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**TAB**

# Research and technology policy for a sustainable development

Summary



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## SUMMARY

Science and technology are extensively recognised as playing a key role in operationalising and implementing the model of »sustainable development« which is currently dominating national and international debate on the prospects of ecologically acceptable forms of industry and production. TAB has been concerned with the challenges posed for research and technology policy by this model in a monitoring project since end-1995, and since 1997 the issue has been continued in a TA project. The present interim report completes the first phase of the project. The comparative international review of approaches to integrating the sustainable development model into research and technology policy developed in the monitoring project (TAB working report No.50) showed that the Dutch programme Duurzame Technologische Ontwikkeling (DTO, or Sustainable Technological Development) in particular offers an approach meeting the criteria formulated by TAB for a »sustainable research and technology policy«. The focus of the work in the first phase of the TA project was accordingly on analysing the Dutch approach and the question of its transferability to German research and technology policy. In addition further research was carried out on the practical importance of the model in the research and technology policies of European countries and a review was prepared of the status of social debate over sustainable development.

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## THE SUSTAINABLE DEVELOPMENT MODEL IN SOCIETAL DEBATE

A prerequisite for successful implementation of the sustainable development model in research and technology policy is imbedding the model in social debate and the strategies for action of social and political actors. It is true that the content of sustainable development is extensively controversial and can be linked with different ideas of social development, ranging from »no change« through to the idea of »abandoning the western model of industry and prosperity«. On the other hand, the indeterminate content of the model is the basis for its societal and political success. »Sustainable development« appears to be a widely shared description of societal problems and political responsibilities for the future. Broad sectors of society, from industry through the ecological associations, no longer regard the development of society solely in terms of boosting material growth but rather in terms of a qualitative change in economic and living conditions. Even if ideas about what changes are needed in the various sectors of society differ sharply, there is a widely shared assessment of the priority of shaping the future as a sign of the debate over sustainable development. Shap-



ing the future is a prophylactic matter within the framework of the sustainable development model, integrating care for the basis of life for future generations into present-day planning. To this extent, orientation of research and technology policy towards »sustainability« would be thoroughly compatible with the perspectives and strategies of important actors in the system of innovation.

There are, however, still problems in operationalising the model. At this point, in operationalising the goals and measures for shaping the ecological, social and economic dimensions of sustainable development, the differing perspectives and interests of social actors have their impact. A »sustainable« research and technology policy can and should be linked to different and differentiated attempts to determine the goals and indicators of sustainability, e.g. to the »Zukunftsfähiges Deutschland« (»Viable Germany«) study by the Wuppertal Institute and the work of the Commission of Enquiry on »Schutz des Menschen und der Umwelt« (»Protection of Mankind and the Environment«). However, it will continue to be a key responsibility of science – and hence also of research and technology policy – to contribute through an integrated study of ecological, social and economic interactions towards operationalising the characterisation of the problems, development of indicators and development of successful sustainability strategies.

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## THE MODEL IN THE RESEARCH AND TECHNOLOGY POLICIES OF EUROPEAN COUNTRIES

The model of sustainable development has growing importance in the international debate on the political shaping of technological transformation and is also reflected in research and technology policy in individual European countries in the form of new research programmes oriented towards sustainability. Besides specific programmes on issues of environmental research and ecological technology, programmes spanning different technological fields are being launched to explore sustainable solutions for specific regions, economic sectors or social needs. These reveal the following characteristics.

- > They display the effort to explore in an integrated manner the economic, social and technological relationships involved in ecological problems and the striving towards integrated solutions.
- > Involvement of social actors in problem-oriented programmes (particularly those on a regional basis) plays an important role.
- > There is strong representation of programmes concerned with the scientific development of models of sustainable production and sustainable consump-

tion patterns and lifestyle, and generally with scientific operationalisation of the model (e.g. the development of indicators of sustainability) as a task for research and development oriented towards sustainability.

- > Aspects such as interdisciplinarity and problem orientation and the involvement of social actors appear – at least at the programme level – to constitute important elements of a sustainable research and technology policy. In addition, however, there are many other programmes being started which are structured more along disciplinary lines in the tradition of classic environmental research.

Overall, there is no obvious specific pattern as yet for a »sustainable research and technology policy«, beyond the aspects cited above which are individually evident. Sustainability plays a role as an objective in research and technology programmes in many industrialised nations, but has not as yet led to a reorientation, for example in terms of the procedures for generating research issues and promising development projects and the tools for research promotion. Primarily, smaller individual programmes are being initiated to research specific questions associated with sustainability, e.g. sustainable consumption patterns and lifestyles. The Dutch programme on sustainable technological development *Duurzame Technologische Ontwikkeling* can be regarded as an outstanding approach in terms of objectives and methodology for transforming technology policy from the point of view of sustainable development. No other country has a comparable approach addressing explicitly the development of sustainable innovations and also attempting, through the process of programme development, to find new ways which contribute towards implementing sustainable innovations. The programme can accordingly be regarded as innovative in terms not only of its objectives but also of the manner of promoting research and technology.

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## THE DUTCH DTO PROGRAMME

The DTO programme does not regard itself as a research and technology programme as such but can be seen as a type of meta-research programme seeking to study methods for achieving the quantum jumps in technology development which are both intended and required for sustainable development. The programme also regards itself as a stimulation and demonstration programme for showing the goals and possibility of sustainable technology development, in order to initiate self-organised processes of sustainable innovation. The aim is to demonstrate the practicability and benefits of the sustainability model as a new paradigm for technology development. The programme is intended to function



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here as a catalyst. As the development of sustainable technology is regarded as a long-term process, the programme serves primarily:

- > to give industry, major national research facilities and universities initial experience of integrating the model into their research and development work and to stimulate new networking between the relevant actors, and
- > to explore lines of research which could lead to sustainable technology development with the help of »illustrative processes«.

The criterion for the success of the programme, which is supported by five ministries with a limited five-year term (1993–1998) and budget (NFL 25 million) is not the development of a mature sustainable technology ripe for application but rather the adaption and further development of the research results from the programme by companies, social groups and research facilities.

Although the DTO programme is not based on new methodology, but on methodology already proven in other contexts, it does represent an innovative approach to research and technology policy in its combination of different procedures with respect to the goal of initiating new innovation processes which cannot be derived directly from the further development of existing lines of technology.

The methodology of the programme essentially involves the following steps. Based on analysis of areas of demand intended to show which needs will exist in 2040 in various areas, a so-called »back-casting« procedure is used to select suitable examples of technologies which could ensure sustainable satisfaction of these needs. Illustration processes are used to study the technological and economic conditions for their feasibility. Concrete research and development programmes are then elaborated for some of these illustrated lines of technology, and preparation made for their implementation.

In many respects the DTO programme implements the criteria developed by TAB for a sustainable research policy. For example, the definition of the tasks for research and technology development is not based on existing lines of technology: instead, the environmental objectives set in the Dutch national environmental plan are used as a basis for determining the problems in various areas of needs to be solved with respect to sustainable development. With this as orientation, suitable lines of technology and research tasks are defined. The programme also seems to have succeeded in combining fundamental and applied research by establishing or stimulating new research and development networks. The back-casting process has also ensured long-term orientation in the research

and development projects pursued, which in individual cases have also been linked with medium-term interests of industry. Overall, the DTO programme seems to have succeeded in individual projects in establishing networks of actors from politics, science and industry to pursue long-term research and development processes oriented towards sustainable development. In addition to the individual projects promoted, the programme seems to offer a promising way of stimulating innovation processes for sustainable development which, despite the necessary long-term and uncertain development prospects, are capable of being attached to strategies and interests of the actors in the system of innovation – for example, several of the ideas thrown up by the programme are currently being taken up and pursued by other Dutch research programmes.

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#### **TRANSFERABILITY OF THE DTO APPROACH TO GERMAN RESEARCH AND TECHNOLOGY POLICY**

Based on the conditions in Germany (existing approaches towards operationalising the model, importance of the model in social and political debate and in research and technology policy) the TAB has reviewed the transferability of the DTO approach to German research and technology policy and the possible outlines of a German research and technology programme to promote sustainable innovations.

Adoption of the Dutch approach, with some modifications required by its shortcomings (also characterised in the Dutch discussion) and the situation in Germany, seems appropriate for German research and technology policy as a way of reviewing the possibilities for implementing the model as a new paradigm for research and development. The initiation of search processes for contents and questions for sustainable research and technology development has also been called for in the German debate (Enquete Commission on »Protection of Mankind and the Environment«, SARU, UBA, Council of Scientific Advisers). Further development of concepts and instruments for a sustainable research policy and a test of the practicability, i.e. limits and potential of orienting research and development by criteria such as interdisciplinarity, involvement of actors etc. can ultimately only be expected from practical trials of the implementation of the model in research and technology programmes. A possible adaptation of the approach for German research and technology policy can take into account the weaknesses of the programme, such as the orientation towards a concept of innovation in terms of a purely technical increase in efficiency and a lack of integration of environment and consumer groups in the phase of defining development lines. Other points that need to be taken into account are the differ-

ing institutional conditions in the Netherlands and Germany for a research and technology directed towards sustainability. A key element in the creation and success of the programme in the Netherlands is the linking of the programme to the objectives set in the Dutch national environmental plan. In addition, interministerial coordination and organisation of research and technology policy have long been standard practice in the Netherlands. Overall, however, the differentiated and lively German debate on sustainable development, which has led to a series of ambitious attempts to operationalise sustainability, together with the fact that the model is politically rooted in environmental policy and also a range of individual programmes of the Federal Ministry of Education and Research, offer a good basis for initiating a long-term programme with defined objectives in sustainable development for operationalising »sustainable« research and technology projects in cooperation with the various actors in the system of innovation.



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