

renz, welche durch eine offene Informationspolitik und nachvollziehbare Verfahren gewährleistet wird. Zweitens die institutionelle Unabhängigkeit, welche Voraussetzung dafür ist, dass sich das TA-Zentrum unbefangen und neutral mit seinen Untersuchungsgegenständen auseinandersetzen kann. Drittens der vorausschauende Blick, der es gestattet, möglichst frühzeitig Themen und Fragen aufzuspüren, die es angesichts der anstehenden Technikentwicklung anzugehen gilt. Wenn es dem TA-Zentrum gelingt, diese drei Grundtugenden weiterhin hoch zu halten, sind die Voraussetzungen gut, um auch die bevorstehenden Aufgaben zu meistern.

Weitere Informationen zum Zentrum für Technologiefolgen-Abschätzung unter:

<http://www.ta-swiss.ch>

* Lucienne Rey, Dr. phil. nat., arbeitet heute als freischaffende Wissenschaftsjournalistin und war zuvor während mehrerer Jahre im Zentrum für Technologiefolgen-Abschätzung tätig. Homepage: <http://www.texterey.ch>

Kontaktadresse der TA-SWISS

Zentrum für Technologiefolgen-Abschätzung beim
Schweizerischen Wissenschafts- und Technologierat
Dr. Sergio Bellucci, Ing. agr. ETHZ
Geschäftsführer
Birkenweg 61, CH-3003 Bern, Schweiz
Tel.: +41 (0) 31 / 322 99 63
Fax: +41 (0) 31 / 323 36 59
E-Mail: ta@swtr.admin.ch
Internet: <http://www.ta-swiss.ch>

« »

From TA to Innovation and Sustainability

The integration of technology assessment and technology and environment studies in the Department of Manufacturing Engineering and Management at the Technical University of Denmark

by **Christian Clausen**

At the beginning of 2002 a new section for research and engineering education on “Innovation and Sustainability” was formed as part of the Department of Manufacturing Engineering and Management. The new organisation was the result of a major reorganisation process at the Technical University of Denmark (DTU) reducing around 30 departments to 15. This reorganisation marked the end of an era of more than 25 years of stand alone departments for social sciences, working environment and technology assessment at the Technical University. The new section for Innovation and Sustainability represents a development towards a closer integration of social science perspectives into technology and engineering. This article will present the new section and the historical developments and recent discussions and deliberations leading up to it. The development is seen from the perspective of the former Unit of Technology Assessment at DTU where the author was employed since 1987.

1 The Unit of Technology Assessment

From the early 1990s the Unit of Technology Assessment at DTU had a main emphasis on the development and integration of a technology studies perspective into technology assessment. The Danish experiences in technology assessment at that time showed a great number of projects and a diversity of approaches, but a weak theoretical foundation. The approaches were either reactive, i.e. looking back on the consequences of already developed technology, or they were purely action-oriented without much theoretical guidance or reflection. In both cases, technology as well as the social structures in which technology was intended to be embedded, were taken for granted. In the search for

new approaches the main inspiration came from the “new” sociology of technology: “Social Construction of Technology”, “Actor Network Theory” and more generally: “The Social Shaping of Technology”. Here, the traditional divide in technology assessment between “society” and “technology” was bridged in the notions of “socio-technical ensembles” or “actor networks” etc. Similar developments took place elsewhere under headlines like “Constructive Technology Assessment” (CTA).

The main thrust of this approach in the 1990’s was related to the evaluation of technology assessment projects, technology policy and dialogue with policy makers in government, technology policy units, unions, user and environmental groups as well as non-government organisations (NGOs). The ‘social shaping of technology’ approach proved to be very helpful in drawing lessons from technology assessment projects. It gave a new perspective on action-oriented TA strategies, pointing at the interaction between a diversity of players with their different views and perspectives on the technology and the societal context of adoption. In this way the contribution consisted mainly of evaluating old and contributing to new TA strategies, taking into account how new actors and agendas were created and how existing views on technology could be negotiated.

However, a shift in technology policy from a basic concern with the potential consequences and lack of democratic influence and control to a strong technology promotion in the second half of the 1990s reduced the general interest in technology assessment. In line with experiences from several European countries the Danish TA community experienced a decline of the resources allocated to TA and a discontinuation or reconstruction of TA institutions. On the other hand: The new sociology of technology not only provided a new perspective on technology assessment – it also challenged the traditional engineering understanding of technology and especially the science-based view of technology. A basic question for the Unit was then: how to find relevant uses and interested users for technology studies and how to integrate the outcomes of these studies into technology development and engineering work.

During the 1990s the dominant trend at the Technical University became more and more

influenced by natural sciences where technology and engineering were seen merely as the application of scientific principles. Consequently, studies of the use of technology, assessment of its consequences and even management of technology were regarded as of little importance for engineering students. Further, a university reform replacing the former democratic rule of the university by appointed managers removed or weakened important union and student support for social sciences and technology assessment. This development left only little room for a social science perspective or even a management perspective on technology. New arguments and new alliances for the integration of technology assessment and technology and environment studies were needed.

From the mid 1990s technology and environmental management as well as socio-technical design were introduced at DTU as concepts where technology studies could be applied. The perspective was to develop concepts where engineers in their professional career in companies, in technology policy etc. could apply insights from technology studies to the management of technology in society. A range of Danish and European research projects was launched in which concepts like “social spaces” for the shaping of technology, “development arenas”, “social networks” were developed. But the area still did not obtain a strong position in the engineering curriculum. Basically we had to “turn” the engineering students into “socio-technical” students at a late stage of their studies, and given the new science orientation at the university we were not certain to be able to sustain the recruitment of students or maintain our positions in the future.

The Department of Technology and Social Sciences was established in 1995, unifying five former independent units (one of these being the Unit of Technology Assessment). But, during 1999 it became clear, that the university management would decide that the department was too small a unit to fit in the new university management structure. It should be mentioned that the department was performing relatively well, with a staff of 11 permanent research positions and a total number of 35 employees. Eventually, as the result of a search for new partners, a new and larger merger was made with the Department of Manufacturing and

Engineering, giving birth to the new Department of Manufacturing Engineering and Management.

Two social science units from the social science and technology department, the Unit of Technology Assessment and most of the Unit of Technology and Environment joined forces and found new partners in a group working with life cycle assessment and integrated design in the new department. As the outcome of a development project a research program for the new section for Innovation and Sustainability was set up. The other half of the Department of Technology and Social Sciences, including the Working Environment Group joined the section of Industrial Management in the same department.

2 Innovation and Sustainability

The basic idea behind the new section was to develop a new ground for research and a new engineering curriculum combining different perspectives on innovation, technological development and sustainability. These different orientations were to integrate business and practical engineering-oriented approaches with social sciences, including innovation studies, technology studies and sociology of organisation. A main emphasis was to be on management of processes of change, innovation and technology synthesis.

The general vision is to contribute to a more sustainable development of society through a more sustainable technological development as well as a more sustainable business development in future industry. This vision is broken down into the following aims:

- To create and promote understanding of how products and production processes, materials and socio-technical systems are developed and which consequences they have,
- To develop strategies and methods for the integration of practical, knowledge based industrial, environmental, working environmental, economic and social aspects into technological development work and innovation, and to contribute to production and dissemination of knowledge in these areas.

The research addresses players in companies, institutions and organisations as well as citizens and consumers. The focus is on problems related to engineering in a business and societal context. To realise such a vision, an explicit combination of different core competencies is brought together with the ambition of combining or integrating these to exploit potential synergies:

Technology studies represent a core competence mainly contributed by the former Unit of Technology Assessment. The focus is on development, stabilisation and breaking down of technological artefacts and systems as well as the involvement of the diverse players in processes of change and innovation. Technological and environmental development and use are seen as socio-technical processes where interactions and knowledge processes unfold between a diversity of players in society. These players have different perspectives on and understanding of technology and environment as well as different cultural backgrounds, resources and interests.

Environmental studies represent another core competence, where the focus is on the identification of environmental problems against the background of the interplay between nature and organisational processes on the one hand, and on the development of strategies and methods to solve these problems on the other hand. The point of departure taken here is that modern environmental problems can not only be seen from a business or governmental regulatory perspective, but increasingly the role of consumption will have to be taken into account, thus involving a wider spectrum of social and societal players.

Life cycle assessments and concepts for the development of "cleaner" technological solutions are a core competence aiming at contributing to the highest fulfilment of defined needs through the exploitation of defined resources, highest environmental performance and resource effectiveness within defined conditions. From a systems perspective, the focus is on development of resources and environmentally sound technical solutions at product, production, process and emission levels.

Integrated design and selection of materials and processes are a core competence, aiming at the creation of a design-oriented synthesis of practical knowledge and experience,

insight in use and user needs as well as natural science and engineering-based knowledge of materials and manufacturing processes. The focus is on the practical management and organisation of interdisciplinary design and development processes and prototyping.

3 Research themes

The realisation of the above mentioned vision demands the further development of the core competencies as well as the development of a strong synergy between our competencies, i.e. between technology studies, environmental studies, life cycle assessment and integrated design. The following core or cross-cutting themes have been selected and given priority for the next three years.

Science and technology studies (STS)

The focus here is the continued application of science and technology studies as well as a further development of theory and methodology. A theoretical departure is taken in the “new” sociology of technology, exemplified by “Social Construction of Technology (SCOT)”, “Actor Network Theory” and the broader approaches labelled “Social Shaping of Technology (SST)”. Important inspiration is also taken from history of technology, organisation studies, innovation studies and evolutionary theory depending on the subject area. The focus is on development, stabilisation and breaking down of technological artefacts and systems, where interactions, controversies and knowledge processes unfold between a diversity of players. Attention is increasingly paid to the role of science and knowledge in socio-technical change and engineering. An important emphasis is the development of new perspectives and processes in technology foresight and technology assessment. The application of science and technology studies to technology foresight methodologies reflects the need to deal with uncertainties and the unpredictable nature of many socio-technical developments.

Sustainable development

The emergence and constitution of environmental problems and their potential solution

are the object for studies of company, transport and consumer behaviour as well as studies of the role of public environmental debates and natural science-based research. At the conceptual level, the constitution of sustainable development is studied in emerging disciplines such as “ecological economics”, and in the development of current criteria for sustainable development. Whereas the first subjects of study are mainly concerned with environmental strategy, other subjects are more concerned with the development of engineering tools, and methods and strategies for their use. New perspectives on engineering methods and their introduction and dissemination will be obtained by combining the development of methods and studies of their application in practice. One emphasis is the development of life cycle assessments, cleaner technologies, supply chain analysis or ecological product or production concepts in their own value. New strategies should be found by combining the development of these tools with analyses of their actual working and embedding in organisational knowledge systems and politics.

Design and innovation

The theme design and innovation combines a synthesis-oriented engineering tradition in integrated design and the development of environmentally friendly products and systems with an analysis of design as organisational process and network processes within and between companies and broader social players. One challenge here is to develop design strategies and solutions which are able to handle and incorporate a wide diversity of competencies and knowledge from “grass roots”, production workers as well as from science and engineering. Technology studies can help in this process by contributing to a deeper understanding of the relations between artefacts, meanings and knowledge processes in cross-disciplinary and cross-organisational design processes. Further applications of technology studies will be found in analyses of possibilities for integrating a wide variety of demands and considerations concerned with ethical, societal, economic and environmental dimensions in design and innovation processes. Special attention will be paid to the role of visions in innovation pro

cesses and the structuring of production networks.

Management and regulation of technology and environment

Technology and environmental studies also play an important role in our analysis and development of technology and environmental strategies in the single company, in industrial networks and in technology policy. The main emphasis here is the development of methods and processes in technology, environment and knowledge management as well as the application of technology foresight, socio-technical scenarios and technology assessment. Especially, the need to facilitate the formation of actors in order to establish a dialogue between informed players should be taken into account. Another field of application is studies in governmental regulation of environment and technology, processes of standardisation of technology as well as company technology strategies. With regard to the increasing standardisation of knowledge studies are carried out of the transfer, development and social shaping of management concepts and of developing platforms for managing technology and new forms of organisation in society.

Science shop

The section of Innovation and Sustainability also hosts DTU's science shop. Its aim is to support citizens and organisations of the civil society when dealing with problems and solutions related to technological or environmental change. The science shop also helps identifying new themes for research and education and supports students' collaboration with citizens and non-profit organisations.

4 Current status

The new research section Innovation and Sustainability at the Technical University of Denmark comprises a cross-disciplinary staff of 28 researchers/teachers and PhD students and 5 technical/administrative staff personnel. It is part of the Department of Manufacturing Engineering and Management, which consists of three sections, the two other sections being

Industrial Management and Materials and Process Technology. The section has played an active role in the development of a completely new engineering education in design and innovation at DTU. The new education combines competencies in creative synthesis of technology, socio-technical competencies and reflexive engineering knowledge. With an uptake of 60 new students (limited access with a ceiling of 60), the majority of which would never have entered DTU if this particular education was not offered, we have got an indication that the new, cross-cutting approaches we have taken up have been well received. The next step is to further develop research programs in design and innovation (as part of a planned national program) and in sustainable development.

Contact

Christian Clausen (head of section)
Tel.: +45 45 25 60 69
Fax: +45 45 88 20 14
E-Mail cc@ipl.dtu.dk

Innovation and Sustainability
Department of Manufacturing Engineering and Management
Technical University of Denmark
DTU, Building 307
Matematiktorvet, DK-2800 Lyngby, Denmark
Internet: <http://www.ipl.dtu.dk>

« »