

# Sustainability Science for Global Problems New Cognitive and Organizational Challenges

Joint Conference  
6–8 July 2006, Karlsruhe

Deutsche Gesellschaft für Soziologie (DGS),  
Sektion „Soziologie und Ökologie“

Institut für Technikfolgenabschätzung  
und Systemanalyse  
Forschungszentrum Karlsruhe



Institut für sozial-ökologische  
Forschung (ISOE), Frankfurt am Main



artec | Forschungszentrum Nachhaltigkeit  
Universität Bremen



# 1 Call for Papers

Sustainability has become a central concept for both scientific and political debate. Sustainability, as a concept referring to the interplay of different levels, from the global and to the local, clearly involves norms and values. At the same time, it is a concept of scientific analysis, used to describe and analyze the availability of natural resources and the dynamics of social-ecological systems, both from a natural science perspective and that of the social sciences. However, sustainability is not merely a concept *of* scientific analysis; it is also a concept that *challenges* the sciences, both natural and social, to transform themselves. The question then becomes: to what extent, and how, will the sciences respond to this challenge, both cognitively and organizationally.

Four dimensions are of paramount relevance:

- Integrating natural and social sciences within common theoretical and conceptual perspectives
- Integrating natural and social sciences in global research programs and communities, including the challenge of developing specific policies and organizational structures
- Modeling and simulation for representing specific knowledge bases
- How to integrate the knowledge and the perspectives of different societal actors and how to cope with limited knowledge and uncertainty in political decision-making?

All four dimensions are at the core of what has been called “Sustainability Science”. In order to enhance the understanding of its strong and weak points the conference is being organized jointly by four institutions:

- Sektion “Soziologie und Ökologie” der Deutschen Gesellschaft für Soziologie (DGS)  
The “Sociology and Ecology” section of the German Society for Sociology (DGS)
- Institut für Technikfolgenabschätzung und Systemanalyse (ITAS),  
Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft  
Institute for Technology Assessment and Systems Analysis (ITAS),  
Research Center Karlsruhe, Member of the Helmholtz Association
- Institut für sozial-ökologische Forschung (ISOE) Frankfurt/Main  
Institute for Social-Ecological Research (ISOE) Frankfurt/Main
- artec | Forschungszentrum Nachhaltigkeit (Universität Bremen)  
artec Sustainability Research Center (University of Bremen)

The conference will take place from 6–8 July, 2006 in Karlsruhe. It comprises four sections. Each of them will be commenced by talks by one or two internationally renowned keynote speakers. The conceptual framework of the conference is outlined in more detail below.

We invite the submission of papers referring to aspects of one of the four sections. Proposals, not exceeding 300 words, should be sent in by February 15<sup>th</sup> to the organizers. The proposals will be reviewed by the organizers by the end of March. Full papers should be submitted no later than June 15<sup>th</sup>. Please send the proposals to

[Gotthard.Bechmann@itas.fzk.de](mailto:Gotthard.Bechmann@itas.fzk.de)

[jahn@isoe.de](mailto:jahn@isoe.de)

[lange@artec.uni-bremen.de](mailto:lange@artec.uni-bremen.de)

## 2 Outline

In the Eighties there were two major contributions to the environmental debate which also led to important changes in research: these were the discussion about sustainable development on the political side, and the emergence of global change research on the scientific front.

With the concept of sustainable development, the Brundtland Report in 1987 launched a discussion which links ecological, social and economic perspectives in a novel way and in an overall concept. For all the imprecision and variation in its definition and use, the idea of sustainable development offers links which integrate the ecological debate and offer a bridgehead to a globally-oriented environmental policy. Here, “global” specifically means focusing on the growing gap between the wealth of the industrialized nations and the problems of poverty in “Third World” countries as an issue of justice in connection with environmental problems and putting this on the agenda for international negotiations.

The actual innovation is the integrative approach which makes our use of nature an element in overall social development. “The concept of sustainable ecological development offers a notion which counters simplistic polarization in environmental policy discourse and helps overcome entrenched positions. It is a matter of learning to approach extremely complex, interactive systems – not only ecological, but also modern economic and social systems – and link them in an acceptable way into a functioning whole. These are integrative activities which ultimately can only be secured through a concept which focuses constantly on the fundamental conditions for survival and development of the society” (Der Rat von Sachverständigen für Umweltfragen SRU, note 5, p. 51, Stuttgart 1996). This has initiated a decisive change in perspective. The end-of-pipe environmental policy and its largely defensive character are cast off, revealing a concept which channels efforts into a policy shaping the future of society.

For environmental research, this creates the need to research the complex formed by ecological, social and economic phenomena and to package them and present them in decision-making terms for policy-makers in the context of sustainable development. This forces an interdisciplinary and integrative approach in research, which also has to bear in mind the need to organize knowledge for the purposes of action.

A second major boost to the environmental debate (and also environmental research) comes from global change research. While the concept of sustainable development addresses the global nature of environmental policy and places it in a fruitful relationship with local action, the international sweep and global networking of research organizations in global change research have become formative elements in a newly-emerging field of research which goes beyond environmental research as such.

In contrast to the sustainable development debate, which is concerned with developing positive concepts and establishing criteria and target indicators in an effort to establish guiding parameters for social action, global change research is based on human-driven changes to nature and tackles the phenomenon of potentially self-destructive actions by society rooted in its modes of production. Research becomes reflexive to the extent that it examines the impact of social action on society itself. Environmental problems are causally attributed to human actions, creating an obligation to take political action in response.

Climatic change, advancing karst, reduction in biodiversity and deforestation are all consequences of human actions which can only be controlled by further decisions. This is a fundamental pattern in the ecology problem. To the extent that technological actions change nature with resulting problems for society, we will have to develop greater competency in action rather than less, but exercise this in accordance with criteria which incorporate the impact of risks on us.

Sustainable development and global change research accordingly draw our attention to two fundamental problems of the newly-emerging environmental research:

- (1) Environmental problems as local or regional situated practical problems have to be placed in a global context, indicating the need for an integrative, transdisciplinary approach, considering problems of scale and social diversity
- (2) Nature is no longer viewed as something separate from society: rather, the way society acts on environmental problems relates to hybrids of societal relations to nature.

If this is an accurate description, environmental research takes on central importance in connection with the transformation processes in different societies. On the one hand, it has the task of researching the complex relationship between social development and environmental change; on the other hand, it faces the problem of incorporating this knowledge into decision-making processes. Its feedback into politics and other important areas of action makes it a problem-oriented science with practical relevance.

### 3 Key Issues

#### 3.1 Integrating Natural and Social Sciences: Theoretical and Conceptual Challenges

The interactions between natural and social processes and structures are the most difficult challenge for sustainability science, as well as for global change research. In this respect, the question of conceptualizing the difference between nature and society and the problems of construction connected with it form the point of departure for theory formation.

In spite of their divergent research approaches, sustainability science and global change research have two essential prerequisites in common: the hybridity of the objects of their research, and the problem orientation of their research process. This results in common theoretical and methodical problems.

(a) In the center of the theoretical challenges connected with this situation stands the question of the status and conceptualization of the *difference between society and nature*.

Analysis of the interactions between societal and natural dynamics presupposes differentiation between nature and society. How can this distinction be made? Can we draw back upon an understanding of nature and society as ontologically different spheres of reality? Or mustn't we rather have to assume that we can only distinguish methodically between different subject areas of the natural and social sciences with these general terms (Methodical Dualism)? With these questions, the issue of the theory-dependency of the objects of research and, with it, the transdisciplinary integration of

knowledge move into the foreground. Which bridging concepts or – above and beyond them – transdisciplinary theoretical approaches can we draw upon? How can disciplinary concepts – for instance, from biological ecology or sociology – be adapted to this end? Which theoretical status do terms like *environment*, *system*, *ecology* have here? How can the normativity implicit in these concepts be made explicit, and thereby accessible to empirical testing?

(b) The process of research aims, as a whole, independent of the design of individual research projects, at the production of (new) scientific knowledge for solving societal problems.

The consequence is a sophisticated concept for *cognitive integration*, in the center of which stands the integration of natural- and social scientific knowledge, and of scientific and of everyday knowledge. It extends from combining scientific and daily pragmatic knowledge to a comprehensive epistemic structure (integration of knowledge) and to the overreaching networking and coordination of differing interests and activities (social and organizational integration) to translating linguistic means of expression and communicative practices into a common discursive practice (communicative integration), and to redesigning various technical elements of solutions to a sustainably functionable entity (technical integration).

These questions apply not only to the construction of a common epistemic object at the start of a research project, but just as well for the phase of the multi-disciplinary generation of knowledge, as for the integration of the results at the end. New methodical challenges are connected with it: How can the boundaries between disciplines and those between scientific and non-scientific knowledge be crossed in an orderly manner? Which methods are especially well suited for combining the disciplinary (partial) findings with others? Which are the “transdisciplinary” equivalents for the – then necessary – reductions?

### 3.2 Integrating Natural and Social Sciences in Global Research Programs and Communities. Policies and Organizational Patterns.

Due to the transnational character of global problems global change research is being organized as a transnational process. Hence, new discourse communities are evolving. Although still rooted in national discourse structures, research is increasingly organizing itself in *international networks*. As they are mainly focusing on specific problem clusters and in search of contributions to practical solutions, traditional *disciplinary perspectives* are losing ground. *International research programs* prove to be one of the most relevant frameworks of restructuring both research and knowledge. This leads to a number of questions which are far from being answered so far:

Scientific disciplines and sub-disciplines continue to be an essential prerequisite of scientific progress. How do disciplinary paradigms get integrated into problem-oriented research programs? How and by means of which institutional settings do the findings of problem-oriented research influence the further development of theory in a disciplinary context? Or does the shift to internationally organized problem-oriented research lead to a division into different communities without major communication?

International problem-oriented multi-disciplinary research led to the emergence of specific scientific journals, most of them launched and sustained by discourse groups of specific concern, e. g. nature resources management, natural hazards and disasters, coastal zone management. Academic careers, however, continue to be built on publications with a more disciplinary focus. How can both of these tendencies be linked together without losing their productive potentials? The same restriction can be observed in relation to emphasizing problem-solving and political decision-making rather than being oriented towards theory as a main concern of global change research. On the other hand, most of the relevant international networks of global change research have started from and are still being strongly influenced by disciplinary perspectives, e. g. meteorology, biology, etc. Social science perspectives, although frequently being addressed as crucial, continue to play a less important role.

As can be seen in the example of the Earth System Alliance and its different clusters (including the International Human Dimensions of Global Change and its subprograms), a broad spectrum of research programs and particular science plans has been elaborated. The IPCC can be seen as a characteristic institutional body for making this type of program operationable. But how is the funding of this kind of research being organized? And how independent is it from specific interest groups providing the funding? On one hand, the commitment of global change research to problem-solving is an important precondition for successful fund-raising. On the other hand, the deliberate concern of global change research with political strategies and decision making can lead to political ambitions and to specific forms of sensitivity to political expectations, or even pressure.

### 3.3 On the Function of Modeling and Simulation as a Knowledge Base in Sustainability Science

Because of the heterogeneity of scientific disciplines and due to the organizational diffusion and diversification of (national and international) research, simulations, scenarios, and models are gaining eminent importance for the generation, accumulation, and stabilization of the knowledge base. These instruments form the systematic basis for the integration of disciplines, the harmonization (of research perspectives and priorities, objects, and conceptual frames of reference) and standardization (of methodologies and data formats), and make means for the integration of border-crossing communication, coordination, and networking, not only within transdisciplinary research, but also between research and the contexts of its application – for example, politics – possible.

With the establishment of computational science and of its research instrument, computer simulation, there arises not only a third path besides theory and the experiment for the sciences with an interdisciplinary research landscape, but with the visualization of the enormous amounts of data, pictoriality enters into science in an unprecedented manner. Precisely the visualization, but also its orientation on application predestine computer simulation to become an important instrument for mediating between science, society, the economy, and politics. In the meantime, the medial effects of animated simulation images is immense, and simulations belong in all of the numerous science programs to the standard explanatory tool kit for scientific topics.

But simulations do quite a bit more. First, they give access to areas which would be too small or too large, too fast or too slow, too dangerous or too expensive for conventional experimentation. Second, simulation programs are used for specific problems in the economy as well as in administration, and are a marketable product of the sciences.

Likewise, causal explanations can be replaced by *conditional-hypothetical scenarios*. Scenarios are a pragmatic possibility for deriving future developments out of the past without negating leeway for action in the present or the openness of possible futures. Scenarios therefore offer outstanding possibilities for orientation in decision-making processes. They are well suited to guiding the choice of political or economic alternatives and to justifying decisions made.

In addition, an orientation towards acknowledged *models* or *prototypes* can supplement or even replace references to theory. In this case, models and prototypes gain enormously in importance, because they can strongly influence the direction of research, and, at the same time, suggest technical feasibility and interventions in nature. In this connection as well, it is, therefore, a central question, to which extent *processes of closing* – in other words, the acknowledgment of models and prototypes as a frame of orientation for research – can be identified, and which repercussions are to be expected from the development of models and prototypes for future empirical and experimental research.

### 3.4 New Forms of Organization, Ignorance, and the Relationship to Societal Decision-making

A central dimension of the production of new forms of knowledge is the inclusion of *non-scientific knowledge*. This isn't necessarily a question of the organizational participation of non-scientists, but of the integration of political and economic expert knowledge, and of everyday knowledge in the formulation of research questions as well as for questions of feasibility and of the practical resources or prerequisites connected with the research (keyword: action capability). Further, representatives of organized interests and of public welfare-oriented institutions are potential partners in cooperation. Integration of such actors' knowledge has to be applied in the formulation of the programs as well as in questions of the evaluation and further development of the research programs. Here, too, changes have to be taken into consideration in the course of time which draw back upon processes of the scientification of societal problems, as well as upon forms of the incorporation of practical and social knowledge into research. Further, an explicitly normative basic orientation also results out of the *problem-solving* perspective of trans-disciplinary research – besides explicit orientation, e. g., on questions of justice or on climate-political target figures: improvement of the societal action capability, inasmuch as it is a matter of the concepts and measures for societal interventions into complex social-ecological cause-and-effect relationships, and not exclusively a question of understanding them.