially sustainable development
- to describe and evaluate the sustainability of expected future trends
- to support the formulation and quantification of sustainability objectives
- to evaluate proposed policies, strategies and measures for the promotion of sustainable development
- to evaluate the success of policies implemented to promote sustainable development (controlling function)
- to inform policy makers and society on central problems of sustainable development (information function) and to support the political and public debate on sustainability issues (communication function)
- to facilitate international comparisons on the performance in different countries with regard to their obligations to promote sustainable development to which they have committed themselves at the Rio Conference on Environment and Development

Last but not least, the formulation of quantitative sustainability indicators is a prerequisite to enable scientific quantitative analysis of sustainable problems by means of simulation models, i.e. to simulate and assess the stresses and impacts resulting from human activities and to model the complex interlinkages between social-economic systems and natural systems.

Against the background of the need to further operationalize the concept of sustainable development described above several activities at global, national and local levels are underway to develop sustainability indicator systems. The most prominent activity in this regard is the effort of the UN Commission for Sustainable Development (CSD), which has developed a set of 138 sustainability indicators, which cover the ecological, the economic and the social as well as the institutional dimension of sustainable development. Following the Pressure-State-Response-Indicator-Model (PSR) developed by the OECD for environmental indicators the CSD differentiates Driving force -State and -Response indicators. The CSD indicator set is currently tested by several countries.

Other sustainability indicator sets for the national level were presented by the U.S. President's Council on Sustainable Development (1996), the UK Department of the Environment (1999) and other countries as well as by scientific institutes like the International Institute for Sustainable Development (Bossel, 1999) and by a cooperative project of the German Hermann von Helmholtz Association of German Research Centres (HGF), in which the authors' institutions take part.

See: Sustainability indicators.

5. Sustainable Global Development - The Integrative Concept

Under **the integrative concept** of sustainable development we understand an equal consideration of environmental, economic and social aspects of sustainability. The idea behind this approach is that an effective implementation of the concept of sustainable development is only possible if environmental, economic and social issues are no longer played off against each other, but consistently viewed and treated in their interdependence. The assumption behind the integrative concept is that problems like high unemployment, increasing differences between the poor and the rich, the North-South problem, and the social exclusion of people can also destabilize societies and are thus as unsustainable as trends of environmental degradation.

Next we will focus on potentials, which new and improved technologies can offer to enter more sustainable pathways, that means it will concentrate on the analysis of efficiency and consistency strategies, however without neglecting sufficiency elements. There are two reasons for this. Firstly the past has shown that successes in reducing environmental pollution and use of national resources were mainly based on technological means, although these positive effects were counteracted in some cases by increases in demand or consumption, the so-called rebound effect. Secondly it has to be stated, that major changes of life styles are difficult to realize under the current societal value structure and that efficiency and consistency approaches will encounter higher acceptance in society.

As an additional aspect we remark that the starting point is to explore more sustainable ways in meeting societal needs in different areas, such as construction and housing, mobility, agriculture and nutrition, information and communication, leisure and tourism, health, textile and clothing, and other areas of societal needs. We call such areas of societal needs **activity fields**.

See: Integrative concept, activity fields.

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Biographical Sketches

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Dr. Torsten Asselmeyer-Maluga: was born in October, 1 1970 in Lauchhammer (FRG). He studied physics at Humboldt university and graduated in 1997 with a work about Evolutionary algorithms. In 1998 he got a fellowship from the Louisanna government for the Loyola university to work with Prof. Brans. Since 1999 he worked at the GMD FIRST in the group "System analysis and Simulation".

The objective of his work is to assist in understanding reaction/diffusion processes and pattern formation in all systems especially in the air. Currently he works partly on the M3 project to build a simulation system for sustainable development.