STOA-NEWS

Starting from May 2009 the European Technology Assessment Group will be supporting the European Parliament's technology assessment body, the Science and Technology Options Assessment panel (STOA) for a new period of three years by carrying out TA-studies. The focus of ETAG's activities on behalf of the European parliament will be on studies in the fields of *Transport*, *ICT and Information Society*, *Nanoscale Science and Technology*, *Life Sciences and Human Well Being* as well as *Agriculture, Food and Biotechnology*. For the new period of work ITAS as the leading institution of the Group will cooperate with the following partners:

- Danish Board of Technology, Copenhagen
- Rathenau Institute, The Hague
- Flemish Institute for Society and Technology, Brussels
- Institute of Technology Assessment (ITA), Vienna
- Fraunhofer ISI, Karlsruhe
- Technology Centre AS CR, Prague
- The Catalan Foundation for Research and Innovation (FCRI), Barcelona

For the first set of projects to be carried out on behalf of the European Parliament of the 7th legislature, which had its constitutive meeting in July, ETAG is currently preparing the design of three new projects dealing with the following subjects: *E-democracy and E-voting*, *Risk Assessment of Nanoparticles* and *Synthetic Biology*.

While projects for the new period of cooperation with the European Parliament are about to be set up, ETAG has completed the old work programme by delivering *final reports for four TA projects*. Summaries of the reports are given below. The reports will soon be available for download from ETAG's (http://www.fzk.itas.de/etag) as well as from STOA's website (http://www.europarl.europa.eu/stoa/default_en.htm).

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Completed Projects

Animal Welfare (March 2009)

Animal welfare is a pressing public concern in the EU. At present, animal welfare status on-farm is usually inferred from external parameters, such as cage size or feeder space. This approach has serious limitations because the relation between such design parameters and animal welfare is not clear. Current research offers the possibility of assessing the welfare of animals more directly, in terms of their condition, health, performance and behaviour. This animal-based approach, although still work in progress, is very promising. The STOA project 'Impact of Animal Welfare' investigated the potential for introducing a European system of on-farm assessment of animal welfare using animal-based indicators. Part 1 of the report describes the scientific and technological state-of-the-art with regard to animal-based welfare indicators and monitoring technology. Part 2 explores the socio-economic impact of introducing an animal-based welfare monitoring system on livestock production in EU Member States.

Current research efforts are focused on providing scientifically sound indicators to assess the welfare status of animals more directly on the farm in terms of their behaviour, physiology, performance and health. These animal-based indicators are seen as more sensitive to variations in both farm management and static system-design variables and provide a more reliable assessment of actual animal welfare. The ongoing EU Welfare Quality project seems to be the most promising attempt to set up an indicator system because of its encompassing nature covering the development of integrated sets of animal-based indicators, the provision of concrete measures which can be used by farmers to improve the welfare of their livestock, and the design of a welfare qualification system that can be used to inform consumers about the welfare quality of food products. Structured around the four Welfare Quality principles of good feeding, good housing, good health and appropriate behaviour, are 12 criteria, each covering a separate aspect of welfare with animal-based

indicators for each type of animal. The conclusion is that standardized on-farm animal-based welfare assessment is becoming technically feasible.

Because of the complexity of the subject, the study for the exploration of socio-economic issues related to the introduction of an animal welfare assessment system focuses on one livestock sector, dairy cows, and just two animal-based welfare indicators: clinical mastitis and severe lameness, for which different levels of welfare are constructed. To move from a lower to a higher level of animal welfare, farmers have to take measures that enhance the welfare of their livestock. In order to model the possible economic impact of enhancing animal welfare, cost estimations have to be made with regard to concrete measures – e.g. measures that are relevant for the prevention of lameness and clinical mastitis. An analysis of the compliance with these measures by typical farms in the Netherlands, Sweden, Italy and Austria and of the estimated costs to comply with the 'missing' measures shows that the economic impact of introducing an animal-based welfare assessment in combination with achieving certain welfare levels varies among farms in EU Member States. For some, it will be a relatively steep climb to reach a higher welfare level for mastitis and lameness and may not be feasible within existing farm structures. Substantial welfare improving measures like outdoor grazing cannot be met in each situation. Furthermore, animal husbandry skills of farmers may vary widely, which could considerably affect the implementation of an animal-based welfare system. Efforts to improve animal welfare should not just be associated with higher costs. Reducing mastitis and lameness levels can lead to financial benefits, like sustained milk yield and reduced health care costs. In the case of mastitis and lameness, these benefits largely compensate the expenditure required to reach a higher welfare level.

In order to apply an animal-based assessment on a European scale, further research and development concerning welfare indicators, validation and automated monitoring is needed, which will require financial support. Furthermore, decisions have to be made on how encompassing an animal-based welfare monitoring system should be and whether all possibly relevant parameters should be included, or a more restricted range. Policy options discussed are: linking product labelling to welfare levels, in order to stimulate consumers to buy more animal-friendly products, introduction of an EU-minimum standard regarding animal welfare, that all farmers within the EU must comply with and governmental support for the introduction of an animal-based monitoring system and more animal-friendly food production.

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Agricultural Technologies for Developing Countries (April 2009)

Around half of the world's population lives in rural areas, with agriculture at the centre of their lives. The vast majority of farmers in developing countries (85%) are small-scale farmers, producing on less than two hectares. Furthermore, most of the poor in developing countries (75%) live in rural areas. Climate change will disproportionately affect developing countries and the poor, requiring adaptations of agricultural production systems to climate change. Increasing production and strong economic growth in agriculture – with small-scale farmers at the centre of attention – are urgently needed to achieve poverty reduction and other Millennium Development Goals. In this context, the STOA project "Agricultural technologies for developing countries" investigated the contribution of selected important agricultural production systems and their technologies as well as their management practices to higher food production and food security with focus on small-scale farmers.

The following agricultural production systems were analysed in case studies:

- Rainwater Harvesting (by Prof. Klaus-Dieter Balke, University Tübingen, Institute for Geoscience, Germany)
- Conservation Agriculture (by Dr. Theodor Friedrich, Prof. Amir Kassam, Francis Shaxson, FAO, Plant Production and Protection Division, Rome, Italy)
- System of Rice Intensification (by Prof. Norman Uphoff, Cornell University, Cor-

nell International Institute for Food, Agriculture and Development, USA, and Prof. Amir Kassam, FAO, Plant Production and Protection Division, Rome, Italy)
- Organic Farming (by PD Dr. Heide Hoffmann, Humboldt Universität zu Berlin, Germany)
- Agroforestry systems (by Dr. Carsten Marohn, terra fusca, Stuttgart, in cooperation with the University of Hohenheim, Institute for Agroecology and Plant Production in the Tropics and Subtropics, Germany)
- Transgenic plants (by Dr. Arnold Sauter, Institute for Technology Assessment at the German Bundestag, Germany)

Among the assessed production systems, *Conservation Agriculture, System of Rice Intensification, Agroforestry Systems* and *Organic Farming* can be described as complex agricultural production systems of intensification by higher agro-ecological and biological productivity, without necessarily increasing external inputs (mineral fertiliser, pesticides) and addressing input optimisation. This can be subsumed under *low-input intensification*: The aim is to achieve higher crop yields without or with only restricted additional external inputs, combined with an improved soil and water management. These agricultural production systems have the potential to address especially the needs and possibilities of small-scale farmers. Sustaining and improving soil fertility is a common key element. Key principles are diversified crop rotations, plant associations in case of perennial crops (especially in agroforestry), permanent soil cover and minimal or no mechanical soil disturbance. At the same time, a better retention and use of water can be achieved. An important component is also integrated pest management. Additionally, technologies of Rainwater Harvesting can contribute to balance water demand of small-scale farmers in dry regions with irregular and scarce water supply.

An acceptance of modified agricultural production methods and improved livelihoods can only be achieved when parallel market access for the increased production is built up and the food chain requirements are met. The successful development, introduction and use of agricultural technologies and their integration into adapted practices in developing countries depend on many framing conditions. For example, longer-term investments like soil improvements depend on secure land rights.

Transgenic crops are until today restricted to a small number of cash crops and are mainly working in the frame of high-input production systems. The capacity of transgenic crops to increase yields, to address food security and to be useful for small-scale farmers is discussed very controversially. The complexity of transgenic crops lies mainly outside the agricultural production system, in demanding risk assessment and management as well as regulation strategies and policies, which are still considered to be inadequate or completely lacking in many developing countries.

The identified *options for action* concentrate on the development, adaptation and introduction of the agricultural production systems Conservation Agriculture, System of Rice Intensification, Agroforestry Systems, Organic Farming and Rainwater Harvesting – in other words, on possibilities of intensification by higher agro-ecological and biological productivity, with low external inputs. With the European Consensus on Development, the European development policy is focused on the Millennium Development Goals and poverty reduction. The importance of agriculture for development and the key role of small-scale farmers therein still have to be implemented in the practice of the European development cooperation. The potential of low-input intensification should be much more recognised.

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ICT and Energy Efficiency (May 2009)

Two different aspects can be distinguished regarding the impact of Information and Communication Technologies (ICT) on climate change. On the one hand, ICT is discussed as a technology that enables an increase in energy efficiency, a reduction of energy consumption, as well as a reduction of Greenhouse Gas (GHG) emissions in general. On the other hand, ICT have become a significant energy consumer themselves. The overall contribution of ICT (as energy consumer) to climate change

is estimated to be around 2 per cent. However, future growth rates in ICT will probably be impressive, especially in the emerging countries, so the potential as well as the need for further savings will increase as well.

The report concentrates on the GHG-saving potentials in PCs and Server farms. In addition, a focus is put on new and promising concepts such as virtualisation and "cloud computing". Reasons for this selection are the fast global growth rates in PCs, server farms, as well as the strong global tendency to use more and more the Internet and Internet-based applications. ICT as an enabling technology is of even more complex nature, many relevant linkages are more implicit. The STOA-report puts the focus on the following key-areas: electricity distribution grids (smart grids), smart buildings and smart metering, transport and dematerialisation, industrial processes and organisational sustainability.

It is shown that the saving potentials related to ICT as enabling technology in these key-areas is by far larger than the 2 per cent stemming from ICT as an energy consumer. For example, the Climate Group calculates in the SMART 2020 report, that, in total, ICT could deliver 7,8 GtCO2e emission savings in 2020, which represents 15 per cent of global GHG-emissions in 2020. Still, it can be stated that there is a broad uncertainty on the reliability of data since ICT are in general embedded in complex systems which makes it difficult to isolate their effect. However, in this project many studies have been analysed and discussed with experts. On this basis, it can be stated that the support of ICT as well as its consequent implementation and development is essential for combating climate change. ICT is indispensable for decoupling economic growth from GHG-emissions.

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Human Enhancement (May 2009)

The umbrella term "human enhancement" refers to a wide range of existing, emerging and visionary technologies, including pharmaceutical products, neuroimplants that provide replacement sight or other artificial senses, drugs that boost brain power, human germline engineering and existing reproductive technologies, new brain stimulation technologies, gene doping in sports, cosmetic surgery, anti-ageing medication, highly sophisticated prosthetic applications that may provide specialised sensory input or mechanical output and others. All these technologies signal the blurring of boundaries between restorative therapy and interventions that aim to bring about improvements extending beyond such therapy.

In the STOA study human enhancement primarily is regarded as offering a specific perspective on developments in science, technology, medicine and society. The effects of human enhancement technologies (HET) can be either long term or even permanent (as in the case of genetic enhancements), or temporary (such as improved concentration levels brought about by drugs). The aim may be to improve our natural abilities (for example by making us stronger or happier) or to give us characteristics or abilities that no human being has ever possessed before, such as full night vision, or even extra senses. Faced with the often highly visionary and strongly ideological character of the debate on human enhancement, the report strives for a balance between advancing a rational discussion through critical analysis of the relevant visions and normative stances, and taking a close look at the diversity of HET and their actual social, technological and political significance.

If one takes a closer look at certain segments of the discourse on human enhancement (e.g. gene doping, designer babies, use of drugs for cognitive enhancement, and mood enhancement by means of brain implants) and the involved technologies, it becomes obvious that these diverse cases all share certain characteristics. They all relate, for example, to ideas that push back the boundaries of medical and scientific research. All the research on which these technologies are based stretches the known limitations of the scientific disciplines. Furthermore, novel applications for new technologies can be developed for derivative purposes other than those for which the technology was originally designed. Moreover, many HET have the potential to increase

the incidence of currently illegal practices, and all raise questions of distributive justice now or in the future. They often throw up questions about fundamental cultural values and tend to challenge our view of what it means to be human. More pressing are concerns regarding the costs of the technologies in question, the unintended (side-) effects, the desirability of the social changes they will precede, and the acceptability of medical tourism benefiting from highly specialised medical or enhancement tourism.

The study outlines and discusses possible general strategies of how to deal with the topic of human enhancement and HET in a European context, rejecting a total ban and a *laissez-faire* approach as inappropriate, and identifying a reasoned pro-enhancement approach, a reasoned restrictive approach, and a systematic case-by-case approach as viable options for the EU. However, like all the experts consulted in the course of the project, the report holds that a strategic positioning of EU with regard to the topic of human enhancement needs in any case to be based on a normative framework which does not yet exist. The development of such a framework should take into account those dimensions of the human condition that we tend to consider fundamental to our self-respect and mutual cooperation.

There are currently no arenas on the European level for the political debate of the normative issues and to bridge the gap between the needs and the concerns of the broader public and the practitioners and experts. The report proposes setting up a European body for the development of a normative framework for human enhancement to guide the formulation of EU policies in this field. The European Parliament could decide to set up a temporary committee. Alternatively the European Commission could decide to install a working group including members of the European Parliament. In any case, the involvement of the European Parliament in such a body would be highly desirable in order to strengthen the body's intermediate and public role.

It would be the task of such a body to further explore the topic and prepare the ground for possible further regulation of human enhancement issues that affect such political domains as health, research and economy in the EU. As pointed out in the study, a wealth of resources would be available for the work of such a body, some of them generated in EU-funded projects. The primary task of the body would be to develop a normative framework for human enhancement that should be based on evaluation criteria regarding the above-mentioned dimensions of the human condition.

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