

## **FINAL REPORT**

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**Title: Policies for Sustainable Technological Innovation in the 21st Century: Lessons from Higher Education in Science, Technology and Society (POSTI).**

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## ***Abstract***

The project has as a thematic network organised four major conferences focussed on various aspects of sustainable technological innovation, constructed a database with 517 abstracts of graduate students' dissertations, and analysed a large sample of the database contents. Topically the project has focused on sustainable technological innovation in two complementary senses. Innovation aimed at saving the environment constituted one main area, whereas the other area may be termed as the issue of socially acceptable innovation.

There are three broad categories of public policies regarding sustainability and social acceptability which have been studied and discussed. The first category is composed of the *explicit* policies. The second category is made of the *implicit* policies, so all other domains of public policy may come into consideration. The third and intermediary category is composed of *particular cases*, often belonging to traditional policy making, which have a critical impact on environmental performance or social acceptability, like e.g. the energy sector, the building industry and the urban development, or the transportation sector.

For policy-makers there is invariably an immediate need settle for either a sector-specific perspective, a case-specific policy, or a more or less integrated perspective, according to the context at hand. If we move beyond particular situations, however, we believe that the first task at hand is to admit to the immensity and vulnerability with respect to sustainable technological change issues, and subsequently initiate a general reformation of policy making.

On the contents side of policy making we thus state that there are potential gains to be made by consciously and systematically integrating environmental concerns with social acceptability concerns within policy making. Concrete examples include the relationship between increased customer awareness of, and demand for, environmentally sound products in industrialised countries, and the potential transition from environment-exploiting to environment-sensitive FDI in less industrialised countries.

Regarding factors relevant to future specific policy instruments, the project has shown that it is crucial to look across disciplinary boundaries in order to approach complex issues such as sustainable and socially acceptable innovation. We therefore believe that the establishment of a multi-disciplinary RTD programme devoted to sustainable technological innovation is warranted for. At the more practical level, we recommend thorough revision of curricula in favour of various forms of increased multi-disciplinarity focused on sustainable technological innovation.

## ***1. Executive summary.***

1. This project has been a thematic network which has held four conferences and constructed a database containing 517 entries of social science research degree work completed at the participating institutions. We focused on sustainable technological innovation in two complementary senses. Innovation aimed at saving the environment constituted one main area, whereas the other area may be termed as the issue of socially acceptable innovation.
2. Regarding issues in connection with innovation aimed at saving the environment, the project has assumed that market forces are "blind" when it comes to the relationship between innovation and the environment. Therefore, environmental policies and pro-active strategies are critical to social and technological innovation aiming at sustainability. But a preliminary question that should be raised is the following: What is actually environmental policy? A distinction between explicit and implicit policies appears to be needed due to assess the huge discrepancies which seem to exist. Many policies are today explicitly embedding or directly aimed at environmental improvements. But the policies of e.g. a country is also constituted by its implicit policy regarding the environment within all other domains of policy making. In other words, what are the environmental aspects of the trade policy, the industrial policies aimed at competitiveness, the tax system, financial policy, defence industry policy, systems of subsidies, public health, education, policies towards developing countries, etc. ?
3. A similar distinction could be made regarding the relationship between innovation and social acceptability, i.e. explicit policies regarding social exclusion etc., implicit policies and particular cases.
4. There are thus three broad categories of public policies regarding sustainability and social acceptability which have been studied and discussed. The first category is composed of the *explicit* policies. The second category is made of the *implicit* policies, so all other domains of public policy may come into consideration. The third and intermediary category is composed of *particular cases*, often belonging to traditional policy making, which have a critical impact on environmental performance or social acceptability, like e.g. the energy sector, the building industry and the urban development, or the transportation sector.

For policy-makers there is invariably an immediate need settle for either a sector-specific perspective, a case-specific policy, or a more or less integrated perspective, according to the context at hand. If we move beyond particular situations, however, we believe that the first task at hand is to admit to the immensity and vulnerability with respect to sustainable technological change issues, and subsequently initiate a general reformation of policy making. In other words:

- Any sector- and case-specific policies should, within a reasonable scale, always be required to include an assessment of potential repercussions on other adjacent realms .
  - Integrated perspectives in a topical and/or disciplinary sense should be considered whenever relevant, with necessary measures (such as the establishment of clear loci of responsibilities and communication channels) implemented in order to avoid inefficiency and coordination problems.
5. On the contents side of policy making we state that there are potential gains to be made by consciously and systematically integrating environmental concerns with social acceptability concerns within policy making. Concrete examples include the relationship between increased customer awareness of, and demand for, environmentally sound products in industrialised countries, and the potential transition from environment-exploiting to environment-sensitive FDI in less industrialised countries. Thus there is a need to incorporate broad surveys of potential policy integrations in order to avoid a policy in one realm being formed in parallel or even in contradiction to a policy in another realm (i.e. social acceptability versus environmental concerns, or vice versa).
  6. Current policies are not only often sector specific as well as topically little integrated, but also more often than not of a single-level orientation. The challenges at hand are, however, of such a tremendous nature that any policy should include an awareness of the implications to and potential linkages with other levels than the particular level at which the policy is targeted.
  7. The project has shown that it is crucial to look across disciplinary boundaries in order to approach complex issues such as sustainable and socially acceptable innovation. The establishment of a supra-national, large scale, explicitly multi-disciplinary RTD programme is thus warranted for.
  8. The project has shown that there is material of scholarly interest and policy relevance contained within graduate students' research work. This is work which is more often than not "forgotten"

within relatively inaccessible archives. There is thus a need for electronic archival systems which make such work easily stored and retrieved.

9. Finally, at the more practical level, we recommend that national and international higher education authorities should be encouraged to thoroughly revise the curricula in favour of various forms of increased multi-disciplinarity focused on sustainable technological innovation.

## ***2. Background and objectives of the project.***

Many policy decisions facing institutions involved in the production of goods and services as well as governmental and non-governmental organisations are, at some level, about the relationship between science, technology and society. Decisions about privacy, democracy, education, health care, food safety, the environment, the number and nature of jobs and economic growth are about how to maximise the benefits and minimise the risks and dangers associated with developments in science and technology. Concern is often expressed both by industry and government that the education system is not producing enough people who are adequately prepared for our rapidly changing and complex world. During the 1980s and 1990s, the focus has been on the shortages of people with appropriate information technology skills, in both the production of IT but also its effective use in other sectors of the economy. Rarely is there concern about the lack of people who understand the dynamics of scientific and technological change, within households, workplaces, the media, government and elsewhere. Yet, research has repeatedly demonstrated the importance of people who understand both supply and demand to the success of innovative activities. Failure to introduce new technologies is often the result of lack of understanding of users and their needs.

In Europe, there is a long tradition of research and training in issues related to science, technology and society; research and training which draws on insights from anthropology, sociology, politics, history, philosophy, economics and management studies. People trained within this tradition have contributed much to our understanding of the processes of scientific and technological change, and have played a more direct role in policy-making across a variety of institutions. Unfortunately, because of the continuing division of university education into separate disciplines, it is often difficult to attain a critical mass of academic staff and students within a single university. Scholars concerned with understanding the place of science and technology are often isolated within their home departments and students experience difficulty obtaining financial and intellectual support for what are necessarily interdisciplinary projects.

There are, however, exceptions to this general picture of small numbers of people working at the margins of their own institutions. For example, the Science Policy Research Unit (SPRU) at the University of Sussex, United Kingdom, has been engaged in conducting research and in training young scholars since 1966. Throughout the 1970s, several other universities in Britain were engaged in teaching what was then called “liberal studies of science” to science and engineering students. The latter activity floundered in the 1980s, partly as a result of external pressures imposed by the Thatcher government and also as a result of related internal pressures from science and engineering professional associations and from students who did not want time in the curriculum taken up with 'non-essential' subjects. SPRU, and a small number of other programmes, continued to flourish. Influence over the policy-making process continues to be exercised not only through the publication of research findings, but also through providing advice to parliamentary committees and to commissions of inquiry. Perhaps most important is the training in science and technology policy, upon completion of which graduates enter the world of science and technology policy-making at many different levels in a variety of institutional settings.

There is a small number of technology management masters courses, and an even smaller number of MBAs which deal with the management of technology. There are many more policy issues arising from the interplay between science, technology and society than those falling under the management rubric. There are several traditions within Europe about the appropriate relationship between universities and government. In those countries where there is a long-established tradition of movement between industry, academia and government, STS ideas and approaches are likely to move more quickly between these different spheres and will be enriched in the process. The scarcity of people with experience of STS research experience is a societal problem, nonetheless there are advantages to operating within small communities. There exists a strong invisible college that stretches across national, disciplinary and institutional barriers. This project will strengthen that feature by utilising the resources that lie below the tip of the iceberg, namely the hundreds of dissertations produced each year by Master degree and Ph.D level graduates.

Very little is known, however, on the content of that research, and the ideas, insights and beliefs that originate from it. The purpose of this project - a thematic network – has been to map this emerging agenda and create a European forum for interaction between young academics in the field and their seniors. The objectives have thus, firstly, been the construction of a database containing research degree theses completed at the participating institutions, and, secondly, the organizing of a conference series focussed on the rather broad themes sustainability and social acceptability in connection with technological

innovation. Considerable energy has been put into the development of useful characteristics in order to describe the contributions to the field.

### ***3. Scientific description of the project results and methodology.***

#### **3.1. Introduction.**

On a practical level the purpose of this project has been to develop conceptual categorisation which may contribute towards the methodological and theoretical development of the still young research field in question, as well as towards policymaking field regarding sustainable technological innovation. The project has in other words been an attempt at classifying the various relevant perspectives based on a realisation that there is an urgent need for theoretical frameworks which are capable of selecting, mapping, and comparing research results (Audétat 1999).

Based on the analysis of database contents as well as the various types of conference contributions, we find it useful to distinguish between the *topics treated* and the *approaches utilised* within the field (cf. Table 1). As for topics, there may be a conceptual distinction between three different types of studies:

- those which may be classified as focussing predominantly on issues of sustainability
- those which may be classified as focussing predominantly on issues of social acceptability
- which may be classified as integrated approaches

As for approaches, there is a distinction between approaches which are:

- corresponding predominantly to the science, technology and society (STS) tradition
- corresponding predominantly to the science, technology and innovation (STI) tradition
- integrated approaches

Table 1: Relationship between topics and approaches.

		Approaches		
		STS	STI	Integrated (STS & STI combined)
Topics	Innovation aimed at saving the environment			
	Socially acceptable innovation			
	Integrated themes (environment & social acceptability issues combined)			

The task of assessing approaches to the study of socio-technical change originating in different fields, though incorporating already interdisciplinary features, poses a major though stimulating theoretical challenge. Inter-disciplinarity does not occur by simply summing up approaches ranging from, for example, sociology to economics, nor by putting specialised disciplines aside. Theories do not become articulated spontaneously, nor are they designed for complementing one another. Theories with different foci and orientations are rather (logically and fairly) competing in order to encompass the largest portion of reality. In other words, theories invariably exhibit features of incommensurability. For instance, even approaches which have started to come closer, like historical, cultural and sociological approaches towards the study of innovation (e.g. Hughes, 1983; Bijker, 1995; Law, 1991; Callon et al. 1986), and evolutionary economics (e.g. Nelson & Winter, 1982; Dosi, 1988; Freeman & Perez, 1988; Hall, 1994), do not often state where they do indeed articulate or complement one another.

Thus, although not necessarily a dichotomy between the former “STS” (science & technology studies) and latter “STI” (science, technology and innovation) approaches, the two nevertheless constitute examples of two concrete approaches towards these types of themes. As a whole, they may be combined with a third, integrated approach, and thus we may then in overall distinguish between three different types.

It could be noted that we are not advocating that a doubly integrated form (environment & social acceptability issues combined in terms of topic, and STS and STI combined in terms of approach) is in essence a superior form of research. The level of integration along either of the two dimensions should rather be adjusted to the problem under investigation. We are, however, convinced that in many cases problems of sustainability are closely intertwined with issues of social acceptability (see below for some applied examples). In such cases it may be very useful indeed to keep in mind the simple theoretical chart proposed here.

As will be discussed within the section on policy implications below, a parallel chart may also be useful both for assessing as well as for formulating relevant policies. This is because in current policy efforts both at national and supra-national levels policies tend to be conceptualised within sustainability issues as one sphere and social acceptability issues as another sphere.

As for approaches, needless to say a similar observation is in its place. Some problems may be usefully approached by either a STS-oriented approach or by a STI-oriented approach. However, in connection with investigating particular complex problems, it may be especially useful to design projects which aim at utilising integrated approaches.

## **3.2. The conferences.**

### **3.2.1. Thematic structure of the conferences**

As stated above we are of the opinion that neither the STS, the STI or an integrated approach are necessarily of an inherently superior nature compared to the others. The choice of approach should be determined by the nature of the problem under investigation. However, it seems to be a spreading

perception of economic and societal phenomena that these are increasing in their complexity. In connection with large scale investigations of issues related to sustainability and social acceptability, it may then be an alternative to strive for an approach which has reached a high level of integration between the STS and STI approaches. This is indeed a difficult task. Nevertheless we strived at achieving a distribution of conference which covered approaches which are firmly located within one of the two main traditions, as well as attempts at integrated approaches (Table 2).

Table 2: Relationship between themes and approaches at the POSTI conferences.

		Approaches		
		STS	STI	Integrated
Themes	Innovation aimed at saving natural environment	Firms and society relations regarding environmental issues (Strasbourg)  Towards a sustainable territory (Lausanne)	Environmental considerations within the firm's strategy (Strasbourg)	Normative measures or incentives of environmental policies (Lausanne)
	Social acceptability		Knowledge as a competitive factor (Strasbourg)	
	Integrated themes (both environment & social acceptability issues)			Globalisation processes and local concerns (Strasbourg)  Methodological issues (Lausanne, Strasbourg)  Macro-policies and regulations (London)  The role of higher education (Oslo)

In terms of practical approach we organized the project as follows. There were four major issues ranging from the status and future of innovation performance to the issue of the future policies for sustainable and socially acceptable technology which were found important for investigation. A preliminary analysis of a selection of already completed Master and Ph.D theses had identified that a

certain set of problems has been discussed within these. This set of problems was related to the need for growth, increased levels of competitiveness and technological innovation on the one hand, and the need for a socially and environmentally acceptable technology development on the other hand. This theme was subsequently throughout the project period denominated as problems related to sustainable technological innovation. The theme had been subdivided into a series of working questions as follows:

1. What are the relevant economic and social aspects of European policies for sustainable technological innovation?
2. How do corporations fare when it comes to simultaneously dealing with issues of competitiveness and sustainable technological innovation?
3. What should the emerging policy agenda regarding sustainable technological innovation look like?
4. How and why may STS-education be an input to future policies for sustainable technological innovation?

The first two conferences were thus planned as discussions focusing on the empirical and theoretical findings of hitherto completed work, whereas the remaining two conferences were planned as meetings where policy implications would be more explicitly dealt with. The issues were throughout the conferences to be pursued by following a rather unique set of methodologies in order to ensure the overarching goal of assessing the relevance and potential contribution of STS-related higher education to current and future policies. The methodologies were unique in the sense that:

- a large number of Master and Ph.D theses completed at the participating institutions would be scrutinised and analysed for the first time ever,
- preparation for, and participation in, conferences would be in the form of closely integrated teams composed of both senior researchers and recent graduates, in contrast to networks dominated by senior researchers.

The latter aspect was, however, dealt with by securing that calls for papers were distributed widely to relevant graduates, whereas the actual acceptance or rejection of papers was determined through customary competitive criteria.

This structure of the network thus highlighted theses of especially high quality and stimulated the authors to revise portions thereof for presentation at one of the conferences and for subsequent publication. Secondly, the model consisting of senior~junior integration contributed to the development of the new generation of scholars within the STS-field.

In the end the four conferences attracted a total of 74 papers.

*1st conference: Technological Innovation in a Sustainable Perspective. Lausanne, Switzerland, 29-30 May, 1999.*

The conference was organised around three related themes:

1. How are macro-policies and regulations translated into sustainable innovations?
2. Normative measures or incentives: two complementary philosophies?
3. Towards a sustainable territory: user- vs. technology-oriented experiments

How are macro-policies and regulations translated into sustainable innovations? Sustainable development has progressively become a public sphere at local, national and international levels, and opens an era of socio-technical change. In the near future, we will be confronted with the following key questions: How is global reality translated into local initiatives? Who are the relevant actors? What are the best core conditions favouring sustainable innovations? How to balance public and private responsibilities and initiatives? Participants were invited to present examples, cases and experiments documenting successful or failed innovations, with the aim of enhancing the existing theoretical framework.

Normative measures or incentives through partnerships or fiscality, for instance, appear at first glance as two different approaches to encourage new environmental processes and ideas among actors involved in technological change. One operates by imposing constraints and limits, and the other via stimulation and incentives. Intentions and practices linked with such instruments, however, sometimes produce paradoxical results. In addition, it seems necessary to take into account such operational guidelines as ISO 14000 or EMAS standards, which constitute primarily a recommendation framework. These may be considered a cultural methodology favourable to a general learning dynamic regarding the environmental consequences of technological innovation. Empirical findings and theoretical analysis should demonstrate the depth or superficiality of these claims.

Finally, in the past, environmental problems encountered within the framework of territorial management have generally resulted in the implementation of technological solutions often involving the construction of new infrastructures. Over the past decade, public authorities have recognised the limits of such an approach, which tends to transfer problems to future generations. Consequently, they attempt to involve users and citizens. Whether in the area of transport, energy supply or waste management, there is an increasing number of experiments aimed at improving user and citizen behaviour. In this context, it is interesting to note that technological innovation often remains a key

success factor. Participants should thus demonstrate to what extent both technological and social innovation can contribute to sustainable territorial development.

*2nd conference: Sustainability, Technological Innovation and Competitiveness of the Firm. Strasbourg, France, 27-28 May, 2000.*

This conference was organised around four themes:

1. Environmental considerations within the firm's strategy.
2. Knowledge as a competitive factor.
3. Methodological issues in connection with research on sustainability and innovation.
4. Firms and society.

The stream Environmental considerations within the firm's strategy was devoted to a discussion of specific programmes or policies aimed at incorporation of environmental considerations into the innovation process. We were interested in attracting studies based on international and national policies or guidelines (e.g. the ISO 14000 series, EMAS standards), and discussions of the "industrial ecology" concept. Operational guidelines such as ISO 14000 or EMAS standards may be considered as methodologies favourable to a general learning dynamic regarding the environmental consequences of technological innovation. Empirical findings and theoretical analysis should demonstrate the depth or superficiality of these claims. Similarly, is the industrial ecology concept a revolutionary concept for restructuring industries towards sustainability, or just another fashionable management tool? If it is the former, why, from an economic standpoint, has industrial ecology not been implemented earlier, though? Is there a danger that industrial ecology will reduce ecology and sustainability to technological recipes? Needless to say, in addition to papers which are focussed on discussing such policies or guidelines as such, case studies of the experiences of particular firms which try to apply policy guidelines, or may even have developed indigenous, "green" strategies, were especially welcome.

Knowledge as a competitive factor. Sustainability issues may be approached with a broader perspective in mind than queries focussed exclusively on ecological aspects. Societal sustainability becomes relevant in particular when knowledge becomes a key factor of competitiveness, and this has implications on, for example, equity and on training. If knowledge is becoming a crucial competitive factor for enterprises, it should follow that intellectual capital, intangibles and knowledge management

are elements for the understanding of the entire modern industrial sphere. The stream was thus devoted to theoretical, methodological and empirical papers in this broad and emerging area.

Methodological issues in connection with research on sustainability and innovation was a special session devoted to the discussion of the numerous methodological issues one may encounter in connection with research on sustainability and innovation. Papers should be based on actual studies within the field utilising quantitative and/or qualitative data, but reflect explicitly on the methodological issues encountered. Papers may thus discuss specific methodologies such as, for example, statistical analysis, scenario study methodologies, discourse analysis or case study methodologies.

Papers for the stream Firms and society should focus explicitly on sustainability and innovation issues, while centering the concrete analysis on levels other than the firm level (regions, social groups, the national or international level). Studies appropriate for this stream would thus involve private firms or public organisations, while being focussed on democratic processes of social acceptance vs. rejection of allegedly "green" technological innovations on the societal level (e.g. studies of particular public hearings, international treaties, etc.).

*3rd conference: Policy Agendas for Sustainable Technological Innovation. London, United Kingdom, 1-3 December, 2000.*

This conference was organised around five closely inter-related themes:

1. Socially acceptable technological innovation
2. Economically acceptable technological innovation
3. Environmentally acceptable technological innovation
4. National, European and global policymaking environments
5. Democratisation of policymaking processes
6. Future challenges for sustainable innovation

Socially acceptable technological innovation: Quality of life, ethics and policy. This stream was devoted to elucidation of how citizens, cultural and religious groups, professional bodies and other social groups (such as the young, the elderly, travellers, crime victims, the disabled and their carers, students, immigrants, athletes, charity volunteers, patients, the unemployed, ex-soldiers, nature enthusiasts, women, prison inmates, workers, consumers etc.) define social objectives, and how they

influence policy on sustainable innovation. How are ethical considerations perceived and presented? What regulatory, moral, legal or judicial instruments exist to complement more traditional forms of democratic expression and influence?

Economically acceptable technological innovation: The "real world" of discharging political responsibility. Politicians must confront the conflicting demands of many different prevailing conditions and constituencies in order to deliver policies which satisfy the electorate as a whole. How do macroeconomic conditions, well beyond the control of individual firms or even national governments, affect policies on sustainable innovation within companies and in governments and public sector institutions? How do policies on employment, education, research and technological development, industry, defence, public health and safety etc. impinge upon policies for sustainable innovation? What are the short-term vs. long-term frameworks for developing sustainable technological innovation policy and how do these compare with timeframes for the evaluation of specific policies and with electoral cycles?

Environmentally acceptable technological innovation: Urban, industrial, residential and rural habitats. In this stream, we discussed the factors that influence technological innovations either specific to each of these types of habitats or common to all. What are the main unresolved issues for sustainable habitats (such as economically and environmentally acceptable forms of recycling, safety in the laboratory and the workplace, cumulative or multiple causes of degradation of human health and the natural environment, etc.)? What tradeoffs may exist between "clean energy" at the point of application and the environmental hazards of extraction, processing, generation and disposal, and how can policies be designed that fairly distribute benefits as well as risks of energy exploitation? What policies can be developed on the disposal of rubbish and on the construction of European-owned "dirty" industrial plants in developing countries? What renewable resources could supplant expendable natural resources, and how could research, innovation, regulation and incentives best promote sustainability?

National, European and global policymaking environments: Who decides, who benefits and who pays? This stream focussed on existing policymaking structures and analyse the options for promoting sustainable technological innovation. The agendas of different constituencies and interest groups will be analysed, critiqued and assessed as to the extent of their influence on policies that genuinely promote sustainability. The session will cover industry, inclusivity of social groups, political institutions and movements at local, national and European level, the scientific research community, international institutions such as the United Nations, the IMF and the World Bank, higher education

institutions, and other socio-political actors. How are different agendas communicated through political campaigns, media reports and advertising, and through education and interpersonal/social interaction? Who dominates decision-making and why? Who are the winners and losers in the contemporary world, and in future?

Democratisation of policymaking processes: How can society and the natural environment be heard? Papers for this stream focussed explicitly on reforms to existing policymaking processes or on novel forms of direct expression of public views in a way that can promote sustainable innovation. This session will include papers on citizen/consumer and expert participation in deliberative processes that inform decision-making by politicians and other policymakers in public and private institutions. There will be an emphasis on "giving voice to nature and future generations" and democratic forms of environmental impact assessment. This stream will also include discussion of the implications of political devolution and European integration for the development of policies for sustainable innovation.

Future challenges for sustainable innovation was a special session devoted to forward thinking and creative approaches to innovation in policymaking itself, in which sustainable technological innovation is the core objective. There will be an emphasis on new approaches to mediating between scientific, social, economic and environmental interests as part of robust policy design for a long-term, sustainable future.

*4th conference: Europe's 21<sup>st</sup> Century Policies for Innovation, Sustainability and Social Acceptability: The Role of Higher Education in Science, Technology and Society. Oslo, Norway, 20-21 May, 2001.*

The fourth and final conference was structured around two themes:

1. Europe's 21. century policies for multidisciplinary studies in society, science and society.
2. Europe's 21. century policies for higher education in natural sciences and engineering.

1st stream. Europe's 21. century policies for multidisciplinary studies in society, science and society. In the first stream we wanted to discuss some aspects in connection to the contents, benefits and potential of science, technology and society (STS) programmes. As for contents, we wanted to ask: What is the intellectual background and status quo of such courses? In what degree are they multi-disciplinary? What kind of organisational solutions do there exist today when it comes to the running of such courses? Within this stream we were not only interested in receiving papers which might broadly fall

in the category of STS studies, but also in studies of related types of educational programmes (e.g. higher education in management of technology or in economics of science and technology etc.).

2nd stream. Europe's 21. century policies for higher education in natural sciences and engineering. This stream corresponded more or less to the stream outlined above, except that it took its point of departure in higher education within natural sciences and engineering. In what degree is such education focussed exclusively on scientific and technical aspects, versus including the societal aspects of science and technology? In the case of multi-disciplinary courses, what kind of organisational solutions do there exist today when it comes to the running of such courses? As for benefits, we are interested in focussing on the role that higher education in natural sciences and in engineering plays within the current and future shaping of discourse and practice related to sustainability and social acceptability. Moreover, what are the current policies at the national and European levels regarding such higher education? How should those policies be adapted in the future? What are the most important aspects in connection with policy formation in the area?

### **3.2.2. Conference discussions**

In order to illustrate the main points raised above we will in this section present a very limited number of the contributions to the workshops. These contributions share the trait of being integrated in their thematic focus (i.e. environment & social acceptability issues treated within one and the same paper), but they vary very much as to the level of integration when it comes to approach. In the latter respect they vary between an approach which is indeed taken from outside the STS-STI combination, an approach within the STS tradition, an approach within the STI, and an integrated approach (cf. Table 2).

Table 3: Selected papers categorised according to approaches utilised

	Approaches			
	Misc. Approaches	STS	STI	Integrated (STS & STI combined)
Integrated themes (environment & social acceptability issues combined)	Buen (2000)	Kjos Haugen (2000)	Agrafiotis & Vagianou-Angelaki (1999); Andresen (1999); Cabugueira (2000); Godshall (2000)	Nerhus (2000)

Buen (2000) is a study which discusses prerequisites and obstacles to successful environmentally related technology transfer from the West to the People's Republic of China. Such technology transfer invariably includes the issue of achieving the balance between a purely profitable business avenue and an aid to the improvement of the environment of the receiving country. As with the case of technology transfer to many other developing countries the supplying businesses may in addition face external pressures regarding the issue of whether the receiving country conforms to certain international agreements, such as human rights agreements, or not. Such a study does in this sense refer in a particular way to both the sustainability and social acceptability fields. However, in this particular study there is no special reference to neither the STS nor STI traditions, but rather to an alternative set of theories taken predominantly for political science. The study has thus been categorised in a separate group.

Another study takes sustainability and social acceptability issues into account as well (Haugen Kjos 2000), but this study refers predominantly to the STS framework of understanding. Moreover, rather than Buen's international context the study focuses on the micro level of a particular community and its relationship to the major employer in the community, a cement factory. The UN-supported "Local Agenda 21" encourages local authorities to develop an environmental action-plan for the 21st century together with relevant social groups in the local community. Haugen Kjos subsequently asks whether the process of Local Agenda 21 has contributed to changes in the social and technological spheres. She views society and technology as intertwined, "constructed through negotiation between different social actors, groups or worlds". By joining a Local Agenda 21 project the cement factory benefits by managing to solve hitherto long-lasting problems and conflict with neighbours.

Several studies may be classified as referring predominantly to the STI tradition. Agrafiotis & Vagianou-Angelaki (1999) study the impacts – both the scientific / technical and social - of modern biotechnology on the Agrofood sector in five different countries of the EU were assessed using the Delphi methodology. In their questionnaire a thematic area of 10 statements was included dealing with the environmental impacts of modern biotechnology. The asked experts expressed a kind of ambivalent opinion concerning the future environmental impacts of Agrofood biotechnology: on the one hand they regard modern biotechnology approaches as one opportunity to reduce environmental existed burden (i.e. conversion of animal waste into marketable products etc.) while on the other hand they see the possibility of additional , possibly long lasting environmental damage due to the use of these techniques (like horizontal gene transfer , or the loss of traditionally used varieties and organisms). More specifically, the experts under the perspective of sustainability assess agro-activity as a multi-pollution source for the environment and, thus, they aim to tackle this kind of problems within the perspective of "counter – pollution" science - technology by the monitoring of the pollutants life–cycle and by the implementation of innovative and green technologies. On the other hand, modern biotechnology as an innovative technology, seems to offer a capability for significant reduction of this serious cluster of pollution especially as far as it concerns the heavy-load chemical burden of the natural receptors.

Both Cabugueira (2000) and Saint Jean (1999) discuss the nature of economic rationality and agency in view of new environmental demands. Cabugueira (2000) draws attention to the current situation of several factors simultaneously demanding the restructuring of the traditional view on how should the economic agent act to defend and preserve what he refers to as “environmental quality”. The degradation of the environmental capabilities to fulfil its economic functions (i.e., the degradation of the “environmental quality”), the growing visibility of the environmental problems and the consequent increase of the social “environmental consciousness” and the period of social-economic difficulties in which the world has incur, are requiring a different postures of all social agents in their relation with the environment. Saint Jean (1999) focuses on a fundamental characteristic of cleaner technologies which consists in considering them as a specifically distributed within the innovation process. This can reveal a problem of coordination between activities of different firms in a value chain. The implementation of an innovation subsequently depends upon downstream-upstream relations existing between different partners. To some extent, she supposes that the differential of complementary interfirm links affect the time of diffusion of cleaner technologies. Cleaner technologies need more time to diffuse when "environmental or clean capabilities", often assumed as exogeneous, have to be built through interfirm relationships and through the coordination of complementary activities.

Andresen (1999) and Godshall (2000) are similarly still working predominantly within the STI tradition, but present - rather than macro or meso-level studies, such as the ones presented above - detailed firm level case studies. Andresen (1999) tries to shed light on factors behind environment-saving technological change in the paint industry, and finds that the process of environment-saving technological change is dependent on environmental regulation, the capabilities and incentives of companies to develop cleaner technologies as well as the goals and characteristics of potential users. Her focus is the role of different social groups in environment-saving technological change. In the paint industry, she says, new products are not being developed in isolation, but in interaction with different social groups. It is the dynamic relationship between these actors that will steer technological change. Godshall's study is a description of how and why a particular factory within the pharmaceutical industry underwent certification for the ISO 14001 standard. The ISO 14001 standard is a voluntary international standard outlining the framework for the creation and implementation of an environmental management system (EMS). Being certified as an ISO 14001 company is considered highly prestigious and valuable, but few American companies have chosen to build an EMS and gain certification. Godshall thinks this is possibly due to concerns that ISO 14001 tends to only create a "paper EMS" that does not add environmental value to the company. But in her case the two most important factors in determining whether the ISO 14001 EMS improves the environmental performance of an organization were auditor bias/knowledge of environmental policy and science, as well as certain motivating factors within the company for achieving certification.

Finally the paper by Nerhus (2000) is an example which ambitiously aims at integration between the STS and STI approaches. It should be noted that this is a purely methodological paper since the author had no resources to pursue these ideas in the form of a major empirical study. The paper discusses by way of using various forecasting methods what a future system for passenger transport will look like. The focus is on environmental sustainability and technical innovation. The central elements of the proposed method are that it focuses on trends, looks at actor strategies, goals and expectations, takes a systems view, takes stock of possible external events, looks at interactions and cross impacts, and focuses on both existing technologies and technologies in "the pipeline". Thus there are a wide number of elements taken into consideration when constructing scenarios about the future.

Thus these examples have served as an illustration as to varying choice of approach according to the nature and complexity of problem studied.

### **3.3. Database construction and analysis of its contents.**

#### **3.3.1 Background**

The POSTI project's database has got a structure and interface which is divided into five parts:

- Discipline
- Methodology
- Level of analysis
- Science and technology described in thesis
- Area of application or theme

"Discipline" refers to the approach(es) adopted in the thesis when referring to conventional disciplines (economics, sociology, etc.). When entering a single post into the database (a Master's or Ph.D. -thesis) there may be referred to a maximum of three disciplines as the ones which are predominantly present within the work in question. Although it might make sense to refer to an even higher number of disciplines as being reflected within a single piece of work the maximum number has been set in order to secure the quality of data in connection with future analyses of the material.

"Methodology" refers to the concrete approach used ranging from qualitative to quantitative methodologies, and the maximum number of allowable referrals in this area is three.

"Level of Analysis" refers to the main unit under considerations, ranging from organisation to region etc., and the maximum number of allowable referrals in this area is two.

"Science and Technology described" is distinguished from "Area of application/theme" for two reasons. The first reason is that the former category is more narrow in the sense that it allows for entering specific sciences or technologies (e.g. biotechnology), whereas the latter category refers to application areas in society (e.g. agriculture). Indeed, there may be cases of overlap when it comes to these two categories. We decided to include this difficulty, however, since we expect benefits from dividing into two separate categories in connection with analyses. Secondly, in practical terms a single and extremely large category which included both of these two would lead problems as for usability.

The database does as of June 2001 contain 517 theses. Approximately 70 percent are M.A.-degree theses, approximately 20 percent are M.Sc.-degree theses, and approximately 10 percent are Ph.D.-dissertations.

### **3.3.2. Analysis of database contents**

Within the project we commissioned an empirical study of the characteristics of the POSTI-database (Berthinussen & Lindvig, 2001). The researchers within this part of the project were part of the POSTI project, but were commissioned in the sense that they were not familiar from beforehand with the internal debates regarding neither “STS” and “STI” etc., nor the debates regarding alternative approaches to sustainability and social acceptability issues. They were rather specialists within bibliometrical and higher education research. In this way we avoided a bias within the research design of this part of the project.

The analysis described a cross-section of different labels in the POSTI-database, during the eight-year period from 1993 to 2000. The sample that this report is based on includes 428 persons.

14 different universities were registered as the students' home university, whereas – in the case of student mobility, of which there is a great del - one additional university was registered as the location for the students' second university, making the total 15 different second universities:

Belgium (3 universities): Catholic University of Louvain-la-Neuve, Free University of Brussels, and University of Namur (neither were partners of POSTI project)

Denmark (2): Roskilde University Centre (hereafter referred to as “Roskilde”) and Aalborg University (“Aalborg“)

France (1): Louis Pasteur University – departments BETA and GERSULP (the latter institute not a partner of POSTI project)

Italy (1): Bari – ESST course (not a partner of POSTI project)

Netherlands (1): Maastricht University (Maastricht)

Norway (1): University of Oslo - Centre for Technology, Innovation and Culture (Oslo)

Portugal (1): Lisbon Technical University (Lisbon)

Spain (2): Basque Country University (not a partner of POSTI project) and Autonomous University of Madrid (“Madrid”)

Switzerland (1): Polytechnic School of Lausanne – ESST department (Lausanne)

United Kingdom (2): University of East London – Department of Innovation studies (London), and SPRU

Note that the database – and analysis – thus includes also institutions (the 3 Belgian, one Italian and one Spanish) other than the nine POSTI-project partners. This was possible due to the fact that the POSTI project co-ordinator and some of the partners were already cooperating with these other institutions through other channels, and therefore were able to request the relevant degree work for input into the database.

The POSTI search receipt form provides information about thesis authors, the university at which the students studied at their first and second semester, their nationality and when the students finalised their thesis. There is also information about former students` specialisation, type of thesis (MA, Msc and Ph.D.), compared to discipline and theme, and also an abstract of their theses.

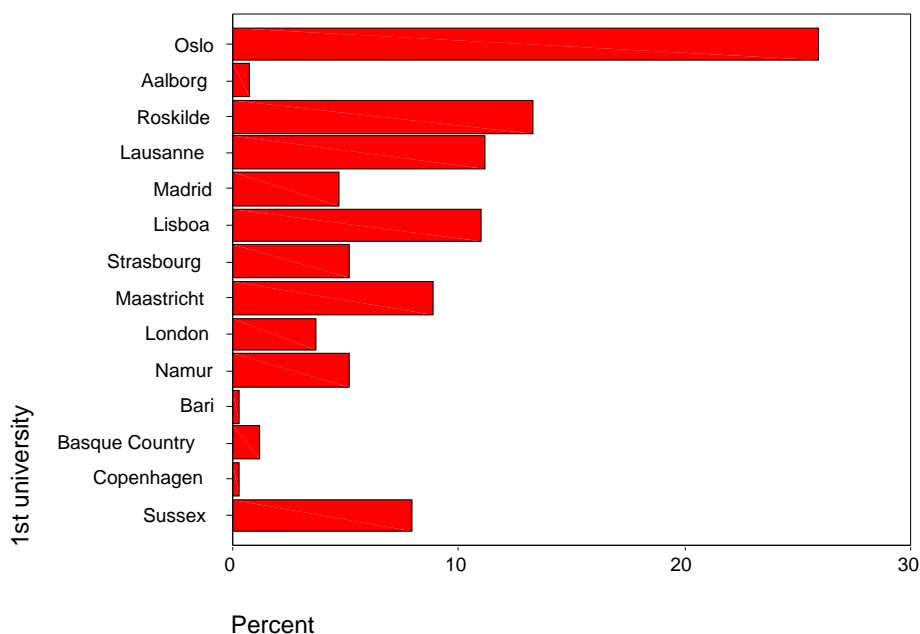
One of the motivating factors for the analysis was to make this information available, and last but not least to examine tendencies and patterns in thesis research within the field today. Unfortunately, the analysis does not include all theses written from 1993 to 2000, due to the fact that some universities have had data problems, others language problems. There were basically two main demands: the information had to be in English, and the information had to be sent to the POSTI project coordinator within a given time limit.

The two researchers read through all the information that they were able to acquire from the POSTI-database on former students` theoretical approaches in their thesis, methodology, level of analysis and theme during the eight-year period from 1993 to 2000. There was a limit of maximum four categories pr. main variable (see enclosure 1), and some have followed this guideline, others have not. Reading through all the information, relevant information was corrected or added. The theses entries varied from half a page to eight pages. Some even have chapter 1 of the thesis as their entry. The researchers were, however, not able to read through the theses themselves, since this would have been too time consuming.

Subsequently, the researchers made a new database by using the software system SPSS. The new database which this report is based on includes 428 persons. Most of the students (46.4 %) registered in the database during the above mentioned period of time come from Norway. 11.6 % are Danish, 10.6 % are English, 8.2 % are Spanish and 6.3 % are German. Year 1994 refers to both the academic year and year of graduation. Thereafter follow 1995 and 1993.

As for 2000, 32 theses are registered (11.5 % of the total). Many of the students, 15 persons, graduating in 2000 spent their first semester at the University of Oslo. Madrid, Maastricht and London were popular as secondary universities at which additional coursework was completed. Totally during these eight years. 14 different universities were registered during the first semester, and 15 universities during the second semester (see graphs 1 and 2). Some of the students have studied at the same university both their first and second semester.

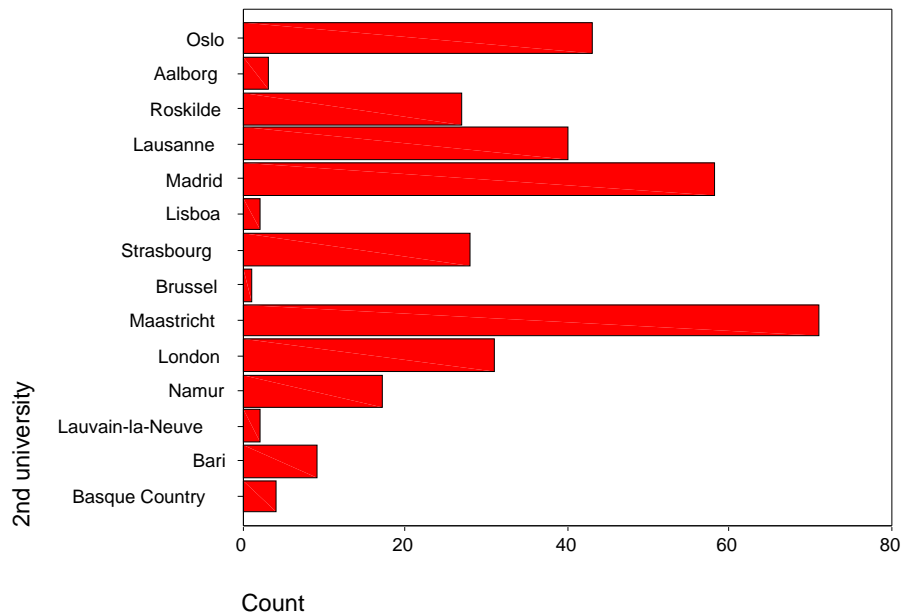
Graph 1: Home universities of the theses authors.



The University of Oslo occupies a significant position regarding primary university during the entire period from 1993 to 2000. 26.1 % of students are associated with the University of Oslo (Norway), 13.4 % have studied in Roskilde (Denmark), and 11.3 % have studied in Lausanne (Switzerland). 0.7 % of the students have not provided information regarding this question.



Graph 2: Second universities of the theses authors.



14 universities are registered as second semester university. Most of the students, 21.1 %, have been studying at Maastricht (The Netherlands), with Madrid (Spain) coming in at a close second with 17.2 % and Oslo (Norway) with 12.8 %. 21.3 % of the students have not provided information regarding this question.

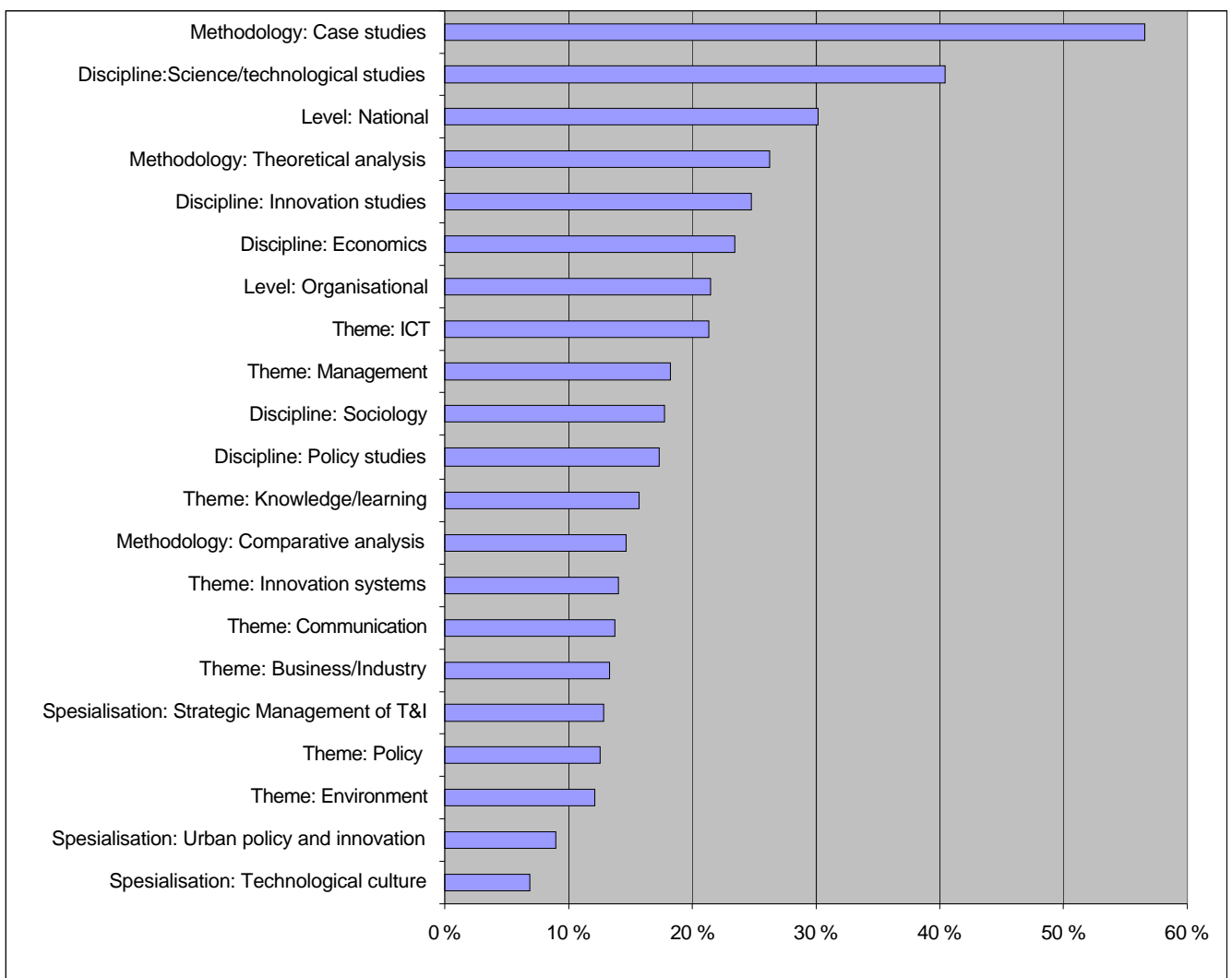
79.9 % of the theses are M.A., 15.6 % are Msc and 4.5 % are Ph.D. theses. The Msc thesis is mainly written at the universities in Lisbon and Sussex. Reading through the POSTI-database, we registered 22 different kinds of specialisations. The three most common specialisations are Strategic Management of Technology and Innovation (12.9 %), Urban Policy and Innovations (8.9 %) and Technological Culture (6.8 %). Regarding discipline, methodology, level of analysis and theme, all students had as mentioned the opportunity to choose a maximum of four categories. This should be kept in mind while looking at the statistics.

When it comes to methodology, most of the students (56.5 %) during the eight-year period chose case studies. 26.2 % made use of a theoretical analysis, 14.7 % have made a comparative analysis and 11.4 % have applied a qualitative approach. Ethnography was very popular in 1994, but has only a total score of 0.5 % during the entire period. None of the students indicated Evaluation/Assessment in 1993, but this method has increased considerably in 1999 and 2000, and ends up with 8.9 %. Historical

analysis was little used between 1994 and 1997, but has increased in popularity during the period from 1998 to 2000.

30.1 % have a national level focus in their thesis, 21.5 % an organisational focus and 11 % have a specific science/technology focus. It is possible to choose between 45 different categories on the POSTI search page. Reading through the abstracts we created seven new theme/keywords: ICT, biotechnology, power relations, pollution, medical, nuclear power and natural science. Of 52 themes 21.3 % chose to write a thesis about ICT, 18.2 % management, 15.7 % knowledge/learning and 14 % innovation systems.

Graph 3: Methodologies and disciplines that categorise the theses.



Graph 3 contains the three different kinds of methodology, and the five disciplines or approaches that categorise the theses in the database. Also included are two levels of analysis, eight themes and three different specialisations. The three most highly rated values in the students' theses are the use of case studies (56.5 %), the discipline science/technological studies (40.4 %) and the opportunity to write a thesis addressing national level issues (30.1 %). The students also rated theoretical analysis highly (26.2 %). Thereafter follow the disciplines innovations studies and economics. In ranking level preferences, the organisational level was ranked second.

### 3.3.3. Theoretical implications

Bourdieu constructs his term "field" on the basis of two terms; *capital* (what is perceived as valuable) and *habitus* (what characterises the actions of agents). In addition, there are various strategies for looking at relations between variables revealing the capital and habitus of agents in a field. Bourdieu uses the terms as the starting point of a theory about the conditions, possibilities and limitations of sociological knowledge, and as a basis for constructing his objects of study. He does not wish to use them in a theory about society, but as tools in the analysis of society (Bourdieu & Wacquant, 1993: 81). This means that the terms should function as vehicles in the description of the dynamics or flow of a social context. The term *field*, as used in this context, means nothing isolated from an actually existing field. Bourdieu is quite clear: "Terms such as habitus, field or capital may be defined, but only within the framework of the theoretical system they constitute, never as isolated items" (Bourdieu & Wacquant, 1993: 81). Broady (1991: 167) describes Bourdieu's thoughts about these terms as "labelling observable phenomena".

Bourdieu describes *habitus* in relation to concrete social contexts as "the various systems of dispositions which they (i.e. the university researchers) have gathered through the field of a defined set of social and economic conditions, and which in a delimited period of time find more or less beneficial opportunities to penetrate within the evaluated field" (Bourdieu, 1991: 90). Using the term "the evaluated field", Bourdieu emphasises the individual's ability to act according to his own premises. Bourdieu sums up habitus as a basis for analysis in the following way: "Habitus is a unifying and generating principle which allows the internal and relational characteristics of a position to express themselves in the form of a uniform lifestyle, in other words as a uniform set of people, benefits and activities" (Bourdieu, 1995: 36).

Without doubt, the term *capital* signifies more than economic issues. For a social scientist, it would be nearly impossible not to associate the term with Marxism or economics. Capital is still described as possessing something valuable, but not necessarily of economic value. In short, capital can be anything considered valuable by groups or individuals.

The term *field* relates to the various aspects of the research object of the analysis, the social sciences. Bourdieu defines a field as: " ... a more or less consistent arena where individuals or groups of individuals share a common understanding of the various positions within the *field*, and an interest in finding their place in relation to these positions" (cf. Bourdieu & Wacquant 1993 pp. 81-100, a collection of texts based on two conferences in Chicago and Paris in 1987). A *field* can be defined on the basis of the actual activities of the participants in a *field*, that is to say, whether they see themselves as a community and what their object of construction might be as they delimit their research community through various activities (Bourdieu & Wacquant, 1993: 81-100). Individuals' attempts to define their place or position in the field need to be revealed in such a way that the structure of a field becomes evident. A definition of *field* within this framework requires the exposition of people's values and activity patterns as they are expected to be found in the field. How do individuals in a field take advantage of various activities to place or define themselves in relation to positions perceived as valuable?

An empirical approach to the term *field* is closely related to a field's construction on the basis of empirical data. Bourdieu sees the term *field* as a general tool for the construction of a system of relations between positions in a field (Bourdieu in lecture in 1984, cf. Broady, 1991: 272). With regard to the specific aspects related to the following empirical construction, they consist of systems of relations between various variable values. Two specific examples of such positions would be gender, female or male. Thus the variables female and male are positioned as points in Bourdieu's social space. Bourdieu constructs a field using data concerning the agent's capital, habitus and the between positions in the field. According to Bourdieu an analysis of a field should comprise of three components (Bourdieu & Wacquant, 1993: 90), preferably leading to an understanding of the relationship between the various positions contained in a field, and of how agents choose to take on these positions.

An objective structure of relations between positions which are held by agents or institutions and which constitute objects of competition should be established. The habitus of agents (the various systems of dispositions which they have gathered through a defined set of social and economic conditions, and which in a delimited period of time they find to be more or less beneficial

opportunities to penetrate within the evaluated fields) should be analysed. The field's position in relation to the power field (the balance of power between social positions) should be analysed. These social positions are expressed in the space of opinions via the space of dispositions (the habitus) (Bourdieu, 1995: 36).

Thus, the three components in question are the following: the power balance between social positions, the objective relations between these positions and the systems of dispositions held by the agents competing for the positions.

#### **3.3.4. Methodology of field “mapping”**

The starting point for correspondence analysis is that the rows and columns of a matrix are transformed into vectors in a multi-dimensional space (Greenacre and Blasius, 1994; Rosenlund, 1995). The positions of the variables can then be visualized as points in a cloud, depending on their relation to the centre of the cloud. This centre is known as the centriod (origo). To be able to visualise the contexts/constellations in this cloud, the analysis estimates a point's relations (correlation and contribution) to axes or dimensions. The number of dimensions is delimited by the number of variables or individuals in the study minus one. These dimensions can be visualised two by two as a map where a point's relation to the axes decides the configuration of the map. Axes are ranged according to the degree to which they explain the dispersion in the cloud. This makes it possible to select those axes which represent the highest degree of explanation. When the two visualised axes are checked against tables relating information on a point's contribution and correlation to the construction of the axes, the resulting model of the relations between the points in the cloud is as exact as possible.

To make this analysis as exact as possible, the POSTI researchers chose to explain the potential interpretations of the axes solely on the basis of those points which represent the 33 % most highly rated values for each axis. Also, none of the points that construct the field are represented by less than 5 answers. Those points which contribute to the construction of the dispersion on the map, are called main variables. To enable a comparison of this map with other groups of answers, the analysis allows for the addition of supplementary variables that do not affect the dispersion. These will position themselves exclusively in relation to the dispersion that already exists.

The optional answers (variable values) to a question are usually called modalities. The analysis assesses the relations between these modalities, not the variation of answers to the variable as a whole. The distance between points says nothing about the volume/size of each point. This implies that it is not possible to derive, the number of respondents to the value represented by a particular point from the point's position in the field. The distance expresses the relation between them. Points close to each other are related to each other, and vice versa. Points found in the centre share approximately the same relation to all other points placed in various positions on the map. Accordingly, opinions held by all groups in the study are found in the centre.

The map displays two different types of points. The most significant points are called main variables (those not in italics). These are the variables constructing the field. The other points are called supplementary variables (those in italics). These variables do not help to construct the field, but relate other types of information to the main variables.

Bourdieu holds the following view with regard to the interpretation of plans and fields: "First of all, I would discourage substantial reading of [...] analyses meant to be structural" (Bourdieu, 1995: 31). By "substantial" Bourdieu means an objective reading, whereas the plans are not objective. His argument is that the system of relations shown in the plans is meant to present a likely image of the real world, rather than the truth about it. An ability or relation shown in a map cannot be related to all individuals or abilities to which it corresponds. Such a relation serves only to illustrate that this connection most likely is correct.

Bourdieu finds the substantial interpretation flawed for its basis in what he perceives as "the common-sensical and racist way of thinking" (Bourdieu, 1995: 31). Bourdieu uses the term racist as a reference to what he considers oppression. Substance orientation, or positivisim, oppresses the core idea of such maps and fields, in that they represent illustrations of the truth, or structures concerning the truth, but never the truth itself. He argues that this form of interpretation of the maps entails a sort of determinism, which does not do justice when applied to agents who possess the will and ability to break free from the structures. A substantial reading of the fields is like locking up the field and the information generated by it in a cell. "Searching for objective results implies that an agent's preferences be approached as biological or cultural essences" (Bourdieu, 1995: 32), which they are not.

In Bourdieu's view, the same applies to some uncomplicated statistical methods: "Even the verification of a correlation between two variables hardly helps to explain or comprehend anything, so

long as one of the links in the connection remains unresolved” (Bourdieu, 1995: 62). Yet, the stronger the correlation, the more definite the connection. Bourdieu believes that this type of intuitive “semi-comprehension” arise due to the perception that variables and factors are constant. The point is that, although a correlation of .70 Pearsons R. may be a strong connection statistically, it bears no meaning outside the field in which it is situated or removed from the historical context by which it is affected. Hence, if it makes little sense to see the map as a proof of reality, the structures derived from the map by the researcher may nevertheless well serve to comprehend that same reality.

### **3.3.5. An explanation of the map resulting from the analysis**

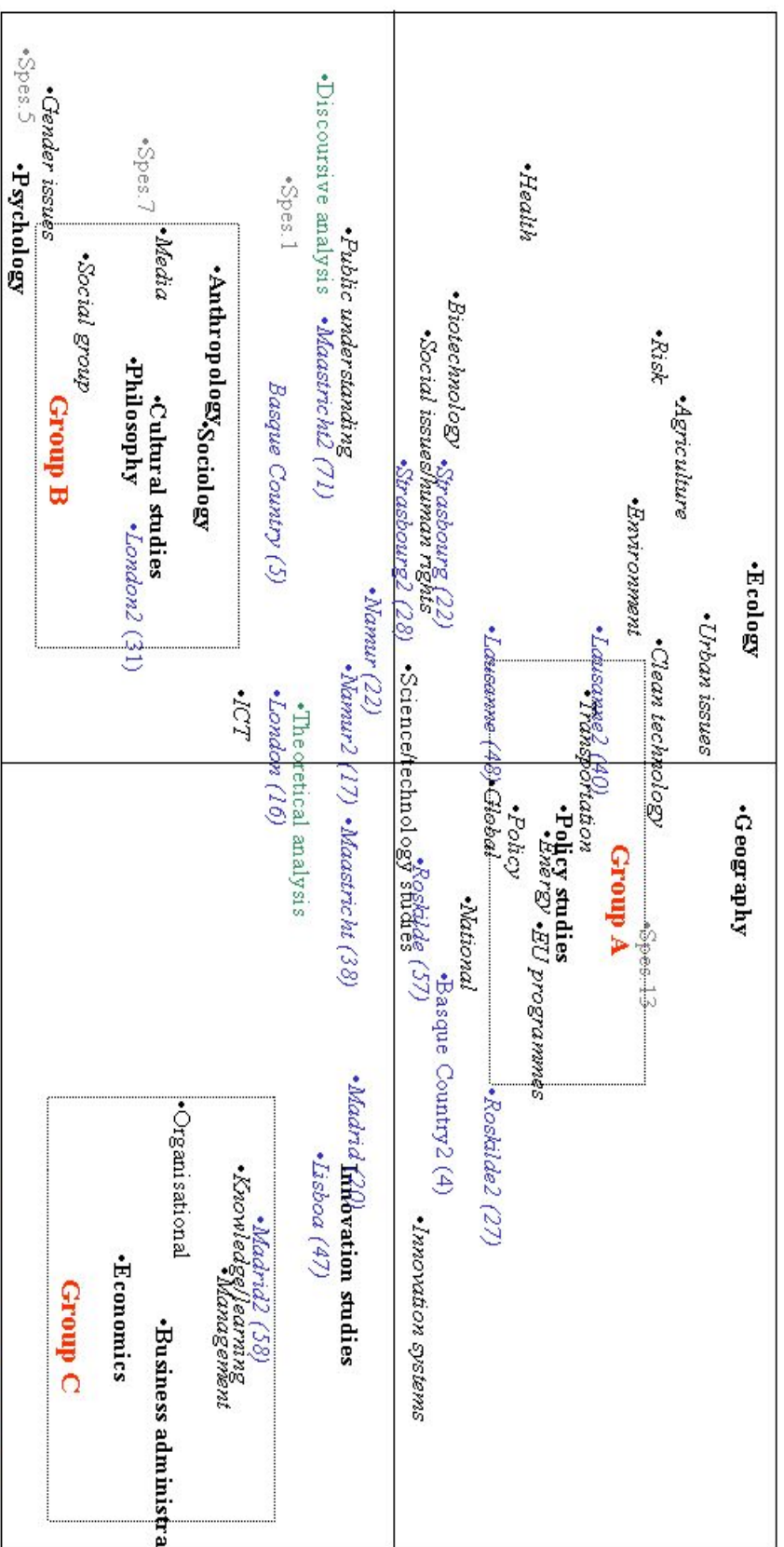
The map shows the relations between the main variables (note, however, that this is a simplified rendering of the findings; for more details see Berthinussen and Lindvig, 2001):

- discipline (Psychology, Ecology, Policy Studies, Innovation Studies, Business Administration, Economics, Cultural Studies, Philosophy, Anthropology)
- theme (Agriculture, Clean technology, Environment, Transportation, Energy, EU programmes, Policy, Social issues/human rights, Biotechnology, Health, Public understanding, Media, Gender issues, Innovation studies, Science/technology studies, Knowledge/learning, Management, ICT)
- thesis methodology (Discourse analysis, Theoretical analysis, )
- universities university specialisation areas (“5” i.e. Gender, Science and Technology; “7” i.e. Public understanding of Science, etc.)

Discipline as a concept is one of the main patterns. The map is marked with three quadrangles that represent/model three different groups. The correspondence map tells that there is a connection between "Policy studies" and "Energy", "EU Programmes" and "Policy" in group A. In group B there is a connection between the line "Sociology", "Anthropology", "Cultural studies" and "Philosophy". One explanation might be that in some cases it is difficult to define a thesis as "purely" sociological, and its point of intersection may rather be between all the disciplines named in group B. In group C there is a connection between "Business Administration", "Economics", "Management" and "Knowledge/learning". These concepts are closely related to each other.

It is typical for a London student to have executed a theoretical analysis, leading them to write or mention the theme ICT. On the other hand, if a person studied at London for her/his second semester, it is more common to find that she/he has written a thesis based on Cultural studies and Philosophy. The students that study for their second semester at the university in Madrid are interested in and mainly focus on Management and Knowledge/learning, while the students that come and spend their first semester in Madrid emphasise Innovations studies. The students at the university in Strasbourg, independent of semester, are characterised by tendency to write about Biotechnology and Social Issues/Human Rights. The discipline Psychology is connected to specialisation number 5, Gender,

## Map 1 Discipline



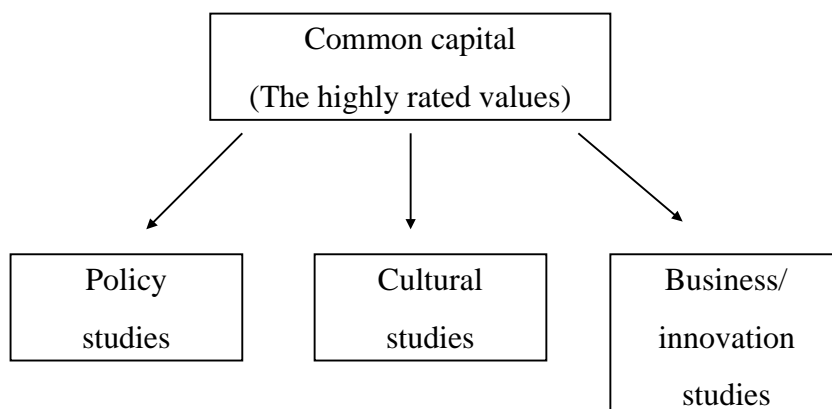
Science and Technology, and the theme Gender issues. Specialisation number 7, Public understanding of Science, is closely connected to group B.

All the variables which are not shown on Map 1 are clustered too near the centre of the graphs and are typical for all the variables. If the student has, for instance, studied at Oslo, none of the groups on the map are more representative than others. But one can say that students at the latter university write theses, which to a great extent are characterised by those traits that can also be seen among second semester students in Madrid and London.

Thus, the field, in a Bourdieuan sense, in question can be rendered rather figuratively (cf. Map 2). The closest group concept to describe group A is Policy studies. The closest group concept to describe group B is Cultural studies, and the closest group concept for group C is Business and Innovation studies.

Map 2: The structure of the field

## The structure of the field





#### 4. Conclusions and policy implications.

##### 4.1. Comparison of conference discussions and database analysis

There are some important distinctions between the materials when assessing the discussions resulting from the conferences on the one hand, and the results of the database analysis on the other. Firstly, the conferences were after all managed and structured according to pre-determined themes, whereas the database analysis related to the empirical material which the total mass of these constitutes. Moreover, the conferences were managed by academics *within* the field, whereas the database analysis was conducted by persons who were *not* particularly familiar with the internal academic debates but were rather experts in bibliometrical methodology.

Table 4: Lessons from conferences and database analysis compared.

	<b>Lessons from conferences</b>	<b>Lessons from database analysis</b>
<b>Historical, cultural and sociological approaches</b>	STS	“Cultural studies”
<b>Evolutionary and institutional economics</b>	STI	“Business/innovation studies”
<b>Policy studies</b>	<category not used>	“Policy studies”
<b>Integrated studies</b>	Integrated studies	<category not used>

Thus it is both striking, as well a source for further insight, to see that there are certain distinct parallels between the findings of independent database analysts and the reflections based conference discussions. (Table 4).

- Within the context of conferences the separate category “policy studies” was avoided. Instead, authors were encouraged to submit papers which could be studies of specific policies at the supra-national, national, regional or organisational levels at the same time as the study was placed within one or both of the established traditions.
- The organisers of the POSTI conferences were indeed aware of the tendency to link specific approaches to specific topics (cf. the POSTI database analysis finding on the link between

evolutionary and institutional economics as an approach to the study of business and innovation), but tried to encourage a broader view and, indeed, “integrated approaches whenever relevant.

The organisers of the conferences may have been more or less naïve, and more or less successful, regarding their aims. Nevertheless we believe that the comparisons between database analysis and conference discussions show that:

1. The status quo is indeed that there are distinct realms within current research, and that there is limited communication between these realms (cf. the results of the POSTI database analysis).
2. Much can be gained - both within academic research and, probably, also with regards to policy formulation - by trying, whenever, relevant, to look across these boundaries in terms of relevant approach to the topics studied (cf. the set-up of the POSTI conferences).

#### **4.2. Types of policies.**

This report has repeatedly discussed the existence of different types of scholarly approaches, different types of societal topics, and different types of integration between scholarly approaches and societal topics. A similar observation could be made regarding different types of policies.

To take the point of departure in “environmental policy”, a preliminary question that should be raised is the following: What is actually environmental policy? The terms policies and strategies are used first in their broad meaning, encompassing public policies, strategies of actors, and firm strategies. Although it is common to reserve the term "strategies" for private firms and the term "policies" for public intervention, this should not obstruct the way to articulation of micro and macro levels of analysis illuminated by theoretical models.

The project has assumed that market forces are “blind” when it comes to the relationship between innovation and the environment. Therefore, environmental policies and pro-active strategies are critical to social and technological innovation aiming at sustainability. Many theses and contributions to the POSTI conferences have focussed on various environmental policies and strategies and constitute a potential asset for POSTI project’s aims. But since the POSTI project is a thematic network and not a RTD project the comparison of various policies in Europe with regards to

sustainability has been a far too big task. However, the variety of existing policies asks for making distinctions and classifications.

A distinction between explicit and implicit policies appears to be needed due to the huge discrepancies which exist. Many policies are today explicitly embedding, or directly aimed at environmental improvements such as conservation, waste reduction, and international agreements on pollution etc. But the policies of e.g. a country is also constituted by its implicit policy regarding environment within all other domains of policy making. In other words, what are the environmental aspects of the trade policy, the industrial policies aimed at competitiveness, the tax system, financial policy, defence industry policy, systems of subsidies, public health, education, and policies towards developing countries?

There are thus three broad categories of public policies regarding sustainability (cf. Table 5). The first category is composed of the explicit environmental policies. The second category is made of the implicit environmental policies, so all other domains of public policy may come into consideration. The third and intermediary category is composed of particular cases, often belonging to traditional policy making, which have a critical impact on environmental performances, like the energy sector, the building industry and the urban development, or the transportation sector.

A similar distinction could be made regarding the relationship between innovation and social acceptability, i.e. explicit policies regarding social exclusion etc., implicit policies and particular cases (cf. Table 5).

Table 5: Categories of public policies regarding environmental and social sustainability.

	Categories		
	explicit policies	implicit policies	particular cases
Characteristic environmental policy	Policies explicitly targeted at environmental concerns (e.g. Agenda 21)	Environmental concerns included in general (e.g. economic) policies	Traditional policies (e.g. energy sector policies) and their environmental impacts
Characteristic of social policy	Policies explicitly targeted at social concerns	Social concerns included in general (e.g. economic) policies	Traditional policies (e.g. anti-poverty policies) and societal impact

Apart from such rough chronological classifications of policies, the project's broad aim of spanning both STS as well as STI approaches to science, technology and society may add a new conceptual framework which allows for emphasis on critical aspects. Such critical aspects include in particular the role of experts understood as actors, the relevance of mapping those actors who seem to have a changing perception of the issues at stake, and issues related to democracy and the design of participative schemes to policy making.

### **4.3. Policy implications.**

Public policies and economic and innovative strategies are increasingly required to integrate societal and environmental demands. STS-studies, STI-studies, and studies integrated between STS and STI have demonstrated a particular awareness of both the importance and the difficulty of this process of integration. This insight leads to a series of reflections regarding overall policy formulations, as well as the potential for instituting appropriate policy instruments. As for reflections regarding overall policy formulations the following stand out:

1. *Reform of policy making approach.* For policy-makers there is invariably an immediate need settle for either a sector-specific perspective, a case-specific policy, or a more or less integrated perspective, according to the context at hand. There may, obviously still be unresolved tensions:
  - A sector-specific perspective (e.g. transport system-targeted, etc.) policy may be more or less successful in improving conditions within the particular sector, but may at the same time trigger unfortunate repercussions in other sectors.
  - A case-specific policy may likewise be successful in a narrow sense, but may at the same time contradict measures taken within other areas of society.
  - A more or less integrated perspective may easily become such a large scale endeavour that it becomes inefficient and difficult to coordinate.

If we move beyond particular situations, however, we believe that the first task at hand is to admit to the immensity and vulnerability with respect to sustainable technological change issues, and subsequently initiate a general reformation of policy making. In other words:

- Any sector- and case-specific policies should, within a reasonable scale, always be required to include an assessment of potential repercussions on other adjacent realms .
- Integrated perspectives in a topical and/or disciplinary sense should be considered whenever relevant, with necessary measures (such as the establishment of clear loci of responsibilities and communication channels) implemented in order to avoid inefficiency and coordination problems.

2. *Gains to be made by policy integration.* On the contents side of policy making we recommend that particular attention is being paid to the following. Although at first sight seemingly leading to increased control and coordination costs, there are nevertheless potential gains to be made by consciously and systematically integrating environmental concerns with social acceptability concerns within policy making. Such gains can be mentioned as the more or less self-evident improved quality of life (social acceptability policy) as a result of improved natural environmental (environmental policy), to more seemingly peripheral connections such as the potential links between democracy, social equality and social justice (social acceptability) on the one hand and equal access to and control over natural resources (environmental concerns) on the other. Concrete examples of the latter include the relationship between increased customer awareness of, and demand for, environmentally sound products in industrialised countries, and the potential transition from environment-exploiting to environment-sensitive FDI in less industrialised countries. Thus there is a need to incorporate broad surveys of potential policy integrations in order to avoid a policy in one realm being formed in parallel or even in contradiction to a policy in another realm (i.e. social acceptability versus environmental concerns, or vice versa).

3. *Multi-level policies.* Current policies are not only often sector specific as well as topically little integrated (cf. no. 1 and no. 2 above), but also more often than not of a single-level orientation. In other words, it makes sense to target a policy to a sub-national and local level, a national level, or a supra-national (such as e.g. EU) level. Whereas this makes sense organizationally, and should thus continue to be the dominant practice in the foreseeable future, the challenges at hand are of such a tremendous nature that any policy should include an awareness of the implications to and potential linkages with other levels than the particular level at which the policy is targeted.

As for the potential for instituting appropriate policy instruments, the following stand out:

4. *Multi-disciplinarity*. The project has shown that it is crucial to look across disciplinary boundaries in order to approach complex issues such as sustainable and socially acceptable innovation. The establishment of a supra-national, large scale, explicitly multi-disciplinary RTD programme, where discussion of the conditions for changes in techno-economic paradigms could take place, is thus warranted for. There do indeed, to a certain extent, exist relevant instruments on which this idea may be based (e.g. GROWTH, IST and IHP). However, even more drastic re-orientations seem to be needed since singular disciplines and singular projects per definition tend to attract already established groups and networks of similarly minded researchers. Explicit incentives for transcending the established disciplinary barriers may be needed in order to proceed forward with respect to sustainable technological change issues.
  
5. *Need for a broad knowledge base*. The project has shown that there is material of scholarly interest and policy relevance contained within graduate students' research work. This is work which is more often than not "forgotten" within relatively inaccessible archives. There is thus a need for electronic archival systems which make such work easily stored and retrieved. Supra-national organs should take the initiative to demonstrate the necessity of such measures as well as suggest a format which makes the information commensurable across national boundaries, national higher education authorities should be encouraged to develop and provide guidelines as for the procedures, and national higher education authorities should also consult with their higher education institutions as for the budgetary consequences regarding the feasibility of reform including electronic archival systems.

Finally, at the more practical level, the project has shown that there should be attention paid to the following aspect:

6. *Reform of education curricula*. Assuming that the positive experiences of multi-disciplinarity gained within this project are possible to develop in a much larger scale, national and international higher education authorities should be encouraged to thoroughly revise the curricula in favour of increased cross-subject communication channels (as a mild form of multi-disciplinarity) as well as developing genuine multi-disciplinary curricula focused on sustainable technological innovation. Indeed this is a process which is already its starting phase in many countries. More large scale measures are, however, needed in order to facilitate the fruitful mutual input of knowledge between hitherto insurmountable walls between the traditional academic disciplines and cultures.

## *5. Dissemination and/or exploitation of results.*

There are three kinds of papers which have been produced as a result of the POSTI project:

- Conference papers presented at the workshops after having passed a referee system
- Keynote speeches at the conferences by invited speakers,
- Position papers focussing on and presenting the project itself

Revised versions of a large majority of the workshop papers are accessible to the public through the project' s WWW-site (<http://www.esst.uio.no/posti>).

### *Conference papers.*

Adamson, K. & T. Foxon. "Disruptive Technologies and Sustainable Development: The Case of Fuel Cell Vehicles". (3rd Conference).

Agrafiotis, Demosthenes & D. Vagianou-Angelaki . "Biotechnology and Agrofood Sector: Environmental Impacts and the Question of Sustainability". (1st Conference).

Andresen, Anne-Lene. "Factors behind Environment-Saving Technological Change: The Case of the Norwegian Paint Industry". (1st Conference).

Audétat, Marc. "A New Configuration for Environmental Innovations". (1st Conference).

Audétat, M. "Can Risk Management Be Democratic?" (3rd Conference).

Avadikian, Arman, Daniel Llerena & Katrin Ostertag. "Organizational Mechanisms in Environmental Management: Some Empirical Facts". (1st Conference).

Barke, Richard, Kenneth Knoespel and Eliesh O'Neil Lane. "Sustainability and the Convergence of Engineering and Liberal Arts Education". (4th Conference).

Bauler, Tom. "Indicators for the Efficiency of an Interregional Environmental Information System: The Case of Luxembourg". (1st Conference).

Berthinussen, Siri and Yngve Lindvig. "Trends within STS Higher Education: Results from an Analysis of the POSTI Database". (4th Conference).

Bingle, Gwen. "Socially Sustainable Engineering? From Participation in Engineering to the Engineering of Participation: The Challenge of the Conscious User". (4th Conference).

Bonfim, J. & M. Mira Godinho. "Impact of evaluation exercises in the architecture and management of environment policy: Analysis of the manufacturing and energy dimension of the Portuguese CSF programmes". (3rd Conference).

Brattebø, Helge. "Impact of Industrial Ecology on University Curricula". (4th Conference).

Buen, Jørund. "Can the Clean Development Mechanism Stimulate Green Innovation in Developing countries? The Case of China". (2nd Conference).

Burnand, Alexandre. "Local Agenda 21: A New Policy for Local Sustainability". (1st Conference).

Cabugueira, Manuel Francisco Magalhaes. "The Positioning of the Firm on the Environmental Regulation: What makes the Firm Participate and What is Its Role?" (2nd Conference).

Cespedes, Alvarez Gil, and de Burgos. "Linking Operation Strategy". (2nd Conference).

Cespedes, Alvarez Gil and de Burgos. "Green Service Operations Management in the Hospitality Industry". (2nd Conference).

Delaplace, Marie & Hakim Kabouya. "Regulations and Technological Innovations: the Case of Biodegradable Material in Germany". (1st Conference).

Dratwa, J. "Innovations in integration: The concurrent (re)shapings of technologies, policies, environments and Europe". (3rd Conference).

Eike, M.C. "GM Food: Controversy and Uncertainty". (3rd Conference).

Flamm, Michael. "New Car Use Scheme as a Means to Reduce Problems Arising from Traffic?". (1st Conference).

Gisler, Priska & Christian Pohl. "Concepts in flux: barrier and opportunity analysis of Swiss energy conservation ideals on their way from research to realisation". (1st Conference).

Godinho, Manuel Mira and José Bonfim. "Social Sciences and STS in the Context of Portuguese Higher Education: Their Role in Shaping the Competencies of New Graduates in Natural Sciences and Engineering". (4th Conference).

Godshall, Lauren E. "ISO 14001: A Case Study in Certification at Bayer Corporation, Berkeley, CA". (2nd Conference).

Gregersen, B. & B. Johnson. "Towards a Policy Learning Perspective on the Danish Wind-power Innovation System". (3rd Conference).

Guillaume, Xavier. "Integration of Environment by Swiss Proactive Firms: Motivations for Implementing Ecomanagement and Industrial Ecology". (1st Conference).

Hall, J. "Reducing Environmental Impacts Through the Procurement Chain" (1st Conference).

Hauge Kjos, Stine Pernille. "Local Agenda 21 : Challenges, socio-technical Changes and Hindrances. The Story of a Norwegian Municipality". (2nd Conference).

Haugen, Anders. "Bridging the Gap? Sustainable Innovation and R&D Co-operation between Firms, State Finance Institutions and Academia in the Grocery Retail Industry of Norway". (2nd Conference).

Haaland, H.O. "Energy Economising Discourse and the Policy Process". (2nd Conference).

Hof, Patrice. "A Tentative Definition of the Interface of Innovation: The Model of the Three Millstones". (2nd Conference).

Jacquinet, Marc "Technological Innovation, Knowledge Dynamics and Competitive Emergence: A Methodological Issue". (2nd Conference).

Jansen, K. "Making Policy Agendas for Safe Pesticide Use: Public and Private Interests in Technology Regulation in a Developing Country". (3rd Conference).

Kestemont, Marie-Paule. "The Greening Adaptation to Environmental Policy: Learnings of the International Business Environmental Barometer". (1st Conference).

Lai, O.-K. "Coupling E-Democracy and E-Equity with Technological Innovation in Network Society: The Contours of the On-Line / Real Time E-Governance for Sustainable Development".(3rd Conference).

Lang, Pia, Kristin Rønning and Marte-Eline Stryken. "Student-supervisor Relationships in an International and Interdisciplinary Situation: An Evaluation of the Situation within the ESST Master Programme". (4th Conference).

Levidow, L. "Which Sustainability? Policy Dilemmas over GM Crops". (3rd Conference).

Llerena, Patrick and Frieder Meyer-Krahmer. "Interdisciplinary Research and the Organisation of University: General Challenges and the Case of University Louis Pasteur". (4th Conference).

Martin, S. "Uncertainty and money calculation: Lessons from innovation management". (3rd Conference).

Miranda, A. de & M. Kristiansen. "Technological Determinism and Ideology: The European Union and the Information Society". (3rd Conference).

Munch Andersen, Maj. "The Economic Organisation of Interfirm Greening Mechanisms". (1st Conference).

Mulder, Karel. "From Environmental Management to Radical Technological Change and Beyond : Tasks for the New Engineer". (2nd Conference).

Mulder, Karel. "Training Engineers for Sustainable Development: Integrated Problem Solving at Delft University of Technology". (4th Conference).

Nerhus, Hans Einar. "How to Imagine a More Sustainable Transport System?". (1st Conference).

Nieminen, M. "The Incontestable Nature of Biodiversity". (3rd Conference).

Ottersen, Ø. "Conflict, a Missing Element in Ecological Modernisation Discourse and National System of Innovation Concept?". (2nd Conference).

Pérez, Susana Elena. "Industry-Academia Relationships: Measuring Intangibles for Innovation. A Spanish Case Study" (4th Conference).

Quist, J.N. & P.J. Vergragt. "System Innovations towards Sustainability Using Stakeholder Workshops and Scenarios". (3rd Conference).

Roediger-Schluga, T. "The political negotiation of environmental regulation and technological change: Some evidence from Austrian VOC emission standards". (3rd Conference).

Rossel, Pierre. "Ecobalance as an STS Challenge?" (1st Conference).

Rønning, K. "Public Decision-makers and Uncertainty". (3rd Conference).

Saint Jean, Maïder. "Variations in the Source of Innovation and Cleaner Technologies: An Analysis in terms of value chain ('filière'). The Case of the Electronics Industry". (1st Conference).

Saint Jean, Maïder, Vanessa Oltra, and Nathalie Gaussier. "The Dynamics of Environmental Innovations: An Exploration through a Micro-simulation Model". (2nd Conference).

Scheller, A. "Measuring Sustainability The Making of Sustainability Indicators in Interdisciplinary Research Settings". (3rd Conference).

Schueler, J. "Image management and large technological projects". (3rd Conference).

Silveira, Rogério Manuel Rosado. "Environmental Protection and Competitiveness: The Role of Technological Innovation". (2nd Conference).

Stryken, M.-E. "Implementation of 'modern' environmental policy in a local context: the case of Madona municipality in Latvia". (3rd Conference).

Ter Kuile, Christine. "A Global Overview of the Factors Involved in the Shift Towards Ecological Farming : What Prevents the Farmers from Changing?". (2nd Conference).

Turner, Antony. "Schumacher College: An Alternative Approach to Higher Education". (4th Conference).

Valenduc, G., C. Patris & F. Warrant. "Technological innovation fostering sustainable development: Some case studies in Belgium". (3rd Conference).

Vickers, I. "Innovation Support Policy, Competitiveness and Sustainable Development". (3rd Conference).

Wagner, Marcus. "The Relationship between Environmental and Economic Performance of Firms". (2nd Conference).

White, D. "On Babies and Bath Water: Why Factor Four and Natural Capitalism Deserve A Careful Critique". (3rd Conference).

Wyatt, Sally, Wiebe Bijker and Olav Wicken. "Crossing Boundaries: Europeanisation of STS Education". (4th Conference).

Zuiderent, T. "The Construction of Technology Assessment: Towards a Symmetrical Approach of Technology, Morality and Politics". (3rd Conference).

*Keynote speeches.*

de Wilde, Rein. "Innovating Innovation: A contribution to the philosophy of the future". Keynote lecture at the 3rd POSTI International Conference, London, United Kingdom, 1-3 December, 2000.

Fisch, Peter. "Social Sciences in the New Framework Programme". Keynote lecture to the 4th POSTI International Conference, Oslo, Norway, 20-21 May, 2001.

Godinho, Manuel Mira Godinho and Ricardo Pais Mamede. "Technological Convergence in Europe: What are the Main Issues?" Presentation of research project at the 1st POSTI workshop/The Annual ESST Scientific Conference, Lausanne, Switzerland, 29-30 May, 1999.

Gregersen, Birgitte. "The Learning Economy and Future Challenges for STS research". Closing lecture at the 3rd POSTI International Conference, London, United Kingdom, 1-3 December, 2000.

Kestemont, Marie-Paule. "Individual and Society Management of Risk: The Case of Genetically Modified Organisms (GMOs)" Presentation of a potential research project at the 2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, 27 - 28 May 2000, Strasbourg, France.

Muñoz, Emilio. "Has the Time Come for Society-Based Science and Technology?" Keynote lecture (the Ricardo Petrella-lecture) held at the 1st POSTI workshop/The Annual ESST Scientific Conference, Lausanne, Switzerland, 29-30 May, 1999.

Sánchez, Paloma, Leandro Cañibano, Manuel García-Ayuso, Cristina Chaminade, Marta Olea and Carmen Gloria Escobar. "Measuring Intangibles to Understand and Improve Innovation Management : Spanish Exploratory Case Studies" Presentation of research project at the 2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, 27 - 28 May 2000, Strasbourg, France.

Stein, Josephine. "Technology and Sustainable Development: the Democratic Management of Innovation". Keynote speech at the 1st POSTI workshop/The Annual ESST Scientific Conference, Lausanne, Switzerland, 29-30 May, 1999.

Wyatt, Sally. "The Information Society: What it Means to be Out of the Loop?" Keynote lecture (the Ricardo Petrella-lecture) held at the 2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, 27 - 28 May 2000, Strasbourg, France.

*Position papers.*

Audétat, Marc. "Technological innovation in a sustainability perspective: Report from the 1st conference of the TSER-funded project POSTI". Lausanne and Oslo, 29 December, 1999.

Audétat, Marc and Terje Grønning. "Categorising Sustainability, Social Acceptability and the Policy Implications of Studies within these Fields" Paper to the 2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, 27 - 28 May 2000, Strasbourg, France.

Grønning, Terje. "POSTI: Status, advantages and difficulties regarding the planned project". Paper to the Annual ESST Scientific Conference, Strasbourg, September 1998.

Grønning, Terje. Policies for Sustainable Technological Innovation in the 21st Century: Character and Results of a Project. Paper to the 4th POSTI International Conference, Oslo, Norway, 20- 21 May, 2001.

Grønning, Terje & Thierry Roedelé. "Methodology, preliminary findings and future course of the EU-funded project POSTI". Paper to the 1st POSTI workshop/The Annual ESST Scientific Conference, Lausanne, Switzerland, 29-30 May, 1999.

Llerena, Patrick & Marta Olea. "Sustainability, technological innovation and competitiveness of the firm: Report from the 2nd conference of the TSER-funded project POSTI". Strasbourg & Madrid, December, 2000.

Stein, Josephine Anne. "Policy Agendas for Sustainable Technological Innovation: Report from the 3rd conference of the TSER-funded project POSTI". London, December 2000.

Grønning, Terje. "Sustainable Technological Innovation: Insights from Higher Education in STS (Science, Technology and Society) and Engineering": Report from the 4th conference of the TSER-funded project POSTI". Oslo, May 2001.

### *Publication plans.*

Although not part of the deliverables planned as an integral part of the POSTI project itself there are at project's close publication activities at a planning stage. These plans consist of a international book publication with a selection of 10-12 papers from the conferences, with the addition of introduction and closing chapters.

### *Database contents.*

Database contents are publicly accessible through the project's Internet address, <http://www.esst.uio.no/posti>.

### *Database maintenance and expansion plans.*

Although the POSTI project has ended the participating institutions are inclined to institute routines for the continued input of newly completed degree work also in the future. Moreover, although not possible to include within the POSTI project's framework itself there are plans for making available on the web site approximately 300 of the collected theses in full text (in the so called PDF-format) as a separate, future project.

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Kjos Haugen, Stine Pernille (2000). "Local Agenda 21: Challenges and sociotechnical changes on the firm level. The case of Buskerud Betongvarefabrikk AS.", paper to the 2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, 27 - 28 May 2000, Strasbourg, France.

Law, John (ed.) (1991). *A Sociology of Monsters: Essays on Power, Technology and Domination*. London : Routledge.

Nerhus, Hans Einar (1999). "How to Imagine a More Sustainable Transport System?", paper to ESST Annual Scientific Conference, in collaboration with the first POSTI meeting, May 29-30, 1999, EPFL, Lausanne, Switzerland.

Rosenlund, Lennardt (1995). "Methodology and the analysis of urban cultural spaces", paper presented to the conference Culture and Identity, 10-14 August, 1995, Berlin.

Saint Jean, Maïder (1999). "Variations in the Source of Innovation and Cleaner Technologies: An Analysis in terms of value chain ('filière'). The Case of the Electronics Industry", paper to ESST Annual Scientific Conference, in collaboration with the first POSTI meeting, May 29-30, 1999, EPFL, Lausanne, Switzerland.

## ***Annex 1: Text of conference Calls for Papers***

### *Conference no. 1: Technological innovation in a sustainable perspective*

First POSTI meeting in collaboration with the ESST Annual Scientific Conference, May 29-30, 1999, EPFL, Lausanne, Switzerland.

Many policy decisions in modern societies necessitate an understanding of the interactions between science, technology and society. There is, however, a lack of systematic knowledge about the dynamics of scientific and technological change, within households, workplaces, the media, government and elsewhere. In Europe, there exists, however, a tradition of research and training in the 'science, technology and society' (STS) field which has produced new insights on these issues. The main objective of this project is to extract the policy implications from this academic production within the STS-tradition.

During recent years several hundred young academics have graduated from STS programs, and as part of this they have submitted theses based on their own research. Very little is done, however, to systematise the content of that research, and the ideas, insights and policy conclusions that originate from it. The POSTI project intends to map a part of this source of knowledge and create an European forum for interaction between young academics in the field, their seniors, business and policy makers. The deliverables will include a database on work by young researchers in this area, four workshops as well as a final report which summarises the main conclusions from this mapping process and the policy discussions that follows. The database and the four workshops planned in this project will cover work hitherto completed at the participating institutions. Needless to say this research covers a large number of aspects of science, technology and society. The network will bear in mind the variety of approaches taken thus far, while at the same time focus on the policy implications of a theme identified as common within much of the conducted research. This is the theme of sustainable technological innovation and its relevance to the formulation of modern policies.

The ESST Annual Conference / First POSTI Workshop entitled *Technological innovation in a sustainable perspective* is an opportunity for researchers to contribute to a knowledge building process in the field of sustainable innovation, by participating, debating and submitting papers.

By sustainable innovation, we mean, as a first step, two different things:

1. the sustainable preoccupations and measures incorporated in the innovation process or output;
2. the innovation process or output which aims directly at improving the present or future quality of the environment, in a broad sense.

It seems that this distinction is merely a practical choice, however, since there is a more serious problem associated with the finality of both types of innovation, i.e. the social component of their sustainability, which addresses the societal debate and acceptability of science and technology issues as well as their ecological impact.

We want to identify and document, on the one hand, various types of innovation - technical, method-oriented, organisational and systemic - and on the other, the pressures or restraining factors, the context and particular dynamics of such innovation processes.

Presentations and papers should show original empirical findings on innovations and experiments, in addition to elements which could lead to the progressive construction of a theoretical framework built upon STS concepts and tools.

In the choice of the selected presentations and papers, we wish to give an opportunity to both the POSTI network of senior and junior researchers, and also non-POSTI scholars, to report on their activity and participate in discussions within a specialised group.

### **Programme and content guidelines:**

In order to stimulate such debate, we have divided time and topics into four sessions, each one lasting half a day, dedicated to the exploration of a particular problem.

1st session: How are macro-policies and regulations translated into sustainable innovations?

Sustainable development has progressively become a public sphere at local, national and international levels, and opens an era of socio-technical change. In the near future, we will be confronted with the following key questions: How is global reality translated into local initiatives? Who are the relevant actors? What are the best core conditions favouring sustainable innovations? How to balance public and private responsibilities and initiatives? Participants are invited to present examples, cases and experiments documenting successful or failed innovations, with the aim of enhancing the existing theoretical framework.

### **2nd session: Normative measures or incentives: two complementary philosophies?**

Normative measures or incentives through partnerships or fiscality, for instance, appear at first glance as two different approaches to encourage new environmental processes and ideas among actors involved in technological change. One operates by imposing constraints and limits, and the other via stimulation and incentives. Intentions and practices linked with such instruments, however, sometimes produce paradoxical results. In addition, it seems necessary to take into account such operational guidelines as ISO 14000 or EMAS standards, which constitute primarily a recommendation framework. These may be considered a cultural methodology favourable to a general learning dynamic regarding the environmental consequences of technological innovation. Empirical findings and theoretical analysis should demonstrate the depth or superficiality of these claims.

### **3rd session: Towards a sustainable territory: user- vs. technology-oriented experiments**

In the past, environmental problems encountered within the framework of territorial management have generally resulted in the implementation of technological solutions often involving the construction of new infrastructures. Over the past decade, public authorities have recognised the limits of such an approach, which tends to transfer problems to future generations. Consequently, they attempt to involve users and citizens. Whether in the area of transport, energy supply or waste management, there is an increasing number of experiments aimed at improving user and citizen behaviour. In this context, it is interesting to note that technological innovation often remains a key success factor. Participants should thus demonstrate to what extent both technological and social innovation can contribute to sustainable territorial development.

#### **4th session: Technology transfers in quest of a convincing sustainability perspective**

Recent research on development programmes (ODA) and on the overseas of activities of multi-national corporations has increasingly focused on whether such activities include a concern for the natural environment of the receiving countries or not. On the one hand there are undoubtedly resource-extracting activities which contain little or no regard of such issues. On the other hand there appears to be ODA programmes as well as private enterprises which aim for both profit-maximisation for the delivering firms as well as a contribution to the local environment through implementation of the new technology. This session focuses especially on the second type of activities: in what ways do such activities aim at reaching a state of compatibility between the two types of aims? And in what degree may one say that they have succeeded thus far? This 4th session should bring to light documented cases as well as new knowledge on some of the dilemmas linked with technology transfers and development issues when considered in a sustainable innovation perspective.

#### **Extra-session activities**

According to the number of applications we will get, we may want to organise in parallel in Poster session, with specific presentations and debates. In particular, all former ESST Master degree's holders are welcome to introduce us to their current research activity, provided that it is related to the POSTI conference topic(s). Finally, on Saturday night, a dinner party will allow all the participants to meet in a more informal manner.

#### **Organisation**

Proposals for papers should include a title, a 20-30 line abstract, a 10-line CV, with if possible relevant information on the topic presented.

Deadline for proposals: March 29th, 1999.

Proposals will be refereed by a committee lead by ESST Vice-President for Research, Prof. Patrick Llerena (BETA-ULP-Strasbourg), POSTI coordinator Dr. Terje Gronning (TIC - Univ. of Oslo) and Workshop organiser, Dr. Pierre Rossel (ESST-EPFL).

#### *Conference no. 2: Sustainability, technological innovation and competitiveness of the firm.*

2nd POSTI meeting in collaboration with the ESST Annual Scientific Conference, Strasbourg, France, 27 – 28 May 2000. Organised by Bureau d'économie théorique et appliquée (BETA), Université Louis Pasteur, Strasbourg and Instituto Universitario de Administracion de Empresas (IADE), Universidad Autónoma de Madrid.

#### *Background*

POSTI (Policies for Sustainable Technological Innovation in the 21st Century) is a project funded by the EC's Targeted Socio-economic Research Programme. The project aims at creating an European forum within the Science, Technology and Society (STS) field for interaction between young academics, their seniors, business and policy makers, and it consists of a database containing information about M.A., M.Sc. and Ph.D. dissertations, as well as a series of four workshops. This workshop is the second within this series and provides an opportunity for researchers to contribute to a knowledge building process in the field of sustainability and innovation by submitting papers, participating and debating.

By sustainable innovation, we mean, as a first step, two different things:

1. the sustainability-related preoccupations and measures incorporated in the innovation process or output;
2. the innovation process or output which aims directly at improving the present or future quality of the environment, in a broad sense.

We want, in other words, on the one hand to identify and document various types of innovation (technical, methods-oriented, organisational and systemic) and the ways sustainability-related preoccupations and measures may be incorporated in these. We want to illuminate the pressures or restraining factors as well as the contexts and particular dynamics of such innovation processes. On the other hand there is also need for research which focusses on various dimensions of explicit outputs (e.g. "clean technologies" and "green" products).

Presentations and papers should show original empirical findings on innovations (in a broad sense) and experiments, in addition to elements which could lead to the progressive construction of a theoretical framework and tools. In the choice of the selected presentations and papers, we wish to give an opportunity to both senior and junior researchers to report on their activity and participate in discussions within a specialised group.

#### *Programme and content guidelines*

We have, in order to stimulate focussed debates, divided time and topics into three streams which are dedicated to the exploration of particular problems related to firm level research on sustainability and innovation. In addition we will organise two streams which are more openly constructed, where one is still focussing on the firm level while explicitly handling methodological issue. The last stream will accept papers which do not necessarily focus the analysis exclusively on the firm level, but nevertheless treat issues concerning the inter-relationship between firms and society at large.

#### *1st stream: Environmental considerations within the firm's strategy*

This stream is devoted to a discussion of specific programmes or policies aimed at incorporation of environmental considerations into the innovation process. We are interested in studies based on international and national policies or guidelines (e.g. the ISO 14000 series, EMAS standards), and discussions of the "industrial ecology" concept. Operational guidelines such as ISO 14000 or EMAS standards may be considered as methodologies favourable to a general learning dynamic regarding the environmental consequences of technological innovation. Empirical findings and theoretical analysis should demonstrate the depth or superficiality of these claims. Similarly, is the industrial ecology concept a revolutionary concept for restructuring industries towards sustainability, or just another fashionable management tool? If it is the former, why, from an economic standpoint, has industrial ecology not been implemented earlier, though? Is there a danger that industrial ecology will reduce ecology and sustainability to technological recipes?

Needless to say, in addition to papers which are focussed on discussing such policies or guidelines as such, case studies of the experiences of particular firms which try to apply policy guidelines, or may even have developed indigenous, "green" strategies, are especially welcome.

#### *2nd stream: Globalisation processes and local concerns*

Recent research on the overseas activities of multi-national corporations as well as research on development programmes (ODA) has increasingly focused on whether such activities include a concern for the natural environment of the receiving countries or not. On the one hand there are undoubtedly resource-extracting activities which contain little or no regard of such issues. On the other hand there appears to be private enterprises as well as ODA programmes which aim for profit-maximisation for the delivering firms at the same time as improvement of the local environment is being aimed for. This session focuses especially on the second type of activities. In what ways do such activities aim at reaching a state of compatibility between the two types of

aims? And in what degree may one say that they have succeeded thus far? In addition, whenever a large, multinational corporation is present, several local small and medium-sized enterprises (SMEs) may play a new and specific role. We welcome also papers focussed on such SME-related issues. This stream should bring to light documented cases as well as new knowledge on some of the dilemmas linked with technology transfers and development issues when considered in the perspective of sustainability and innovation.

#### *3rd stream: Knowledge as a competitive factor*

Sustainability issues may be approached with a broader perspective in mind than queries focussed exclusively on ecological aspects. Societal sustainability becomes relevant in particular when knowledge becomes a key factor of competitiveness, and this has implications on, for example, equity and on training. If knowledge is becoming a crucial competitive factor for enterprises, it should follow that intellectual capital, intangibles and knowledge management are elements for the understanding of the entire modern industrial sphere. The stream will be devoted to theoretical, methodological and empirical papers in this broad and emerging area.

#### *4th stream: Methodological issues in connection with research on sustainability and innovation*

This is a special session devoted to the discussion of the numerous methodological issues one may encounter in connection with research on sustainability and innovation. Papers should be based on actual studies within the field utilising quantitative and/or qualitative data, but reflect explicitly on the methodological issues encountered. Papers may thus discuss specific methodologies such as, for example, statistical analysis, scenario study methodologies, discourse analysis or case study methodologies.

#### *5th stream: Firms and society.*

Papers for this stream should focus explicitly on sustainability and innovation issues, while centering the concrete analysis on levels other than the firm level (regions, social groups, the national or international level). Studies appropriate for this stream may thus involve private firms or public organisations, while being focussed on democratic processes of social acceptance vs. rejection of allegedly "green" technological innovations on the societal level (e.g. studies of particular public hearings, international treaties, etc.).

#### *Submitting proposals.*

Proposals for papers should consist of title, an outline of maximum 3 pages (ca. 1200 words) including references, and a 10-line CV. Proposals will be refereed by a committee lead by Prof. Paloma Sanchez (IADE-UAM, Madrid), Prof. Patrick Llerena (BETA-ULP, Strasbourg) and Dr. Terje Gronning (TIK, University of Oslo). In thread with the objectives of the POSTI project we would like to emphasise that proposals coming from younger researchers (Master' s degree graduates and above), as well as proposals from persons working in private enterprises or public administration, are particularly encouraged.

Contact person: Prof. Patrick Llerena (pllerena@cournot.u-strasbg.fr),  
61, avenue de la Forêt Noire, 67 000 Strasbourg, France.  
Tel: (+33) (0) 3 90 41 41 65 Fax: (+33) (0) 3 90 41 40 50

#### *Schedule*

Call for paper issued: 20 October, 1999.  
Deadline for proposals: 17 January, 2000.  
Note of acceptance given to the author: 7 February, 2000.  
Issue of draft programme: 14 April, 2000.  
Full papers due: 2 May, 2000.

#### *Conference venue*

The conference will be held on the premises of Université Louis Pasteur. For information about Strasbourg, see:  
<http://www.sitesatlas.com/Europe/France/Strasbourg.htm>.

#### *Conference no. 3: Policy Agendas for Sustainable Technological Innovation.*

1-3 December 2000. Organised by Department of Innovation Studies, University of East London.

The purpose of this conference is to debate policy design strategies for a sustainable future based on scientific research, technological innovation and new concepts of democracy in the 21st century. The conference will explore the agendas of various actors (governments, companies, political parties, industrial associations, non-governmental organisations, social groups, universities, the media, etc.) and their role in defining policies for sustainable technological innovation. The conference will also cover aspects of ecological systems and socioeconomic conditions which interact only weakly with traditional democratic institutions, discussing how the policymaking environment itself may need to innovate in order to accommodate new expressions of social concern, environmental degradation or ecological disruption.

The conference will discuss the interactions between citizens and these various actors, institutions and natural environments in the context of the emergence of "post-Parliamentary democracy": forms of direct public participation in policymaking processes such as consensus conferences, "shareholder responsibility" movements and more broad-based environmental campaigns (for example in schools, local communities, or in cyberspace).

Proposals for papers are invited from a broad range of Science, Technology and Society (STS) and related disciplines, and may focus upon theoretical, methodological, empirical or applied research topics -- or upon direct experience of STS-informed policymaking in the public or the private sector.

#### *Background*

This conference will be the third of four international conferences organised as part of the European POSTI project: "Policies for Sustainable Technological Innovation in the 21<sup>st</sup> Century". Funded by the European Community's Targeted

Socio-Economic Research Programme, POSTI aims to contribute to a more systematic, mutual learning process between researchers in STS studies and policy makers.

The main activities of the POSTI project consist of the compilation of a database containing information about M.A., M.Sc. and Ph.D. dissertations in STS, and the organisation of a series of international conferences. These conferences provide a European forum for interaction between young academics, established researchers and professionals in public policy and the private sector. The best contributions from all four conferences will be published as an edited book.

By sustainable innovation, POSTI refers to two different concepts:

- sustainability-related objectives and measures incorporated in innovation processes or outputs;
- innovation processes or outputs which aim directly at improving the present or future quality of the environment, in a broad sense.

While POSTI encompasses ideas related to "clean technology" and "green innovation", it also incorporates aspects of sustainability in the interactions between social, political, economic and ecological spheres.

#### *London Conference programme content*

The conference will be organised into plenary sessions, panel discussions, a keynote address and topical working group sessions. In order to stimulate focused debate, we have identified three streams dedicated to the exploration of social, economic and environmental aspects of policy on sustainability and innovation. In addition, there will be two streams which deal more explicitly with democratic aspects of policymaking processes in Europe. The last stream will accept papers which do not necessarily fall into any of the above categories, but which include some element of forecasting or planning.

#### *1st stream: Socially acceptable technological innovation: Quality of life, ethics and policy*

This stream is devoted to elucidation of how citizens, cultural and religious groups, professional bodies and other social groups (such as the young, the elderly, travellers, crime victims, the disabled and their carers, students, immigrants, athletes, charity volunteers, patients, the unemployed, ex-soldiers, nature enthusiasts, women, prison inmates, workers, consumers etc.) define social objectives, and how they influence policy on sustainable innovation. How are ethical considerations perceived and presented? What regulatory, moral, legal or judicial instruments exist to complement more traditional forms of democratic expression and influence?

#### *2nd stream: Economically acceptable technological innovation: The "real world" of discharging political responsibility*

Politicians must confront the conflicting demands of many different prevailing conditions and constituencies in order to deliver policies which satisfy the electorate as a whole. How do macroeconomic conditions, well beyond the control of individual firms or even national governments, affect policies on sustainable innovation within companies and in governments and public sector institutions? How do policies on employment, education, research and technological development, industry, defence, public health and safety etc. impinge upon policies for sustainable innovation? What are the short-term vs. long-term frameworks for developing sustainable technological innovation policy and how do these compare with timeframes for the evaluation of specific policies and with electoral cycles?

#### *3rd stream: Environmentally acceptable technological innovation: Urban, industrial, residential and rural habitats*

In this stream, we will discuss the factors that influence technological innovations either specific to each of these types of habitats or common to all. What are the main unresolved issues for sustainable habitats (such as economically and environmentally acceptable forms of recycling, safety in the laboratory and the workplace, cumulative or multiple causes of degradation of human health and the natural environment, etc.)? What tradeoffs may exist between "clean energy" at the point of application and the environmental hazards of extraction, processing, generation and disposal, and how can policies be designed that fairly distribute benefits as well as risks of energy exploitation? What policies can be developed on the disposal of rubbish and on the construction of European-owned "dirty" industrial plants in developing countries? What renewable resources could supplant expendable natural resources, and how could research, innovation, regulation and incentives best promote sustainability?

#### *4th stream: National, European and global policymaking environments: Who benefits, who pays and who decides?*

This stream will focus on existing policymaking structures and analyse the options for promoting sustainable technological innovation. The agendas of different constituencies and interest groups will be analysed, critiqued and assessed as to the extent of their influence on policies that genuinely promote sustainability. The session will cover industry, inclusivity of social groups, political institutions and movements at local, national and European level, the scientific research community, international institutions such as the United Nations, the IMF and the World Bank, higher education institutions, and other sociopolitical actors. How are different agendas communicated through political campaigns, media reports and advertising,

and through education and interpersonal/social interaction? Who dominates decisionmaking and why? Who are the winners and losers in the contemporary world, and in future?

*5th stream: Democratisation of policymaking processes: How can society and the natural environment best be heard?*

Papers for this stream will focus explicitly on reforms to existing policymaking processes or on novel forms of direct expression of public views in a way that can promote sustainable innovation. This session will include papers on citizen/consumer and expert participation in deliberative processes that inform decisionmaking by politicians and other policymakers in public and private institutions. There will be an emphasis on "giving voice to nature and future generations" and democratic forms of environmental impact assessment. This stream will also include discussion of the implications of political devolution and European integration for the development of policies for sustainable innovation.

*6th stream: Future challenges for sustainable innovation*

This is a special session devoted to forward thinking and creative approaches to innovation in policymaking itself, in which sustainable technological innovation is the core objective. There will be an emphasis on new approaches to mediating between scientific, social, economic and environmental interests as part of robust policy design for a long-term, sustainable future.

#### *Submitting proposals*

Proposals for papers should consist of a title, an outline of maximum 2 pages (ca. 800 words) including references and a 10-line CV. Proposals will be refereed by a committee led by Dr Josephine Anne Stein (University of East London), Professor Wiebe E. Bijker (University of Maastricht) and Dr Terje Grønning (University of Oslo).

In keeping with the overall objectives of POSTI, we encourage the submission of proposals from younger researchers (Masters degree graduates and above), as well as proposals from senior academics and persons working in private firms or in public administration.

Organiser: Dr Josephine Anne Stein, Principal Research Fellow,  
Department of Innovation Studies

Contact: Gillian Perkins, Conference administrator, Department of Innovation Studies  
University of East London, 4-6 University Way, London E16 2RD, UK

tel: +44 20 8223 4215

fax: +44 20 8223 7595

e-mail: g.s.perkins@uel.ac.uk

Deadline for proposals: 15 September, 2000

Response to applicants: 20 October, 2000

Full papers due: 10 November, 2000

#### *Conference venue*

The conference will be held at the Docklands Campus of the University of East London. Information about the campus and local transport can be found at: <http://www.uel.ac.uk/docklands/index.htm>

#### *More information*

The POSTI project is closely associated with the European Inter-university Association on Society, Science and Technology (ESST). ESST will be holding meetings prior to the POSTI conference, from 30 November-1 December, at the University of East London. Recent ESST graduates are proposing to organise a workshop in London in conjunction with the POSTI conference, with the aim of launching an international alumni association for ESST graduates throughout Europe. Participants will discuss how to set up organisational structures and networking arrangements, both person-to-person and over the Internet. For more information about ESST and POSTI, see the Websites:

<http://www.esst.uio.no>

<http://www.esst.uio.no/posti>

For more information about ESST alumni activities, contact Anna Charlotte Larsen: [a.c.larsen@tik.uio.no](mailto:a.c.larsen@tik.uio.no)

*Conference no. 4: Europe's 21. century policies for sustainable technological innovation: The role of higher education in science, technology and society.*

20-21 May, 2001. Organised by Centre for Technology, Innovation and Culture (T.I.K.), University of Oslo.

## Background

This conference will be the fourth and final international conference organised as part of the European POSTI project: "Policies for Sustainable Technological Innovation in the 21st Century". Funded by the European Community's Targeted Socio-Economic Research Programme, POSTI aims to contribute to a more systematic, mutual learning process between researchers in STS studies and policy makers.

The main activities of the POSTI project consist of the compilation of a database containing information about M.A., M.Sc. and Ph.D. dissertations in STS, and the organisation of a series of international conferences. These conferences provide a European forum for interaction between young academics, established researchers and professionals in public policy and the private sector.

By sustainable innovation, POSTI refers to two different concepts:

1. sustainability-related objectives and measures incorporated in innovation processes or outputs;
2. innovation processes or outputs which aim directly at improving the present or future quality of the environment, in a broad sense.

While POSTI encompasses ideas related to "clean technology" and "green innovation", it also incorporates aspects of sustainability in the interactions between social, political, economic and ecological spheres.

## Oslo conference programme content

The conference will be organised into plenary sessions, panel discussions, a keynote address and topical working group sessions. In order to stimulate focused debate, we have identified two overall streams related to higher education.

1st stream. Europe's 21. century policies for multidisciplinary studies in society, science and society.

During recent years several hundred young academics have graduated from society, science and society (STS) programmes. In this stream we would like to discuss some aspects in connection to the contents, benefits and potential of such programmes.

As for contents, we would like to ask: What is the intellectual background and status quo of such courses? In what degree are they multi-disciplinary? What kind of organisational solutions do there exist today when it comes to the running of such courses?

As for benefits, we are interested in any studies which have charted the career paths of persons who have graduated from such courses. What kinds of jobs do the graduates have? Do they feel like they have benefited from this type of education in their current work situation?

At a more general level, we would like to ask what kind of benefits this type of education may or may not have for corporations, communities and society. Does this type of education play any role at all within the current and future shaping of discourse and practice related to sustainability and social acceptability?

Finally we want to illuminate policy-related aspects of higher education in science, technology and society. What are the current policies at the national and European levels regarding the fostering of such multidisciplinary higher education? Should there be any policies within this area in the future? If yes, what are the most important aspects in connection with policy formation in the area?

Note that we are within this stream not only interested in receiving papers which might broadly fall in the category of STS studies, but also in studies of related types of educational programmes (e.g. higher education in management of technology or in economics of science and technology etc.).

2nd stream. Europe's 21. century policies for higher education in natural sciences and engineering.

This stream corresponds more or less to the stream outlined above, except that it takes its point of departure in higher education within natural sciences and engineering. In what degree is such education focussed exclusively on scientific and technical aspects, versus including the societal aspects of science and technology? In the case of multi-disciplinary courses, what kind of organisational solutions do there exist today when it comes to the running of such courses?

As for benefits, we are interested in focussing on the role that higher education in natural sciences and in engineering plays within the current and future shaping of discourse and practice related to sustainability and social acceptability. Moreover, what are the current policies at the national and European levels regarding such higher education? How should those policies be adapted in the future? What are the most important aspects in connection with policy formation in the area?

#### Submitting proposals

Proposals for papers are invited from a broad range of Science, Technology and Society (STS) and related disciplines, and may focus upon theoretical, methodological, empirical or applied research topics, or upon direct experience of STS-informed policymaking in the public or the private sector. The best contributions to the four POSTI conferences will be compiled into a major book.

In keeping with the overall objectives of POSTI, we encourage the submission of proposals from younger researchers (Master's degree graduates and above), as well as proposals from senior academics and persons working in private firms or in public administration.

Proposals for papers should consist of a title, an indication for the stream which the paper is intended for, an outline of maximum 2 pages (ca. 800 words) including references, and a 10-line CV. Proposals will be refereed by a committee consisting of Dr. Birgitte Gregersen (Aalborg University), Dr. Manuel Mira Godinho (Technical University of Lisbon), and Dr. Terje Grønning (University of Oslo), preferably as an e-mail attachment (to [terje.gronning@tik.uio.no](mailto:terje.gronning@tik.uio.no)), with a hard-copy backup faxed or posted to the address below. In cases where submission form transmission fails please use the e-mail address, fax number or postal address below.

#### Schedule

Call for papers issued:	10 December, 2000
Deadline for proposals:	1 February, 2001
Response to applicants:	28 February, 2001
Issue of draft programme:	1 April, 2001.
Final date for registration	7 April, 2001
Full papers due:	23 April, 2001.
Finalisation of programme:	2 May, 2001

#### Conference venue

The conference will be held at the Soria Moria Hotel and Conference Centre just outside Oslo.

#### Registration

All participants with or without paper must register regarding their participation by 7 April, 2001. Contact person:

Contact person: Grazyna K. Normandbo, conference administrator  
Centre for Technology, Innovation and Culture (T.I.K.), University of Oslo P.B. 1108 N-0317 Oslo, Norway  
tel: +47 22 84 06 00  
fax: +47 22 84 06 01  
e-mail: [g.k.normandbo@tik.uio.no](mailto:g.k.normandbo@tik.uio.no)

#### Other activities

The POSTI project (Policies for Sustainable Technological Innovation in the 21st Century) is closely associated with the European Inter-university Association on Society, Science and Technology (ESST). ESST will be holding its 10th Anniversary Conference in Oslo the day after the POSTI conference.

Recent ESST graduates are proposing to organise a workshop in Oslo in conjunction with the POSTI conference, with the aim of launching an international alumni association for ESST graduates throughout Europe. Participants will discuss how to set up organisational structures and networking arrangements, both person-to-person and over the Internet. For more information about ESST alumni activities, contact Anna Charlotte Larsen.

Conference dinner is on the evening of 20 May. It should be mentioned at the time of registration whether you intend to participate or not.

Otherwise we have not planned any structured tourism-related events or "social programmes", but can mention that there is only a relatively short distance to major tourist sites (such as ), as well as to the University of Oslo main campus although the conference centre and hotel is just outside the city centre. It is also possible to go hiking in Oslo's forests starting at the entrance of the hotel. Be sure to bring with you appropriate shoes and clothing.

**Annex 2: Database interface as of July, 2001: the registration part as example.**

Family name.....	First name.....
University 1 <sup>st</sup> .....	University 2 <sup>nd</sup> .....
Course/specialisation.....	
Academic year.....	Graduation year.....
Nationality.....	Type of thesis (M.A., MSc, Ph.D).....
Title of thesis.....	
.....	
.....	

Thesis synopsis.....
.....
.....
.....

**Discipline - approach(es) adopted in the thesis. Tick the appropriate topics - maximum three**

<input type="checkbox"/> Anthropology	<input type="checkbox"/> Educational Science	<input type="checkbox"/> Innovation studies	<input type="checkbox"/> Political Science
<input type="checkbox"/> Business Adm.	<input type="checkbox"/> Epistemology	<input type="checkbox"/> Law	<input type="checkbox"/> Psychology
<input type="checkbox"/> Cultural Studies	<input type="checkbox"/> Future Studies	<input type="checkbox"/> Literature studies	<input type="checkbox"/> Religion/ethics
<input type="checkbox"/> Ecology	<input type="checkbox"/> Geography	<input type="checkbox"/> Philosophy	<input type="checkbox"/> Science & technology studies
<input type="checkbox"/> Economics	<input type="checkbox"/> History	<input type="checkbox"/> Policy studies	<input type="checkbox"/> Sociology
<input type="checkbox"/> Other.....			

**Methodology. Tick the appropriate areas - maximum three**

<input type="checkbox"/> Case studies	<input type="checkbox"/> Ethnography	<input type="checkbox"/> Statistical analysis	<input type="checkbox"/> Quantitative/survey
<input type="checkbox"/> Comparative analysis	<input type="checkbox"/> Evaluation/Assessment	<input type="checkbox"/> Theoretical	
<input type="checkbox"/> Other:.....			
<input type="checkbox"/> Discourse analysis	<input type="checkbox"/> Historical	<input type="checkbox"/> Qualitative	

**Level of Analysis. Tick the appropriate areas - maximum two**

<input type="checkbox"/> Global	<input type="checkbox"/> Local	<input type="checkbox"/> Organisational	<input type="checkbox"/> Social group
<input type="checkbox"/> Individual	<input type="checkbox"/> National	<input type="checkbox"/> Regional (e.g. EU)	<input type="checkbox"/> Specific science & technology
<input type="checkbox"/> Other.....			

**Science and Technology described in thesis. Tick the appropriate topics - maximum two**

<input type="checkbox"/> Biotechnology	<input type="checkbox"/> ICT	<input type="checkbox"/> Military/space	<input type="checkbox"/> Medical
<input type="checkbox"/> Natural sciences	<input type="checkbox"/> Production	<input type="checkbox"/> Transportation	
<input type="checkbox"/> Other.....			

**Area of application/theme. Tick the appropriate topics - maximum four**

<input type="checkbox"/> Agriculture	<input type="checkbox"/> Gender issues	<input type="checkbox"/> Manufacturing	<input type="checkbox"/> Quality
<input type="checkbox"/> Architecture/construct.	<input type="checkbox"/> Globalisation	<input type="checkbox"/> Marine resources	
<input type="checkbox"/> Research & Development	<input type="checkbox"/> Arts	<input type="checkbox"/> Health	<input type="checkbox"/> Marketing
<input type="checkbox"/> Risk	<input type="checkbox"/> Business/Industry	<input type="checkbox"/> Home/everyday life	<input type="checkbox"/> Military/space
<input type="checkbox"/> Social issues/human rights	<input type="checkbox"/> Clean technology	<input type="checkbox"/> Implementation	<input type="checkbox"/> Media
<input type="checkbox"/> Standardisation /Regulation	<input type="checkbox"/> Communication	<input type="checkbox"/> Industrialisation	<input type="checkbox"/> Networking
<input type="checkbox"/> Transportation	<input type="checkbox"/> Design	<input type="checkbox"/> Industry-academia	<input type="checkbox"/> Policy
<input type="checkbox"/> Employment	<input type="checkbox"/> Intellectual property	<input type="checkbox"/> Private services	<input type="checkbox"/> University/education
<input type="checkbox"/> Energy	<input type="checkbox"/> Innovation systems	<input type="checkbox"/> Productivity	<input type="checkbox"/> Urban issues
<input type="checkbox"/> Engineering	<input type="checkbox"/> Knowledge/learning	<input type="checkbox"/> Professions	<input type="checkbox"/> Environment
<input type="checkbox"/> Labour relations	<input type="checkbox"/> Public services	<input type="checkbox"/> EU Programmes	<input type="checkbox"/> Management
<input type="checkbox"/> Public understanding			
<input type="checkbox"/> Other.....			

**Free text keywords (e.g. name of specific science/technology/industry/company/country):**

.....

.....

*Annex 3: Contact persons at the project partner organisations.*

1. (Project coordinator) University of Oslo, Centre for technology, innovation and culture ("UOSLO.ESST ")

Dr. Terje Gronning,  
Centre for Technology, Innovation and Culture,  
University of Oslo,  
P.b. 1108 Blindern  
0317 Oslo, Norway.  
Tel: (+47) 22-84-06-05  
Fax: (+47) 22-84-06-01  
E-mail: terje.gronning@tik.uio.no

2. Université Louis Pasteur, Strasbourg I, Bureau d' Economie Théoretique et Appliquée ("ULPS.BETA")

Professor Patrick Llerena, Vice President chargé des Relations avec les entreprises, University Louis Pasteur, Bureau d'Economie Théorique et Appliquée, 61, avenue de la Forêt Noire, F - 67 070 Strasbourg, Cedex 07, France.  
Tel:+33 (0) 3 90 41 41 00 / 41 65  
Fax: +33 (0) 3 90 41 40 50  
E-mail: pllerena@cournot.u-strasbg.fr

3. Ecole Polytechnique Fédérale de Lausanne ("EPFL")

Dr. Pierre Rossel, ESST-EPFL, CM1 — 620, EPFL CH-1015 Lausanne, Switzerland.  
Tel. +41 21 693 71 91  
Fax +41 21 693 71 90  
E-mail: pierre.rossel@irec.da.epfl.ch

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