

The Socialisation of Scientific and Technological Research

A meta-evaluation and
experimentation

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Social Sciences and European
Research Capacities (SS-ERC)

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Citizenship and governance
in a knowledge based society



**Social Sciences and European Research Capacities
(SS-ERC)**



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Foreword

Societies experience a shift towards the “knowledge society”, characterised by social diversification, globalisation and rising importance of cognitive dynamics. In this framework, scientific and technological (S&T) research has taken on an unparalleled importance in many sectors of socio-economic life.

Science and technology is becoming more and more socially, economically and politically significant. Science-based innovation is furthermore acknowledged as a pivotal factor of competitiveness and S&T is viewed as a key element for successfully coping with global problems such as climate change, secure and sustainable energy and environmental protection.

At the same time, the way research is produced is changing: it increasingly involves a broader number of actors and stakeholders; it is becoming ever more result-oriented; it is more embracing a trans-disciplinary nature; it is expected to be more effective, accountable and able to generate results for the benefit of the private sector and society in general.

These transformations have increased the bearing of social dynamics embedded in S&T research and made the science and society relationship more intense, but also complex to manage. Despite a growing relevance, S&T, quite paradoxically, risks to become socially marginalised as it is perceived by large sectors of society as an institutional value irrelevant and foreign to society. This may happen despite the fact that science and technology is becoming a “social undertaking”.

“Social Sciences and European Research Capacities” (SS-ERC) has been elaborated over a time period of three years. It is a project in the framework of the FP6, performed by a total of six European research institutes. Its aim is to strengthen the capacity of European research by favouring a broader knowledge base and more effective governance of social dynamics of S&T. The research ascertains the role and presence of social sciences in European scientific and technological research. All the project results have been collected in the Handbook on the Socialisation of Scientific and Technological Research¹.

This report is an integrated part of the SS-ERC project. Its objective is to stimulate socialisation of S&T with use of social sciences and increase awareness regarding the capacity of social sciences to support policy. The report is the outcome of a study carried out by a team comprising Karen Siune, Niels Mejlgaard and Stig Aagaard.

A special thank goes to Members of the Danish Parliament that have taken an interest in and actively participated in the study.

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¹ Bijker, W. E. & D’Andrea, L. (eds) (2009). Handbook on the Socialisation of Scientific and Technological Research. Social Sciences and European Research Capacities (SS-ERC project). River Press Group, Rome.

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Section A

1. Social Sciences and European Research Capacities

Towards the knowledge society

Societies today experience a shift towards the “knowledge society”, characterised by social diversification, globalisation and rising importance of cognitive dynamics. Science and technology (S&T), has gained unprecedented importance in all sectors of social life. In Europe, many hurdles are arising however in managing the transformation presently affecting science and technology and in driving the increasingly dense and multi-layered relationship between science and society. Such difficulties set limits to the capability of European research capacities and reduce the speed of knowledge-based innovation processes.

The way science and technology is produced is changing at the same time: it involves a decidedly broader number of actors, in addition to the researchers community; it is more and more taking on a transdisciplinary nature; it is proceeding at a fast pace, thanks to information and communication technology. Such changes have resulted in a growing importance of social dynamics embedded in research, and multiplied the linkages between science and society.

Despite its growing relevance, science and technology, paradoxically, risks to become socially marginalized, as it is perceived by large sectors of society as an institutional value foreign to society. This may be the case, while science and technology is becoming a “social undertaking”, calling for increasingly complex interactions among actors and a wider consensus for attaining high levels of quality and productivity.

S&T is more and more socially, economically and politically significant and visible. Science-based innovation is acknowledged as a pivotal factor of competitiveness in the global market and science and technology is viewed as a key element for successfully coping with global problems such as sustainable energy, climate change, environmental protection, etc. The power and pervasiveness of technologies have developed to the point that they profoundly affect everyday life. Science and technology is therefore expected to be more effective, accountable, result-oriented and capable to generate benefits for the industrial sector and citizens in general. The latter includes e.g. assuring citizens' health, fighting virus epidemics such as the Asian flu and H1N1.

The paradox: Social marginalization as demands on S&T to solve universal problems increase

Despite this development, in large parts of society, there is a growing mistrust towards science and technology and widespread indifference as regards - not so much the scientific discoveries and technological innovations, which are usually highly valued - but - the future prospects of the scientific and technological research. Equally important, there is an indifference towards addressing the problems met by scientists and scientific institutions trying to deal with issues stemming from rapid developments and global challenges.

This problem manifests in society in different ways: decreasing social status of scientists (in terms of salaries, lack of trust, etc.) in comparison with other professional groups; weak investments in research; low appeal to younger generations of scientific faculties; growing obstacles to pursue scientific careers for young researchers; a significant gap between science, on the one side, and social and cultural life, on the other; scarce attention to research and innovation in some countries by large sectors of public administrations and political leaderships; continuous gender gap in scientific careers (male domination of top academic positions and wasted talent of women researchers); sense of anxiety among citizens as regards science and technology related risks.

Acknowledging these risks and the paradox of social marginalisation, while societal demands are increasing, Europe tries to cope with these issues through the Lisbon Strategy², and by setting up the European Research Area³.

The SS-ERC project

The Social Sciences and European Research Capacities project aims to study this set of issues with the goal of valorising the role of social sciences. It aims to increase the quality of European scientific and technological research. The project strives towards producing new knowledge on the social dynamics of S&T, identifying the hindering and facilitating factors in these dynamics. Moreover, it attempts to investigate the current and potential contribution of social sciences in the science and technology development, and propose a series of measures for managing the social processes of science and technology.

The SS-ERC project comprises: (i) a *study of the socialisation dynamics* in five countries of the European Union, namely Denmark, Italy, Netherlands, Slovenia and Spain; (ii) a *mapping of the state-of-the-art concerning the new disciplinary areas* involved in the study of science and technology; (iii) an *inventory of European social research institutes specialised in S&T studies*; (iv) an *inventory of themes* dealt with by social science research within science and technology; (v) *five experimentations* concerning the socialisation of science and technology, conducted in Denmark, Italy⁴, Slovenia and Spain; and finally (vi) *the production of a handbook on the socialisation of scientific and technological research*.

² At the Lisbon and Barcelona European Councils in the beginning of the new century, the European Union committed its member states to become the most competitive and dynamic knowledge-based society and economy in the world by 2010, and to increase investment in research on average to 3 percent of GDP. The European Council, in March 2005 and based on an evaluation of the progress made, re-launched the Lisbon Strategy and refocused priorities on growth and employment, placing the main emphasis on knowledge, innovation, and optimisation of human capital.

³ In 2000, the European Union decided to create the European Research Area (ERA), a unified area all across Europe, with the aim to (i) enable researchers to move and interact, benefit from world-class infrastructures and work with networks of research institutions; (ii) share and use knowledge effectively for social, economic and policy purposes; (iii) optimise and open European, national and regional research programmes in order to support the best research throughout Europe and coordinate these programmes to address major challenges; (iv) develop strong links with partners around the world so that Europe benefits from the worldwide progress of knowledge and takes a leading role in international initiatives to solve global issues.

⁴ Two of the experiments were carried out in Italy.

The SS-ERC project is carried out by a network of European research institutions. It comprises the Danish Centre for Studies in Research and Research Policy, University of Aarhus (Denmark); Tor Vergata University of Rome, (Italy); Laboratorio di Scienze della Cittadinanza (Italy); University of Maastricht (Netherlands); Primorska University of Koper (Slovenia); and La Rioja University (Spain). The project is conducted within the Sixth Framework Programme for Research and Technological Development⁵ of the European Union.

The project aims at strengthening the capacity of European research by favoring a broader knowledge base and more effective governance of social dynamics involved in the process of scientific and technological research. The research ascertains the role and presence of social sciences in European scientific and technological research. It is based on data collected from documents, literature, statistics and “living sources”, such as prominent key stakeholders and experts. Furthermore, equally important new knowledge is produced through experimentations. The experimentations focus on the obstacles and the facilitating factors related to a more pertinent presence of social sciences in S&T. The main characteristics of policies related to science and technology in this framework are considered.

1.1. The SS-ERC institutional and theoretical framework

The SS-ERC focuses on the role of social sciences in improving the quality of scientific and technological research, an area of society in which social sciences could and should make a contribution and which is more and more central in knowledge-based societies.

The underlying assumption is that science and technology, as well as innovation and research, are social endeavors. This was established in empirical and theoretical studies during the last forty years by a multidisciplinary variety of approaches from the social sciences and humanities. The social character of scientific and technological research is now even more relevant for a strengthening of research, because of the changing nature of knowledge production and the structural changes connected to the pace of globalization. A strengthening of S&T is one of the major social and economic challenges that the European Union is facing today and the current financial crisis will no doubt has a catalytic effect on redistribution of power, wealth and technology bases worldwide.

Social sciences are called to provide a better understanding of the dynamics that affect the scope and pace of development of S&T. The project is based on the interpretation of the “stake” involved in scientific and technological research, which centers in the acknowledgement of two important processes:

- Firstly, the increased significance of science and technology in terms of economic and social development, and more generally as a factor of social change.
- Secondly, the transformations affecting the ways in which research is produced and the relations between S&T and society.

⁵ Priority 7 – Citizenship and Governance in a Knowledge-based Society, Research Area 8 - Actions to promote the ERA in SSH, the European Commission.

Growing demands for accountability, effectiveness, relevance and justification for government funding of science are changing the contract between science and society. S&T is increasingly becoming a strategic resource for key sectors and countries (cf. Gibbons et al. 1994, Ziman 1994, Etzkowitz et al. 2000, Novotny et al. 2001).

The process has called into play a variety of factors of social nature, including economic, political, cultural, relational, psychological or communication aspects, which in the past looked less important or which, although represented, were less visible as they were handled and mediated through a consolidated system of social institutions.

Changes have taken place in a very short time and often in a chaotic and contradictory manner. They have produced displacements between the accelerated pace of S&T research and the pace required to activate suitable “regimes” (social, cultural, political, organisational, etc.) capable of handling the growing co-penetration of science, technology and society, and exploit the related opportunities and control risks. Such changes have resulted in a gap between the governance of S&T and the society at large.

In order to study and define the features of the gap, the concept of “*socialisation of science and technology*” was introduced by the SS-ERC project team. It refers to the very “regimes” of change, and basically each orientation, act, action, measure or phenomenon of a widespread, collective, organisational or political and social nature, which whether intentionally or not, leads to recognising, interpreting and dealing with the social elements of science and technology. S&T socialisation is the process involved in the production, use and circulation of scientific research and its products in an inseparable connection with its social context. Inadequate levels of S&T socialisation bring about risks which can affect the quality of scientific and technological research, exploitation of the research results, rise of conflicts in the management of technological products and, more generally, the marginalisation of science in the global community.

The project has the objective to, on the one hand, add to the science knowledge reservoir on science and the awareness of the role of social processes in S&T. On the other hand, the objective is to develop new approaches to S&T governance. A key expected outcome of the project was to take a first step towards a broader social “*technological responsibility*”, a term that refers to the importance of the individual and the collective engagement with the processes and the S&T products of science and technology. A new collective engagement may lead to more overall production and quality gains. This should be going well beyond the narrow economic aspects and result in equally important social, cultural and climate innovation achievements.

Key questions that the project addresses are henceforth:

1. Whether the socialisation levels of the European science and technology are adequate and which are the main constraints, weaknesses and strengths of research with respect to S&T socialisation.
2. Which is the added value that social sciences produce, or may produce, in order to increase the socialisation levels of science and technology?

To address these questions, a study of literature within social sciences on S&T was carried out. The study has revealed that last decade social science research on S&T has expanded tremendously. Take alone the fact that approximately half of the 217 social research institutes specializing in science and technology recorded in the SS-ERC study⁶ have been set up over the last ten years. At the same time has the number of publications of social sciences on S&T dramatically increased (the increase depending on the discipline is between 3 and 37 times). This tendency has recently become more evident.

On the basis of the vast literature⁷ developed by social sciences on S&T, a theoretical model has been set up identifying six concepts which characterise S&T socialisation processes and have been the point of departure for the experiments carried out in the six prior mentioned countries involved in the project. These concepts are briefly described in the following:

- **Scientific practice** – comprises the human and social elements (relational, economic, political, psychological, etc.) that inevitably are present in scientific practice, such as in laboratory activities, in interactions between researchers, in solving theoretical disputes etc. and which affect its quality and relevance (although not affecting researcher autonomy).
- **Scientific mediation** – includes the heterogeneous and little formalised set of activities linking scientific and technological research to different social “micro-environments” within which it is produced. It comprises the informal relations between researchers and technicians, management of research institutes or projects, design activities for accessing research funding, interactions between research and teaching or the occupational dynamics affecting careers in science.
- **Scientific communication** – contains the communication involved in S&T production such as for disseminating the results of research activity or for promoting new programmes to be financed. It also includes the communication linked to the valorisation of research and the construction and dissemination of a generalised scientific culture.
- **Evaluation** – comprises sets of practices, programmes or measures aiming to assess and evaluate the aspects directly or indirectly linked to S&T, its outcomes and impacts, such as the validation of research results, the refining of evaluation instruments, the evaluation of research policies, the allocation of funds, the assessments of impact, the forecasting of research programme impacts, etc.
- **Governance** – includes the set of practices, activities and policies (carried out at international, national or local level) geared to steering scientific research towards objectives of collective interest, linking S&T to other sectors of policy intervention (environment, health etc.) and managing, supporting or channelling the participation of civil society in S&T decision making.

⁶ see <http://www.techresp.eu/>

⁷ Nine different disciplinary approaches have been taken into consideration in order to develop the theoretical model; psychology; economics; anthropology and ethnography; communication sciences; management sciences; evaluation sciences; political sciences; sociology; science and technology studies.

- **Innovation** – includes every kind of impact of an economic, social or cultural nature linked to science and technology and regardless of whether it is caused by programmes, measures or actions.

1.2. SS-ERC design

The project comprises two phases. The **first phase** consists of a so-called *mapping exercise* with the aim of making an overview of the involvement of European research institutions in the social sciences and humanities that are engaged in research on science and technology. A *literature review* and a *survey* were carried out, aimed at obtaining knowledge and interpretational tools for the social dynamics linked to scientific and technological research. It also includes the potential, actual role and added value of social and human sciences in support of S&T and the exploitation of its results in economic and social terms. Internet-based search for research institutions focusing on S&T was conducted, *interviews* and *focus groups* with different groups, including researchers, managers and administrators of research institutions, policy-makers, professionals from the media, etc. were organized.

The **results of the first phase**⁸ of the SS-ERC project conducted in the earlier mentioned countries (Denmark, Italy, the Netherlands, Slovenia and Spain) comprise:

- (i) a discussion of the theoretical framework of the project and approach to the analysis of the added value of social sciences in relation to science and technology;
- (ii) conclusions on the capacity of social sciences to provide support in understanding and dealing with science and technology dynamics;
- (iii) the degree of socialisation of scientific and technological research, describing the overall picture of science, technology and society relationship, identified opportunities and risks, policies and instruments to manage them, best practices and success stories;
- (iv) the role and added value of social sciences in relation to the six above described socialisation areas, different sectors, but also in relation to opportunities/risks, policies and best practices.

The **second phase** of the project, based on the results of the first phase, was developed. It consists of developing and performing *experiments* with the aim of strengthening S&T socialisation in Europe. Experiments were set up in five of the ‘areas’ of socialisation identified in the first phase. Each experiment was developed by one of the project partners, and carried out in the respective country, with regular project meetings assuring the coherence of the project as a whole. A total of five experimentations were conducted, aimed at testing concrete forms of cooperation among and between researchers and other science and technology stakeholders.

Results of the first phase of the project were published in a final report (*SS- ERC Project, Final Report*) while **results of both phases** are presented in a synthesis in a **Handbook on the Socialisation of Scientific and Technological Research** (Bijker et al. 2009). The Handbook is broader in scope than the project alone and the different

⁸ See SS- ERC Project, Final Report, <http://www.techresp.eu/>

project's steps are thus completed in the Handbook. The aim of the Handbook is to provide research actors, policy makers and other stakeholders with an orientation assisting them to cope with questions relevant to socialisation of European S&T research, increasing their analysing capacity, interpreting and managing science-society relationships and the social dynamics embedded in the research process at all levels.

1.2.1. The experimentation in Denmark

A key question in the second step of the SS-ERC project involving the experimentation in Denmark is how science, in particular social sciences and evaluation are used in decision making within the Danish S&T framework. The Danish contribution to the SS-ERC experimentation particularly emphasises the role of the social sciences in S&T socialisation processes as expressed in the underlying principles for policy making.

Focus is on the relationship between S&T evaluation and decision making processes among Members of the Danish Parliament. Central questions here are the extent of interest and information on science and technology among politicians, practical use of S&T in policy, use of the social sciences and evaluation in policy making, type of knowledge required in policy and the politicians view on the role of science in society.

The experimentation exercise lasted one year and consisted of four phases: A **mapping of the state of the art** in S&T policy evaluation as the basis for the following **meta-evaluation** of science and technology socialisation in policy; Models of socialisation of science in policy making were identified and a **typology** attributed to particular paradigms was generated on the perception of S&T and social sciences and their role and contribution in policy; Finally, an **experimentation of the typology** was conducted in order to raise awareness on the potential of social sciences to support policy and enhance S&T socialisation.

Before focusing on the experimentation and its outcome, a brief outlining of the Danish science, technology and innovation framework is offered in section B in order to briefly describe the conditions for S&T policy in Denmark. In the following sections the Danish experimentation's different stages are presented and discussed: in section C the meta-evaluation in the Danish experimentation is described and results are presented; section D focuses on the outcome of the analysis of data, comprising a typology of politicians' perceptions of science and technology and an experimental "confrontation" with selected members of parliament.

Section B

1. The Danish science, technology and innovation framework

This section considers the general conditions for the Danish science, technology and innovation system as well as the underlying policy and the strategy behind recent reforms. It provides the background for understanding the Danish science policy development since the beginning of the new millennium. It concerns not only the internal evolution of science but expresses also different politically, ideologically and possibly socially determined perceptions of science. The perceptions determine the research policies and set thus the framework conditions for the knowledge production.

In Denmark, there are in general increased societal expectations with respect to public science contribution to science, technology and innovation. Moreover, there is a long tradition of non-formal, individual-based industry-science interaction. Nonetheless, the debate on these issues has been intensive and there have been raised critical voices pointing out that universities and other public research institutions do not satisfactorily reward or motivate researchers towards a more forceful orientation to cooperation with other S&T actors and communication with society at large. Nowadays, very few question the necessity to adjust framework conditions in order to intensify the interaction between science and society.

The science and technology system in Denmark is at present in the final stages of a major restructuring process - a process which was speeded up in 2006 by the presentation of an inclusive Globalisation Strategy by the government. The overall aim of the various reforms and initiatives has been to create institutional changes and governance structures better suited for coordination and cooperation between the different actors of the research system and the corporate sector. To achieve this goal the overall responsibility for science, technology and innovation policy has been concentrated in the jurisdiction of the Ministry of Science, Technology and Innovation. The government expects these initiatives to contribute to a reinforcement and improved coordination of research and innovation policies. The majority of the reforms, however, are still in the early phases of implementation and the long-term consequences are accordingly uncertain. Whether they will actually lead to a significantly improved science and technology system remains to be seen.

The overall reform paradigm differs little from the philosophy and the strategies that have been used in many other Western European countries. Initiatives aimed at adapting knowledge production at the universities to the needs of society - often through new public management inspired implementations - are by no means unique for Denmark. What has been truly unique about the Danish reform process, however, is the pace by which it has been implemented. Until some years ago the Danish public research system was to a large extent organised according to the autonomy principles and the legitimacy of the Humboldtian tradition, with an independent internal board at the universities and elected collegial leaders. Even though an increasing share of the total Danish R&D funding since the end of the 1980's has been allocated in competition, often through strategic programmes, this was done without fundamentally altering the traditional organisation of the university system. Under the ministerial motto "From Idea to Invoice", the research system and in particular the university system, has however very rapidly been reorganised according to the needs of the corporate sector, and with

general expectations on increased outcome and faster transferability to other sectors of society. The universities gained increased autonomy, established boards with an external majority and appointed leaders at all management levels. There is growing demand on accountability, efficiency and knowledge diffusion. In addition, the total funding system is currently being reorganised to further boost the level of competition.

The Ministry of Science, Technology and Innovation was established in November 2001 after a reorganisation of the former Ministry of Information, Technology and Research. On this occasion the ministry was given the overarching responsibility reaching from academic education and research to innovation and information technology. The responsibilities for the universities were transferred from the Ministry of Education and most governmental tasks related to innovation and high-tech business development were transferred from the Ministry of Trade and Industry. The Minister of Science, Technology and Innovation nowadays has the main coordinating role in matters related to science, technology and innovation policy. The reform process reflects the general transformation that S&T policy has undergone, due to the increasing focus globalisation. This transformation implies that science and technology policy has moved from a periphery position to become a political priority.

Below the ministerial level, there is a system of advisory and funding councils connected to science, technology and innovation, which is briefly described in the following sections, together with the Danish Globalisation Strategy.

1.1. The Globalisation Strategy

Recent years reform activities must be seen in relation to the overall trendsetting policy document on strategy for Denmark in the global economy⁹ – “Progress, Innovation and Cohesion”. The declared aim is to enable Denmark to maintain its position as one of the wealthiest countries in the world and a country with strong social cohesion. The strategy puts increased focus on S&T as one of the main instruments to address upcoming challenges. In addition, it represents a changed perception of knowledge production and how to achieve higher quality, productivity and socially relevant research outcomes. This has resulted in the earlier mentioned paradox: the more valuable science becomes for the state, the stronger the movement towards an abolishment of the privileged position that was given to science as an institution. The trend that has gained ground - following the liberal-conservative government coalition of 2001 - is a conviction of the possibility to optimise outcome of scientific processes through control and steering and an intensified confrontation with societal expectations on productivity and usefulness of research.

The Globalisation Strategy all in all contains 350 specific initiatives which together entail extensive reforms of education and research programmes and substantial changes in the framework conditions for growth and innovation in society. A large part of the proposals aims to strengthening the quality of education and governance of research, and promoting entrepreneurship and innovation. The strategy focuses on improving the efficiency of public spending on education and research, in particular by allocating

⁹ A Globalisation Council was set up in April 2005 comprised by 26 members: 21 high level representatives from all socio-economic sectors and 5 key ministers, including the Prime Minister as the chairman of the Council.

more public funds in open competition. A key objective is to increase R&D spending to 3 percent of GDP by 2010 and thus to fulfil the Danish commitment to the Lisbon Strategy.

Key initiatives within education, research and development are briefly presented in the following:

Education

According to the strategy, new attractive education programmes should increase enrolment in programmes within engineering, science, ICT and health. A Reform of the short-cycle and medium-cycle higher education programmes has been implemented. Institutions engaged in medium-cycle higher education have been assembled in few multi-disciplinary university colleges in order to create strong and efficient study environments. New profession- and practice oriented education programmes are developed. A key aim is furthermore to increase the number of young people who enrol in higher education.

Reform of the universities

Basic funding for universities should be allocated following an overall assessment of the results and objectives relating to the quality of research, teaching and knowledge dissemination. An independent accreditation body should be set up to evaluate all higher education programmes according to international standards. Accreditation should become a precondition for public funding. Young people should complete an education programme with a global perspective and more students should have the opportunity to pursue studies abroad. Framework conditions should be made more attractive for highly qualified foreign students and professors.

Research and development

Research and development should be strengthened. As earlier mentioned, the objective is that public institutions and private companies spend a total of at least 3 percent of GDP on research and development. Public expenditure on research and development should reach 1 percent of GDP by 2010, while private R&D should be spurred by improved framework conditions. Reform of the public research system with the aim to improve the quality of research, the effective use of resources and ensure that public funds are allocated to the best researchers; at least half of all funds should be subject to competition and allocated based on quality criteria. A greater share of the funds should be targeted at large, long-term research projects and at strategic research. As the demand for researchers is growing, the number of PhD students should be doubled. Close relations between companies and universities should contribute to a rapid dissemination of public research results to the private sector.

1.2. The Advisory and Funding System for Research and Innovation

A large share of the public research funds are being distributed to researchers based on competition through the Advisory and Funding System for Research and Innovation. The system consists of the following bodies (see figure 1):

The Danish Council for Research Policy

The council advises the Minister for Science, Technology and Innovation in matters concerning research policy – including the framework of research, major national and international research initiatives, and development of national research strategies.

The Danish Council for Strategic Research

The council supports research in politically prioritised research areas and contributes to strengthening interaction between public and private research. Furthermore, the council is responsible for seeking out new research trends and advice the minister. It is also responsible for approving the allocation procedures and assessing applications in connection with the allocation of government funds by the ministers.

The Danish Councils for Independent Research

The councils provide support to research based on the initiatives – both single-discipline and cross-discipline – of researchers themselves. They provide advice in all scientific fields for the minister and the Parliament. The councils consist of a Board of Directors and five scientific research councils.

The Danish Research Coordination Committee

The main task of the committee is to ensure coordination between all government research funding, whether the funding is allocated at the institutions or under the auspices of public foundations. Furthermore, the committee prepares joint general guidelines for the performance of the funding function of the Councils for Independent Research and the Council for Strategic Research. Finally, the committee provides advice to the minister, the Parliament and Government on researcher training.

The Danish National Advanced Technology Foundation

The foundation's general objective is to enhance growth and strengthen employment by supporting strategic and advanced technological priorities within the fields of research and innovation. Furthermore, the foundation promotes research and innovation in small and medium-sized enterprises. The foundation focuses on nano-, bio- and/or information and communication technology, including the interface between these areas.

The Danish National Research Foundation

It is an independent foundation that aims to strengthening the Danish basic research (frontier research) within natural, technical, health, social sciences and humanities.

The Danish Council for Technology and Innovation

The council advises the minister on issues related to scheduling and development of efforts to strengthen growth and innovation in the business community. Moreover, the council administers specific initiatives assigned to it by the minister.

Apart from the governing and advisory structures, the Danish STI-policy has two further public sub-systems. A public research system and a technology service system. The major research units within the public sector research system are the *universities*. The university system has undergone substantial changes, including a merger process in 2008/9 that reduced the number of universities from 12 to 8. Furthermore 12 out of 15 government research institutes were merged into the new universities.

In the other subsystem, the *technology service system*, there are presently 8 Approved Technology Service Institutes. These are independent, non-profit institutions serving the Danish business and industry on a commercial basis in order to enhance the development and application of knowledge related to technological, managerial and market issues. The institutes encourage firms to engage in innovation activities. The institutes play an important role as producers and transfers of application-oriented and technological knowledge, especially for small and medium-sized enterprises.

Figure 1. The Danish Advisory and Funding System for Research and Innovation



Section C

1. A meta-evaluation and an experimentation

1.1. Overall aim

The aim of the experimentation in Denmark is to map the socialisation of science and technology research in the decision making process and the use of social sciences, in particular evaluation, as a tool for integrating science in society. The point of attention is hence the relationship between evaluation of S&T research and decision making. Focus is specifically on the relationship between science and technology evaluation and decision making processes among Members of the Danish Parliament (MPs). Central questions are:

- interest and information on science and technology research
- use of science and technology in policy
- use of the social sciences and evaluation in policy making
- type of knowledge required in policy
- how to improve the knowledge on S&T by mapping the type of knowledge required to achieve better research-based decisions.
- the politicians' perception of the role of sciences in society and the role of the social sciences in the political process.

The experimentation addresses the overall objectives of the SS-ERC project, namely:

- Evaluation of the role and weight of social sciences in the context of scientific and technological research.
- Identification of hindering and facilitating factors which affect a greater presence and integration of researchers and experts of social disciplines into systems of scientific and technological production.
- Definition of new elements for the design of policies aimed at a greater integration between social sciences and scientific and technological research.
- Rising of the awareness of actors involved in research activities focusing on the relevance of social dynamics linked to scientific and technological production.

1.2. Specific objectives of the experimentation

The specific objectives of the meta-evaluation and experimentation undertaken in Denmark are the following:

- map the role and influence of S&T research on policy making.
- create a favourable environment that enables better integration of S&T knowledge in policy.
- increase the awareness among MPs and other actors on the capacity of S&T to provide support to policy.
- identify the role of social sciences in this context.
- produce an empirical base that enables better use of social sciences in S&T policy making.
- provide operational indications on how the social sciences and in particular evaluation contributes to policy making.

- identify, organise and disseminate information on the role of social sciences in S&T policy.

Accordingly, this phase of the SS-ERC project carried out in Denmark centre on:

- perception of the role of S&T research and influence on policy making
- practical use of scientific knowledge and degree of scientific knowledge integration in policy making (significance and extent of utilisation of S&T research in policy)
- type of disciplinary/interdisciplinary/transdisciplinary knowledge required/used
- policy areas where S&T research is used
- S&T opportunities/risks in relation to policy making

1.3. The different phases of the intervention

The intervention was organised in four phases and carried out in 2008. It consisted of the following phases (see figure 2):

Phase 1.

A mapping of the **state of the art** in science and technology policy evaluation¹⁰. This has been the point of departure for the formulation of a questionnaire, which was the basis for the subsequent meta-evaluation conducted among the Danish parliamentarians.

Phase 2.

A **meta-evaluation** of science and technology socialisation in policy making processes. A questionnaire was distributed to all MPs, assessing the role and influence of science and technology on policy. A total of 124 parliamentarians (69% of all MPs) initially responded to the survey. A total of 72 parliamentarians answered the questionnaire during this final phase.

Phase 3.

Analysis of the meta-evaluation results and identification of models of socialisation of science in policy making; Models were developed based on the questionnaire responses. Rather distinct response patterns were identified in the analysis of the results, and a **typology** attributed to particular science paradigms was generated on the perception of science and technology and its role and contribution to policy.

Phase 4.

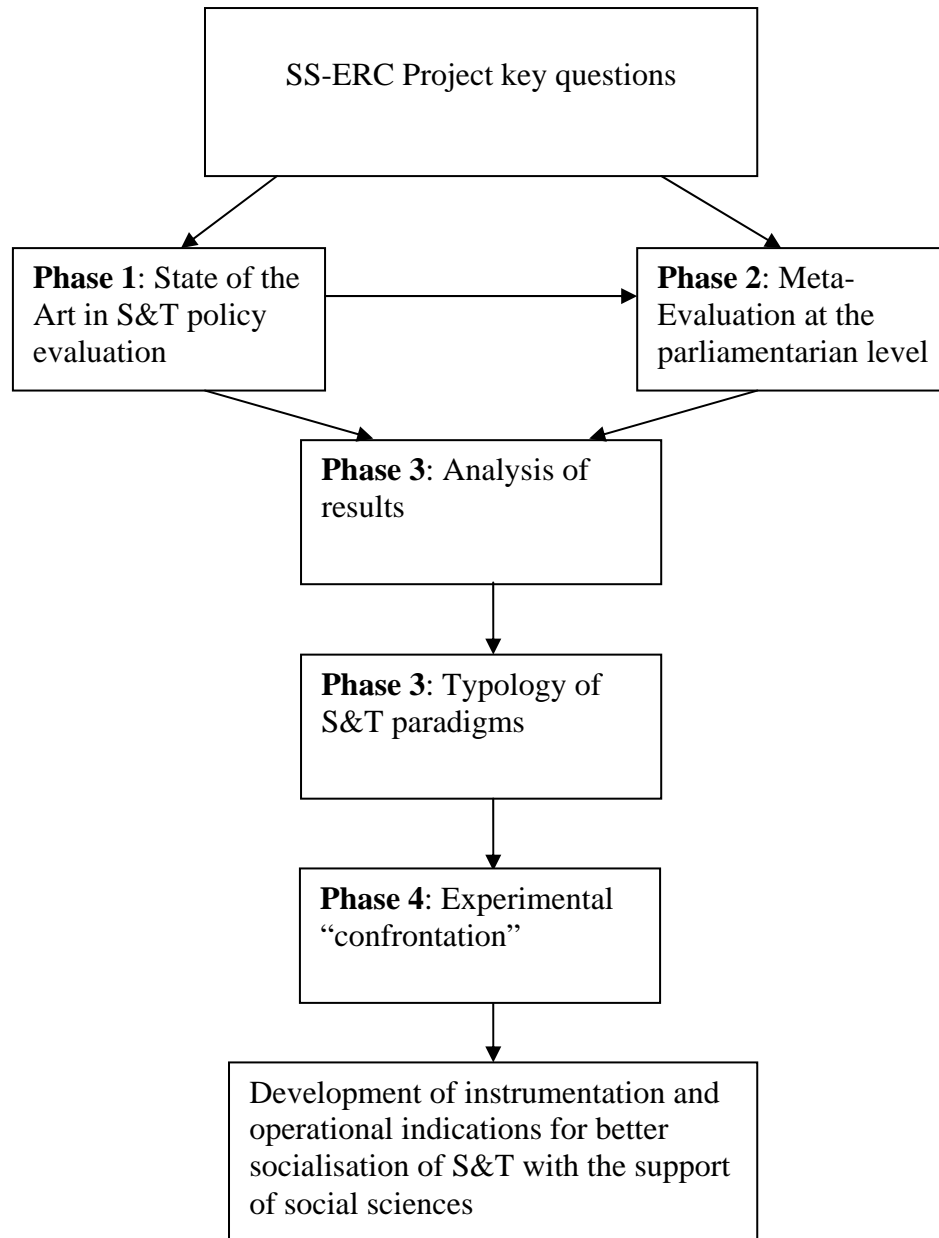
An experimentation of the typology was carried out in order to assess the validity and reliability of the typology on the one hand, and confront a selected sample of MP representatives with the socialisation models, on the other. This component of the experimentation was organized as a “confrontation” of the chairmen of the research committees of parties in parliament with the different paradigms presented in the typology.

The aim of the “confrontation” was to offer stimulus and obtain response in terms of reflections on the relationship between science and society and the role of science,

¹⁰ see Kalpazidou Schmidt, E. (2008): State of the Art in Science and Technology Policy Evaluation. Work package Experimentation, Social Sciences and European Research Capacities. European Commission.

(particularly social sciences) in policy making. The overall objective was thus to stimulate the socialisation of S&T with the use of social sciences and to increase awareness on the capacity of social sciences to support policy.

Figure 2. An illustration of the intervention design



2. The relationship evaluation - science and technology

The attention given to science and technology and the continuous evolution of policies, has spurred an increased interest in evaluation of research, S&T policies and strategies. Evaluation of science and technology has gained importance and become an instrument in policymaking at different levels and within varied contexts.

This development has its point of departure in the acknowledgment that closer links between S&T policy and evaluation are required, as new challenges emerge following changes in the global and European scene, where efforts to enhance socio-economic systems and integrate research systems are intensified. Focus in particular is on the contribution of science and technology to addressing the challenges of the knowledge society and finding solutions to problems. Evaluation, in combination with other instruments, could support these processes.

Evaluations are increasingly used to demonstrate societal relevance of public S&T and prove that policy implementation and investments are worthwhile pursuing. Evidently, the question is how science and technology policy is evolving in the context of growing societal demands for transparency and accountability, on the one side, and greater participation in decision making, on the other. Evaluation could address the question by offering tools to analyse the transformations.

Demands are increasing while knowledge production is nowadays negotiated among a growing number of stakeholders, each with their own, sometimes conflicting, interest. Socialisation of S&T through evaluation is central in this context. Evaluators are increasingly engaged in providing assessments of implemented policies, in offering feedback and advice for policy and strategy formulation.

As a consequence, the role of evaluation in supporting S&T policy has gained importance. The full potential of evaluation, in terms of making it more effective and transparent, improving instrumentation, increasing participatory approaches and its role in valorising the results to attain better quality in decision making, is still under-exploited however.

The following sections discuss the socialisation of evaluation in science and technology policy based on the research conducted in the SS-ERC project, the survey among the Danish MPs and the subsequent experimentation¹¹.

2.1. The role and function of evaluation in science and technology policy

Science and technology policy consists of complex settings that incorporate public initiatives regarding science, technology and innovation, entailing public policies, strategies, regulations and programmes but also the institutions and organisations that perform research. A growing number of researchers in Europe are specialized in S&T evaluation. However, although the reservoir of evaluators is expanding, evaluation is still under-developed in terms of capability to be part of the policy setting. Moreover, as regards the study of the link between evaluation and improved policy making, the evaluation field is yet at an early stage. Socialising the actors of S&T evaluation and the policy makers is a necessity to generate synergies between the relevant networks.

Science and technology policy makers must demonstrate that they initiate meaningful investments with high socio-economic impact. According to one definition, evaluation

¹¹ Key challenges that science and technology policy evaluation faces and operational indications are offered in the final publication of the SS-ERC project, Bijker W. E. & d'Andrea (eds) 2009. Handbook on the Socialisation of Scientific and Technological Research.

in a science and technology policy context is an umbrella term that includes different techniques, methods and measures. It is a mechanism that provides information for policy makers, other stakeholders and the general public on the appropriateness of initiatives for achieving stated objectives.

This definition limits S&T evaluation to accountability or legitimisation and justification of activities. It is a fact that evaluations have traditionally been, and are still in many cases, used to demonstrate control and accountability, and legitimise past actions. Focus has been on quality assessments, allocation of resources, efficiency and effectiveness. However, combined with other methods, such as strategic and foresight approaches, evaluations can strengthen the strategic and analytical potential and attain influence in taking a role that goes beyond traditional activities.

The importance of this particular function of evaluation for the socialisation of science and technology has not yet been fully acknowledged.

Experimentations on evaluation may help decrease the uncertainty in science policy and bridge the gap between science and society. The results of the meta-evaluation and experimentation are presented in the following section.

3. Evaluation of the socialisation of scientific and technological research - key results of the meta-evaluation

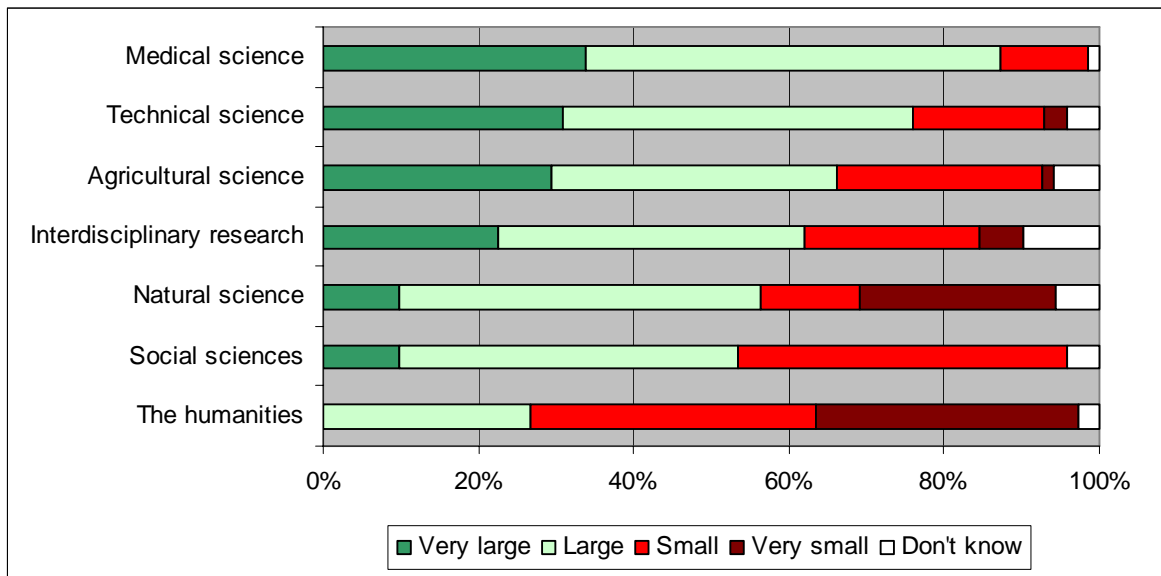
3.1. Significance and usefulness of scientific results

The specific value of the Danish experimentation is that it is based on the politicians' evaluations of central aspects of the science and society relationship. Science is not an object for policy making and governance only; it is also retroactively influencing the decision making process. Politicians make evaluations of research results in their work and use research results as a fundament for argumentation and in outlining coming policy initiatives.

On the other side, politicians take decisions and implement policies that have an impact on research. This refers to the double nature of science policy understood as "...the collective measures taken by a government in order, on the one hand, to encourage the development of scientific and technical research and, on the other, to exploit the results of this research for general political objectives" (Salomon 1977, pp 43-46).

This issue, namely the reciprocal relation between science and policy, has been central in the structure of the Danish experimentation, as well as in assessing the degree of S&T socialisation among policy makers. The first two issues that the politicians were asked to address in the meta-evaluation therefore focus on the relationship between science and the decision making process. Figure 3 illustrates the politicians' perception of the different research fields' relative importance with respect to decision making.

Figure 3. How important are the research results of the following research fields for the political decision making process?



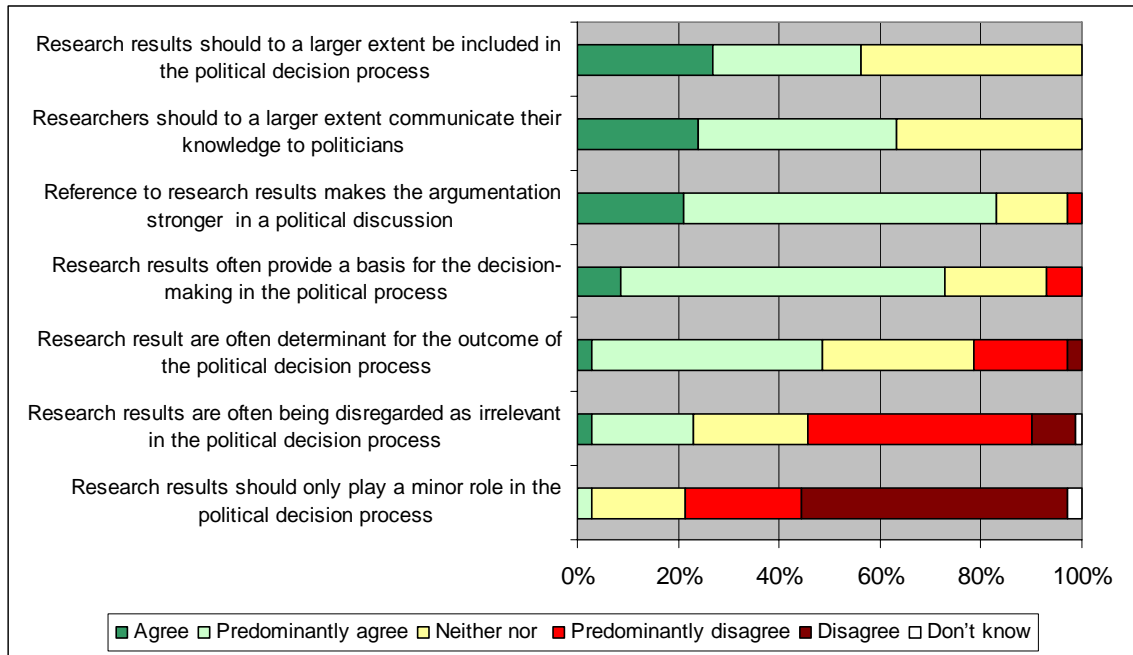
Two noteworthy findings appear in this context. Social science is ranked lowest, considered only slightly more important than the humanities in relation to the political decision making process, while interdisciplinary research is ranked higher than both social sciences and natural sciences in terms of its significance to decision making.

This finding is of high relevance to the general aim of the SS-ERC project, namely to identify the degree of socialisation of social sciences, which obviously is low among policy makers, and to locate hindering factors in terms of social sciences contribution to integration of science in society. The fact that only 10 percent consider the social sciences of being ‘very important’ in relation to decision making reveals a considerable deficit as regards this scientific fields potential contribution to policy.

The question why the social sciences are evaluated as being of minor importance to the decision making process, and which politicians consider the social sciences as less important in this context, are addressed in a following section.

The next figure similarly illustrates the evaluation of the importance of research results in relation to the political process. This again has been carried out through a number of statements that try to disclose to what extent the politicians perceive research results as an influential factor in policy making, as illustrated in figure 4.

Figure 4. Significance of research results in relation to the political process



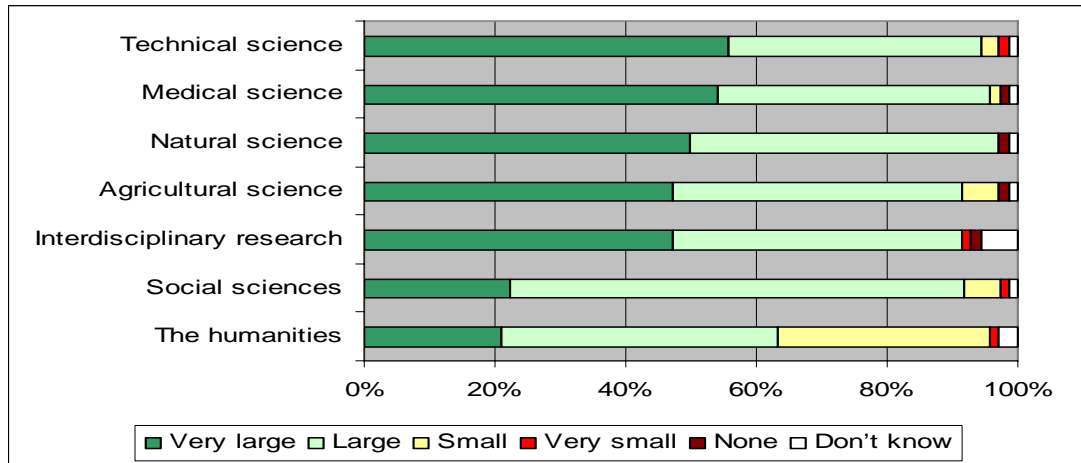
More than 50 percent of the respondents agree or predominately agree with the statement that research results should to a larger extent be included in decision making and that researchers should to a larger extent communicate their knowledge to politicians. None of the respondents disagrees with the statements. 53 percent disagree with the statement that research results should only play a minor role in the political process and only 3 percent agree that research results are often being disregarded as irrelevant in decision making.

The results reveal a noteworthy positive assessment and demonstrate that only very few are sceptical to the contribution of research to decision making. This opens for interesting aspects in terms of the principal discussion regarding the science and society relationship.

Another aspect of the S&T socialisation was addressed by asking the MPs to evaluate the usefulness¹² of science to society corresponding to the various research fields. Figure 5 is an illustration of the usefulness of different research fields, according to MPs.

¹²Usefulness in this context is understood in its broadest sense as any kind of “impact of an economic, social or cultural nature linked to science and technology” as defined in the SS-ERC theoretical framework

Figure 5. How do you assess the usefulness of different research fields for society?

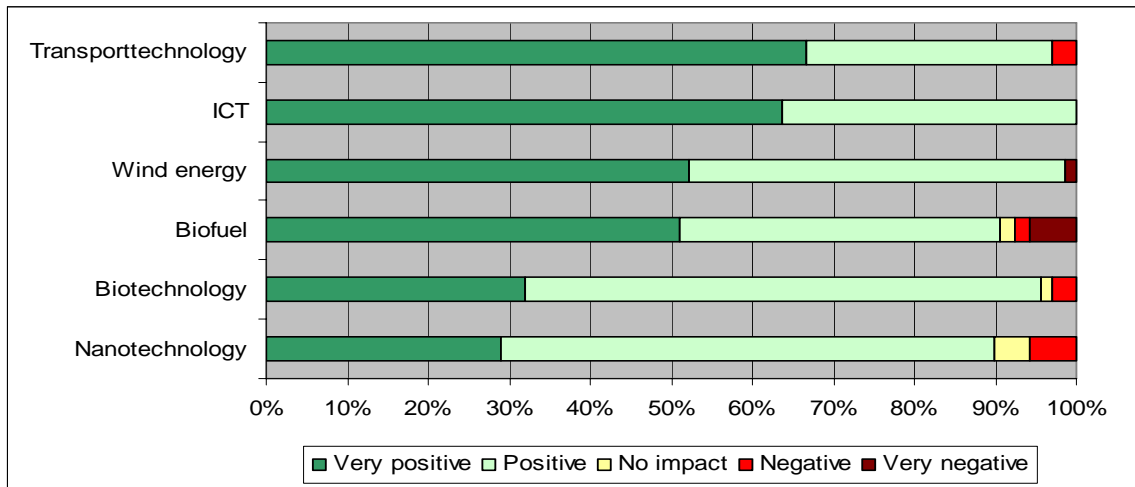


The figure shows an overall notably positive assessment of the usefulness of various disciplines: More than 90 percent of the MPs estimate the usefulness of all disciplines (with the exception of the humanities) to be large or very large. The figure, however, shows a tendency towards linking particularly the technical, medical and natural sciences to usefulness. This is the case for all three disciplines, where more than 50 percent of the politicians have assessed the societal utility of these as being very large. In comparison only 22 percent gave the same answer with respect to social sciences and even lesser for the humanities. Indeed, 32 percent estimated the impact of the humanities to be small. Nonetheless, the total assessment of the usefulness of the social sciences as being very large/large is notably the same as this of the agricultural and interdisciplinary sciences, and almost at the same levels as the other disciplines with the exception of the humanities. Somewhat surprisingly, interdisciplinary research achieves a percentage not far from agricultural and natural sciences.

Accordingly, figure 5 reveals a strong socialisation of S&T expressed in terms of societal usefulness. It shows how S&T is indeed subordinated a social process and socially determined interpretations reflecting current notions of usefulness of research fields; It is worth to notice that the MPs perception of usefulness is linked to strong sectors in the Danish economy such as the technical, medical and agricultural sectors. Accordingly, research within these sectors is assessed of being more useful. A question is hence whether the politicians' views on usefulness reflect a broad societal notion of value and utility - or, as some may argue - a narrow economical perception.

Furthermore, the politicians were asked to assess the impact of various technical disciplines in relation to their future impact on society in order to assess their trust in S&T and trace possible risks, as perceived by the politicians (see figure 6).

Figure 6. How do you assess the impact of the following technologies on society in 20 years?



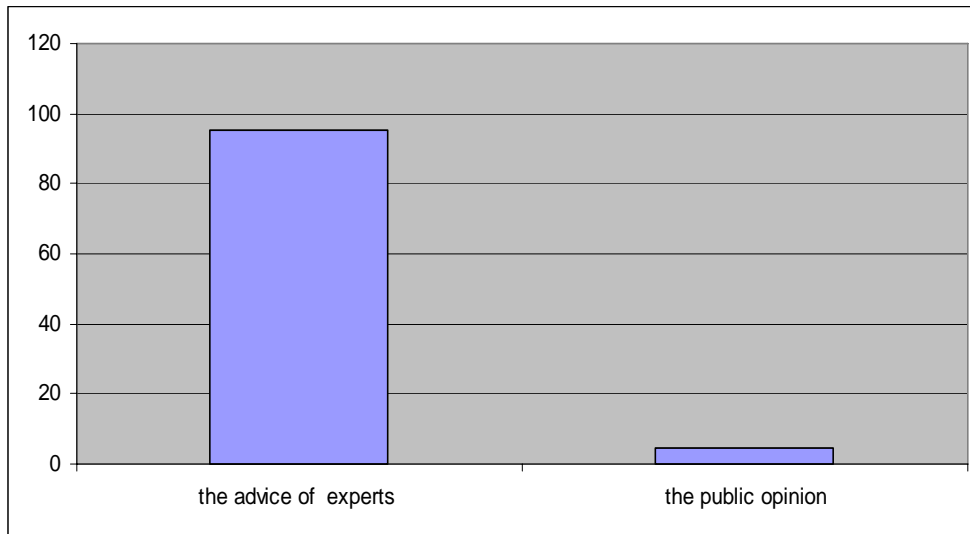
The figure shows a positive assessment of the different research fields in terms of their future impact on society. The figure demonstrates that there is only a remarkable small share of the respondents that see any negative outcome related to the fields in question. This result is interesting from a historical point of view, as large parts of the population, including many politicians, after the Second World War and throughout the Cold War, were sceptical in terms of the potential risks that S&T could implicate. There is an almost complete absence of scepticism in relation to S&T impact among policy makers.

3.2. Evaluation and governance of science and technology

The next question evaluates the status of public opinion as a fundament for decision making and S&T governance on issues related to new technology, seen in comparison to the advice of experts.

Figure 7. Which of the following two statements are closest to your opinion?

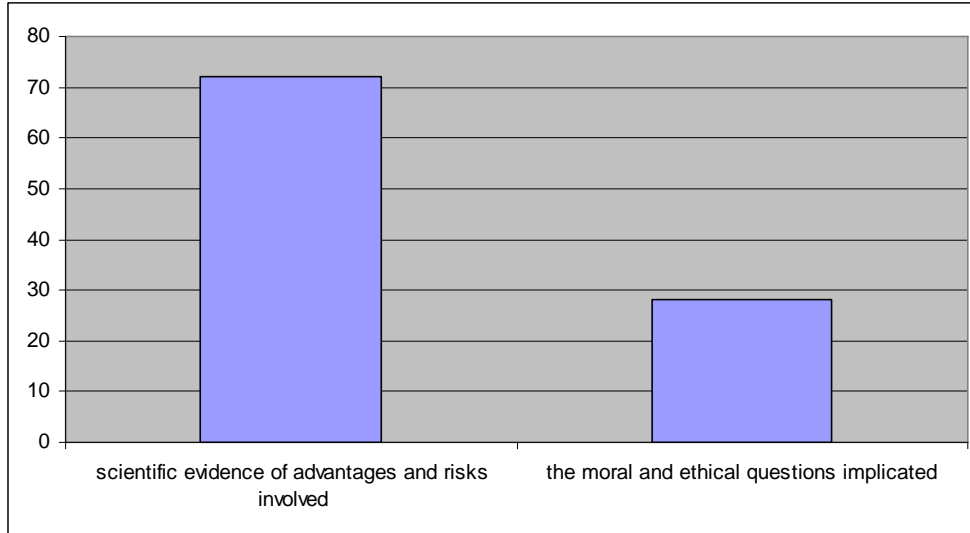
Decisions concerning new technology should primarily be based on the advice of experts or decisions concerning new technology should primarily be based on public opinion



The result shows a clear distribution: 95 percent of the politicians would base decisions on the advice of experts, opposed to merely 5 percent preferring the public opinion. The degree of socialisation of S&T in decision making is also illustrated by the responses to the following question. MP's were asked to specify whether they prefer decisions concerning S&T to be based on scientific risk analysis or rather on moral and ethical considerations. This question, as the previous, was formulated as a compulsory choice question, allowing the politicians to select only one of the statements, as shown in figure 8.

Figure 8. Which of the following two statements are closest to your opinion?

Decisions concerning new technology should primarily be based on scientific evidence of advantages and risks involved or decisions concerning new technology should primarily be based on the moral and ethical questions implicated



The results demonstrate a clear distribution between the two statements. However, the noticed difference is not as striking as in the previous question (see figure 7). 72 percent would rather base decisions concerning new technology on scientific evidence of advantages and risks involved, while 28 percent would base it on the moral and ethical questions implicated in S&T.

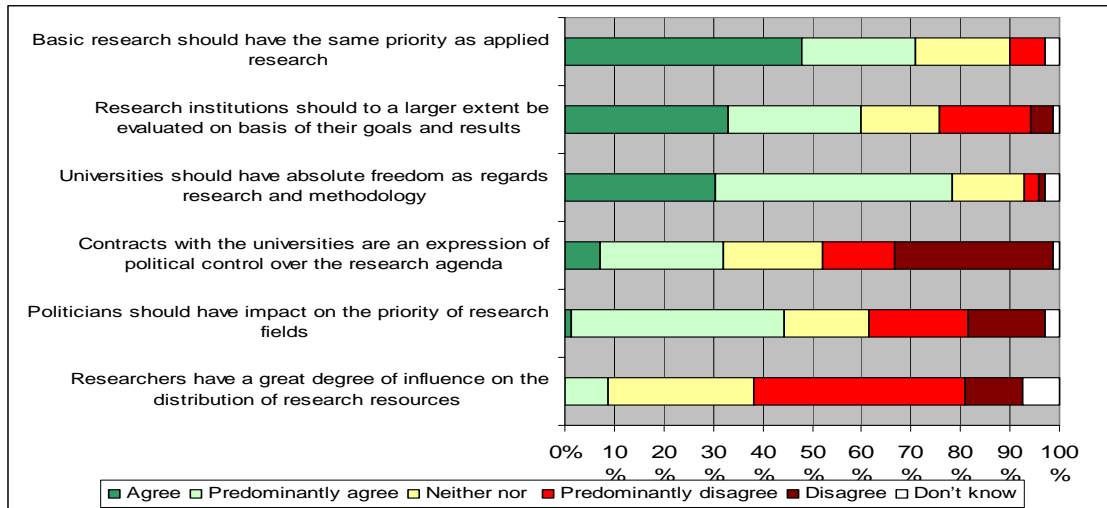
As mentioned above the evaluation and governance perspectives are central concepts in this study. Since the object of the investigation is the central governing organ in relation to framework conditions for scientific practice, the concept of governance obviously requires specific attention in a socialisation perspective. This issue links to the broad, principal discussions concerning the relation between democracy and science. Finally, the governance perspective interlinks with discussions within sociology and philosophy of science regarding “internalist” versus “externalist”¹³ oriented approaches to science and research policy.

Evaluation and governance issues are addressed through an array of questions dealing with central schisms in the relationship between science and policy. This includes the autonomy versus control dichotomy, questions regarding allocation of funds and the relation between different scientific fields or the relation between applied and basic research.

This first set of questions focuses on the evaluation of governance in general and more specifically the relationship between governance and the autonomy of science. This has been put into practice by confronting the MPs with a number of paradigmatic statements related to the issue. The respondents are hence asked to assess some key statements by means of five categories (expressing the extent to which they agree or disagree with these) as illustrated in figure 9.

¹³ For a detailed description see Kalpazidou Schmidt 1996.

Figure 9. Autonomy versus control of science and technology



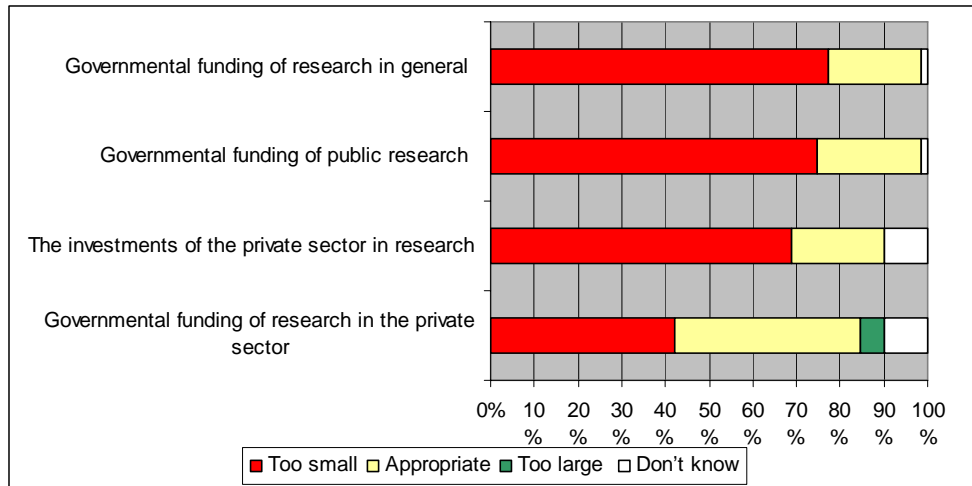
Almost 50 percent of the politicians agree with the statement that basic research should have the same priority as applied research. More than 70 percent agree or predominantly agree with the same statement. 60 percent agree or predominantly agree with the statement that research institutions should to a larger extent be evaluated on the basis of their goals and results, while almost 80 percent agree or predominantly agree with the statement that universities should have absolute freedom as regards research and methodology. Only 7 percent agree with the statement that development contracts¹⁴, signed between the universities and the Ministry of Science, Technology and Innovation, are an expression of political control over the research agenda. Only 1 percent fully agrees with the statement that politicians should have impact on the priority of research fields. Nevertheless 42 percent predominantly agree. 55 percent predominantly disagree or disagree with the statement that researchers have a great degree of influence on the distribution of research resources.

The first impression of the response distribution is that it does not show a clear tendency towards an overall consensus with respect to the autonomy versus control dichotomy. The answers rather indicate very different attitudes and a clear division within the Parliament with respect to this discussion. A closer analysis of the data, offered in the next section, shows though that this tendency appears to be significant as regards overall perceptions on science and technology.

Another question assesses the politician's views on the size of the allocation of research funds in different sectors (see figure 10). This question was addressed to politicians with the aim to map perspectives on the value of science and technology in society, as expressed by the evaluation of the allocation of funding.

¹⁴ Danish universities sign development contracts with the Ministry of Science, Tecnology and Innovation on strategic objectives and how to achieve them.

Figure 10. How do you assess the size of:

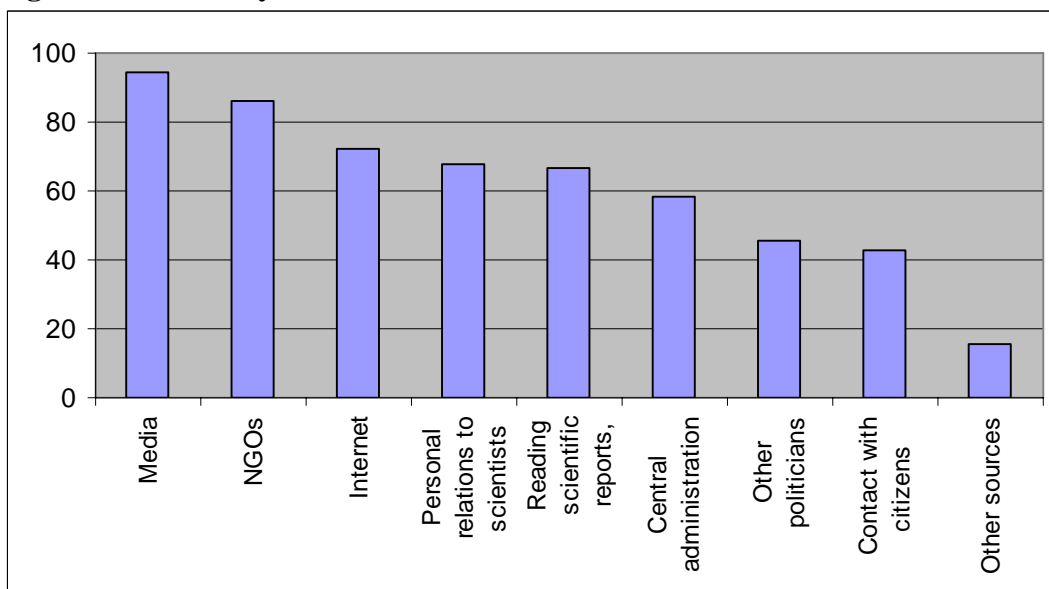


77 percent find governmental funding of research in general to small and 75 percent find governmental funding of public research too small while 69 percent find investments of the private sector in research too small. Likewise 42 percent find governmental funding of research in the private sector too small. An equal amount of the politicians, however, find it appropriate and 6 percent find it too large. The general picture is outstanding, namely a strong wish to increase the overall funding of S&T research.

3.3. Evaluating the importance of scientific communication

The following section considers the specific channels of scientific communication politicians make use of. The key questions are how politicians get information on science and technology, which are the relevant and preferred communication channels and how important are personal networks. The first question pays attention to the channels that MPs use to acquire scientific results, as illustrated in figure 11.

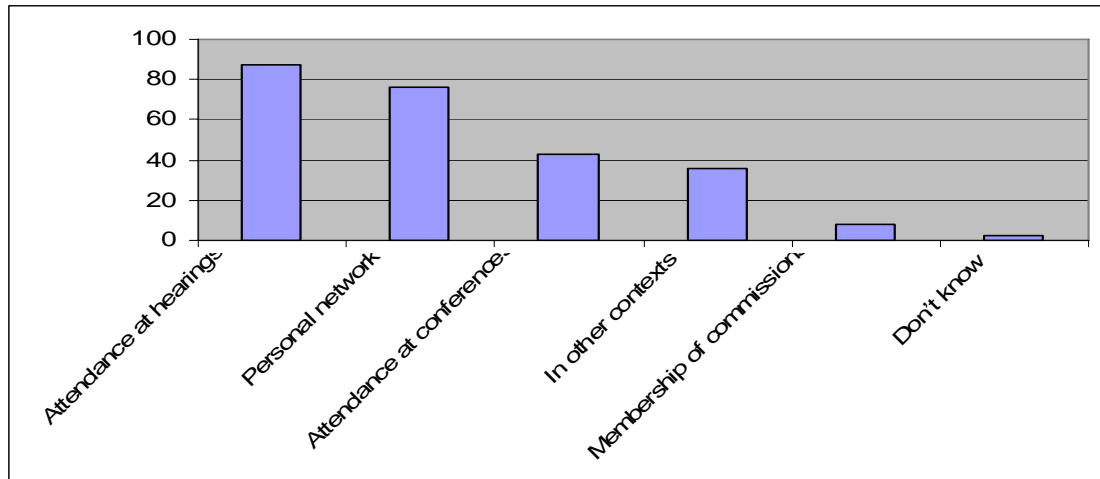
Figure 11. How do you become aware of new research results?



The results reveal that parliamentarians become aware of research results first and foremost through the media, non-governmental organisations (NGOs), the internet and personal contacts. A key outcome in this context is the fact that 68 percent of the politicians become aware of new research results through personal contacts with researchers.

The second question explores specifically the type of personal contacts that politicians have with researchers (see figure 12).

Figure 12. In case you have personal contacts with researchers: in what connection does this take place?

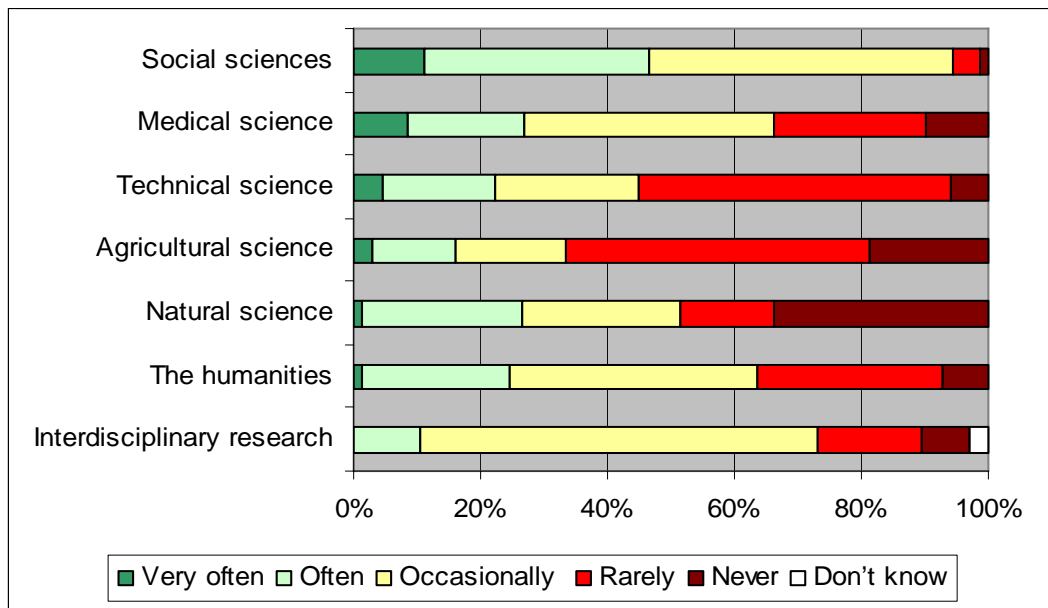


The tendency registered in the previous figure is supported by the fact that personal network, together with attendance at hearings, is ranked as being of great importance in relation to the question on contacts with researchers, as shown in figure 9. 76 percent of the politicians are in contact with researchers through their personal network.

This points out the importance of awareness of the general social and informal aspects of the dynamic interplay in the S&T socialisation. The finding is central to the aim of the SS-ERC project, namely to reveal the social and informal aspects of the S&T socialisation process.

The third question addresses the more formal level of politicians' exposure to scientific processes and research results. Figure 13 indicates to what extent the politicians' are exposed to science and research results, how frequent and with which particular research fields.

Figure 13. How often do you read scientific reports, evaluations, articles and other material from scientists within the following fields?



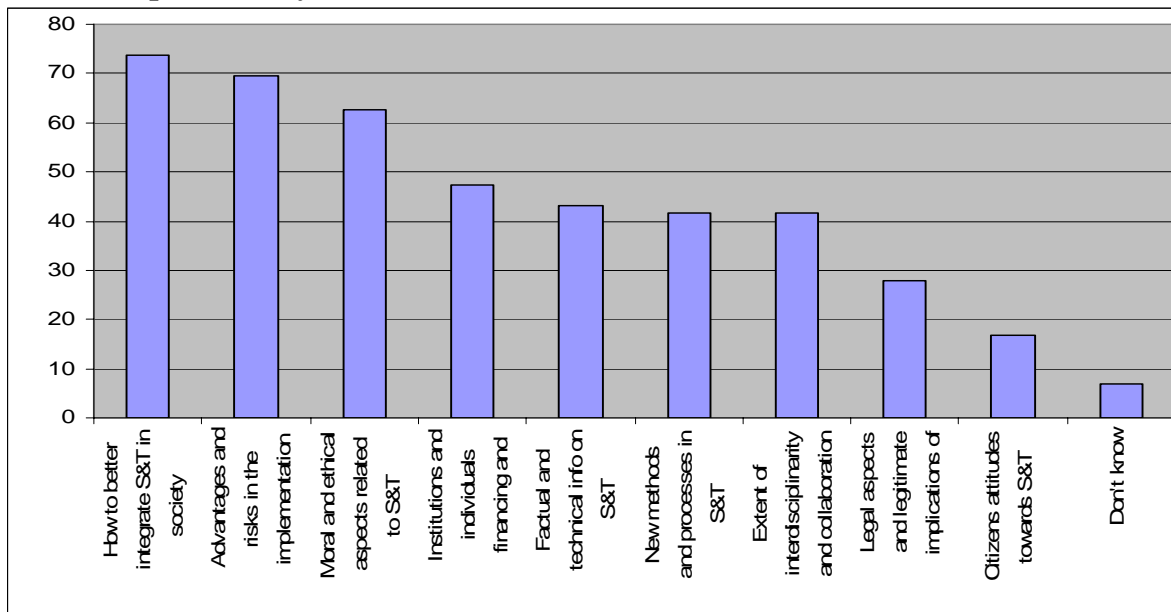
The general outcome is that the politicians rarely or occasionally read scientific material. In the case of social sciences, however, 46 percent very often or often read scientific material. Still, it is not surprising that many respondents state that they rarely read written material. As illustrated in an earlier presented outcome (figure 11), scientific reports are only ranked fifth in terms of channels used to obtain research results. The politicians are more likely to become exposed to science and research results through the media in general, via NGO's, through the use of internet and through personal relations to scientists.

This finding further stresses the importance of being aware of the informal and mediated means of interaction between politicians and researchers as the formal and direct exposure to scientific reports, evaluations, articles and other material from scientists seems to be rather limited. Furthermore, it points out the necessity for better communication, both formal and informal, between researchers and politicians in order to increase the awareness of the existing knowledge reservoir among politicians and amplify the use of research outcomes in decision making.

3.4. Type of science and technology knowledge needed

The following question in the science in policy evaluation deals with the particular types of information that politicians find relevant and valuable in terms of supporting the political decision making process (see figure 14).

Figure 14. What type of information on science and technology are you particularly interested in?



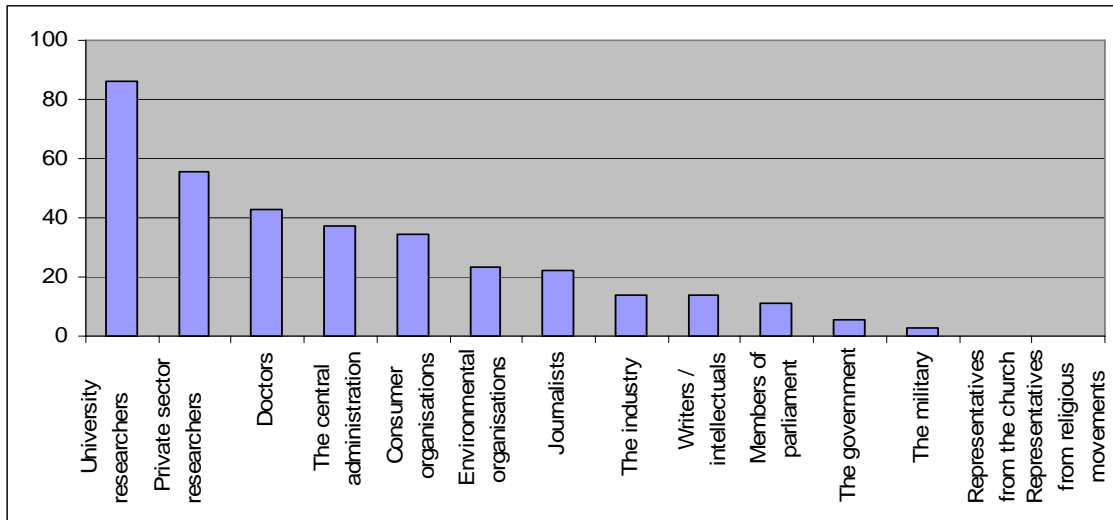
The figure shows a very high degree of interest in a broader integration of science in society, as well as knowledge advantages and risks involved in the implementation of S&T. Additionally more than 60 percent of the respondents are interested in ethical and moral aspects of S&T development, however, not from a classical religious point of view, as illustrated in figure 3. On the opposite side, citizens' attitudes towards S&T are of remarkably low interest to the politicians. This tendency is also backed up by other results obtained in this study (see figure 7).

The interesting issue in this regard is what could be considered as an apparent paradox: On the one side, the politicians' wish to be more informed about the possibility of integrating science better into society and on the other, the parallel disinterest in citizens' attitudes towards S&T. This could partly be explained by the fact that integration of science into society is in current debate in Denmark linked to mainly economic aspects, paying thus less attention to the involvement of the general public.

3.5. Trust on scientists

Another aspect of the S&T socialisation is identified in the perception of which professions or organisations politicians consider the most qualified in terms of explaining the implications of scientific and technological research for society. The question, in other words, deals with the respondents' evaluation of reliance in science compared to other communicators of scientific results and implications of outcomes, as illustrated in the following figure.

Figure 15. Which of the following professions or organizations do you consider the four most qualified in terms of explaining the implications of scientific and technological research for society?

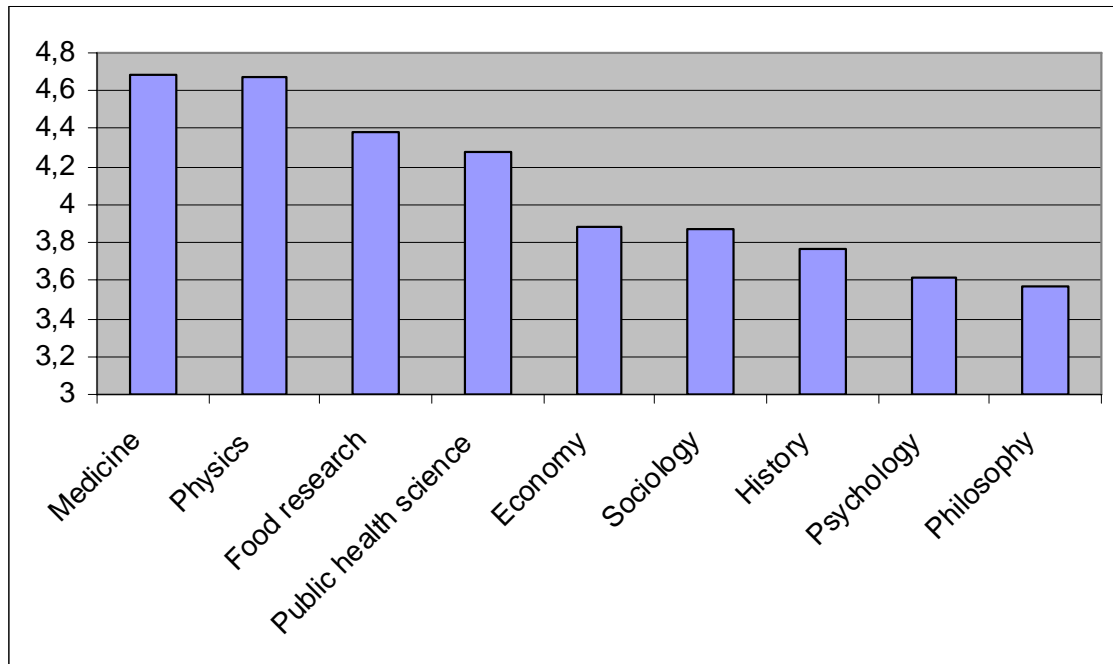


Similar to other findings in the study the politicians demonstrate a very high degree of reliance in scientific researchers - publicly as well as privately engaged. University researchers are evaluated as particularly trustworthy. Close to 90 percent of the politicians state this group as being reliable in relation to the issue. In opposition, representatives from institutions traditionally engaged with ethical judgments (such as religious leaders) are ranked very low compared to researchers.

3.6. Evaluation of the significance of social sciences

The meta-evaluation exercise focuses on the significance of social sciences for policy making and addresses the questions of which research fields the politicians consider as particularly scientific and how they perceive the functions of social sciences in relation to S&T in the knowledge society. Figure 16 illustrates the ranking of the different research fields on how scientific they are, as stated by the politicians.

Figure 16. There are many opinions on how scientific different research fields are. Please rank on a scale from 1 to 5 how scientific you consider the following research fields; (average mean score)

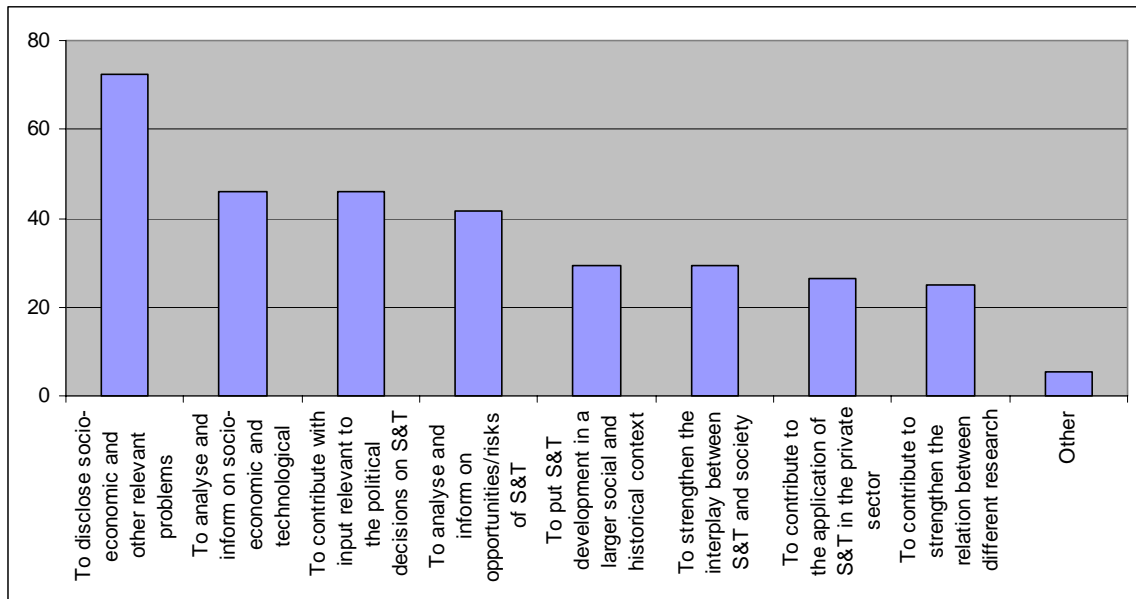


Again, the picture is quite clear. Medicine and physics are considered very scientific, while disciplines within social sciences and in particular the humanities are considered less scientific. The two rather new interdisciplinary research fields ‘food research’ and ‘public health science’ are ranked significantly higher than the disciplines within the social sciences. Economy is ranked on the same level as sociology; significantly lower than medicine and physics.

This tendency supports once again the general notion that the social sciences and humanities in some of the politicians’ views have an obvious deficiency compared to other scientific fields; a very interesting finding in relation to the overall aim of the SS-ERC project concerning the endorsement of social sciences as an important factor in the S&T socialisation process. This view is apparently not shared by all politicians.

The central question is therefore what is the role and function of social sciences in relation to S&T in the knowledge society? The MPs were asked to address the question by identifying the most important functions of the social sciences in this context (figure 17).

Figure 17. What are the key functions of social sciences seen in relation to science and technology in the knowledge society?



The results reveal that the parliamentarians perceive the social sciences key function to mainly be, (i) to disclose socio-economic and other relevant problems, (ii) to analyse and inform on socio-economic and technological development, and (iii) to contribute to the political decision making on S&T. The trend that has been identified in previous questions, namely that the politicians consider research results to be an important contribution to the political decision process, is profound in this outcome as well.

As earlier discussed, the SS-ERC project highlights at least four different ways of using the social sciences in S&T¹⁵: there is a widespread interpretative use (social sciences interpret S&T and the relationship between science and society); a lesser widespread functional use (social sciences provide useful tools and knowledge for handling, steering, measuring and guiding S&T); a rare substantive use (social sciences cooperate with natural sciences on common research programmes); and a sporadic practical use (social researchers play professional type roles).

It is obvious that the MPs first and foremost perceive the social sciences in the frame of their interpretative and functional use, which is the most widespread in relation to S&T.

¹⁵ For a more detailed discussion see SS-ERC project description

Section D

1. A typology of politicians' perceptions of science and technology

This section aims to explore whether the findings of the meta-evaluation presented above are in any way typical to certain categories of politicians, political parties and/or theoretical perspectives. By a closer look at the data, the analysis reveals a strong tendency towards three rather distinct response patterns that can be extracted from the overall response picture. Based on the data analysis, a typology has been developed by means of four key questions that are characteristic to particular approaches to policy making. Factor analysis on the attitudinal items has revealed that these four questions have demonstrated high correlation with a common factor and also high inter-item correlation. Hence, they were merged into a joint variable¹⁶.

The typology on the perception of sciences and their role in society among politicians was created and tested. The typology identified two distinct perspectives, reflecting the two main paradigms, *internalism* and *externalism*, developed within the philosophy of science on how science is organised, controlled and influenced.

According to the MPs in favour of the *internalist* perspective, the development of science is determined first and foremost by structures and processes within the scientific community, reflected in the valuation of all disciplines as similarly useful. According to this perspective, science should only to a limited degree be controlled by external factors.

MPs in favour of the *externalist* perspective view the development of science as influenced mainly by processes in society as a whole and thus value the relevance of disciplines differently, depending on perceptions of their usefulness to society. According to the externalist perspective, science should be controlled and managed by external actors.

In the typology, MPs who are not explicitly advocating for the one or the other perspective (take a standpoint somewhere in the middle) are characterised as “*neutral*”, which in fact does not imply neutrality but rather a middle position (see figure T).

The typology is, as mentioned above, based on paradigmatic statements revealing the respondents' perceptions of the relationship between science and society. The response pattern among MP's has not been initially analysed with the intention of dividing these into specific categories but by a closer examination of the data, the usefulness of the notions was exposed. An interesting part of the investigation is to what extent these

¹⁶ The four items that the politicians were asked to address: (i) research should be oriented towards application in the private sector and society in general, (ii) research institutions should to a larger extent be evaluated on the basis of their goals and results, (iii) funding of public research should be dependent on achieved results of the institution or field of research in question, (iv) use of contracts with universities should be increased in the future. Response categories include ‘fully agree’, ‘tend to agree’, ‘neither agree nor disagree’, ‘tend to disagree’, ‘fully disagree’ and ‘don't know’. An additive index from 4 to 20 is computed based on respondents' score on each item. For purposes of not delimiting N in the model, the few ‘Don't know’ responses are recoded into 3, the ‘neutral’ response category, whereas four system missing respondents (who have not answered the question) were excluded from the model.

perceptions have further consequences as regards the variety of sub-themes in the debate on the socialisation of S&T in society.

The reason for the choice of the externalist versus internalist conceptual framework is that it is closely connected to science and research policy. The main differences in the two concepts as well as the general consequences in terms of approaches to research policy are well known¹⁷. This study, however, does not deal with the philosophical implications of the respective notions, namely whether science is completely distinct from social influences or whether scientific progress is determined by the socio-political climate and the surrounding economic conditions. The assumption is that all the politicians agree on the statement that science should in some way contribute to societal development; the core of the subject is *by what means* and *under what conditions* this should be achieved.

The internalist standpoint assumes that political intervention will only harm the process, distort the outcome and obstruct a development, which on its own is capable of producing the best outcome. The notion is in other words that independent scientists, scientific framework conditions based on self-governance and the internal scientific dynamic will, in the long run, make sure that the best results are achieved.

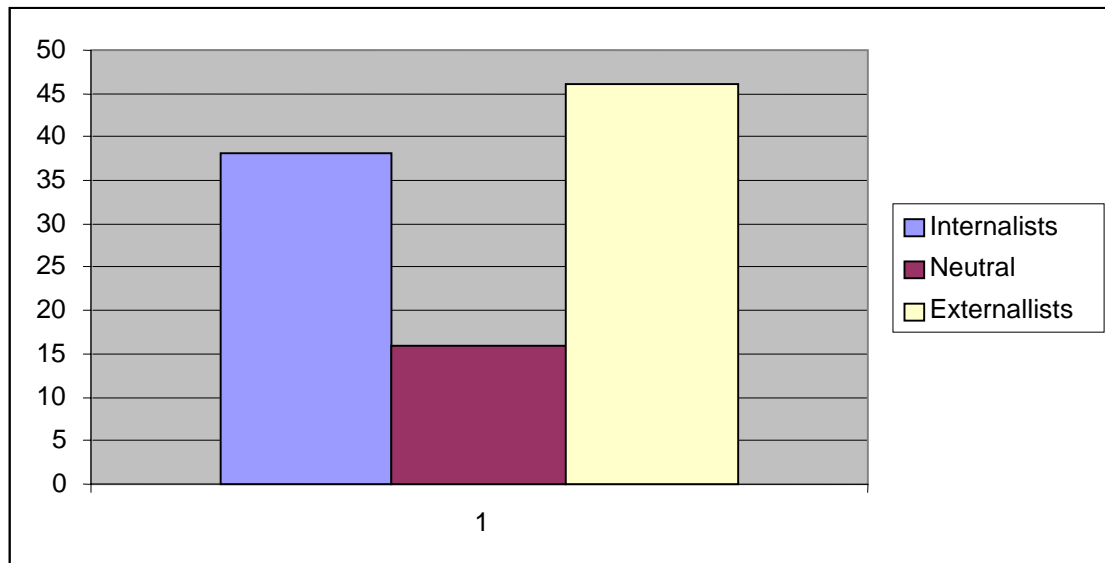
The externalist perspective, on the other hand, is based on the assumption that a higher degree of political intervention can assure more relevant research and an appropriate adaptation of the scientific process that corresponds to societal needs. The instruments used in this process are the measures encompassed in the four statements that are the basis for the analysis, namely the *use of contracts*, *funding based on research outcomes*, *evaluation on the basis of goals and outcomes* and finally a general *orientation towards application of results in the private sector*. In the following, a closer look is taken at the politicians' differences in the perception of the science and society relationship.

The distinct approaches to science and research policy identified - the typology of politicians' evaluations of the use and impact of science in policy making, and perceptions of the relationship between science and society - and their distribution in the Danish parliament are presented below. Figure T1 illustrates the distribution of the main paradigms among the respondents.

The figure demonstrates a rather strong division and polarisation within the parliament with a relatively smaller number of neutral respondents. By examining its diagnostic or predictive capacity, the quality of the typology is examined. This is made by testing the extent to which a person's position within the typology is systematically related with other issues, such as his or her assessment of societal usefulness of different research areas, perceptions of what is scientific and what is not, patterns of science communication and trust in different sources of information, and other findings presented in section C.

¹⁷ For a discussion of the concepts see Kalpazidou Schmidt 1996.

Figure T1. Distribution of the main paradigms within the Danish parliament

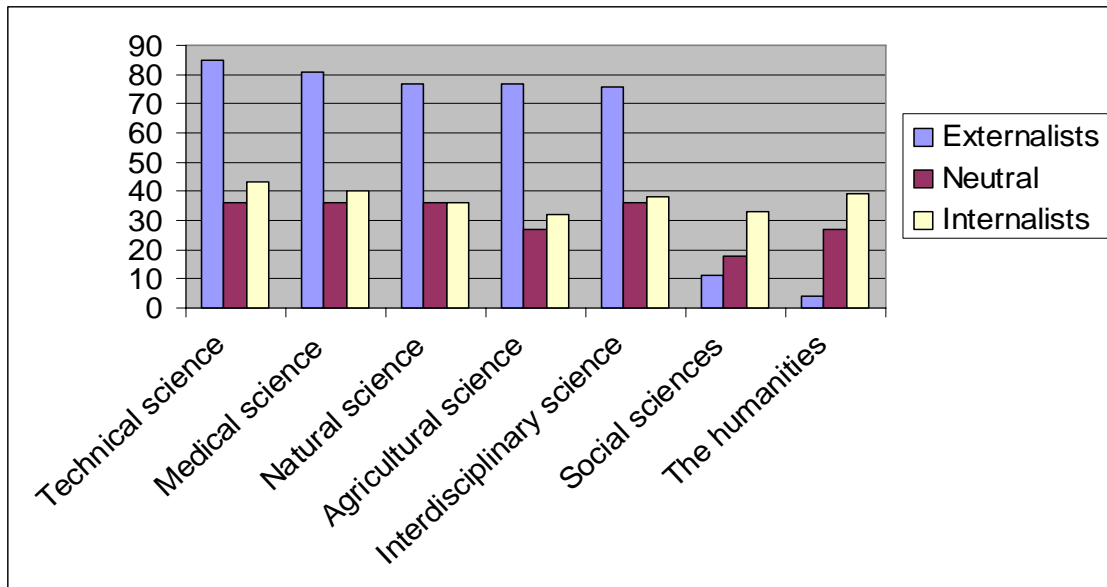


2. Evaluation of the S&T socialisation in a typology differentiated perspective

One of the main questions associated with the internalist/externalist typology is to what extent it implicates distinctions in relation to other areas of the science and society relation. In the previous section, some remarks were made on the MP's perceptions with respect to a more general concept of 'societal usefulness' relative to the different disciplines. The overall picture showed a relative deficit for social science and the humanities compared to other research areas. Figure T2 illustrates the percentage of respondents who state the societal usefulness of different fields of research as being 'very high', structured according to the typology distribution.

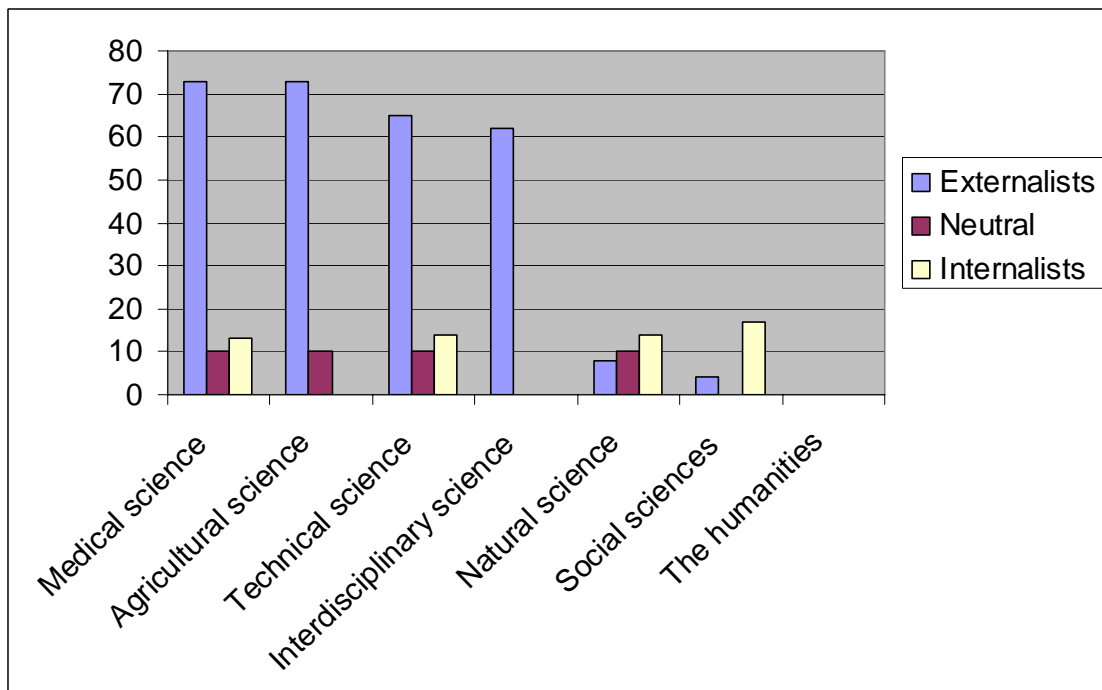
The figure shows a clear distinction between the different scientific fields with respect to the typology distribution. Respondents in the neutral as well as the internalist category assess all disciplines as more or less equal in terms of societal usefulness. The externalists, however, show outstandingly strong differentiation on how useful the different scientific fields are. Between 76 and 85 percent of the externalists rated interdisciplinary, agricultural, natural, medical and technical science in the category 'very high' in terms of societal usefulness while only 11 respectively 4 percent rated social sciences and the humanities as being of 'very high' use. Interdisciplinary science is ranked on the same level as natural and agricultural science, considerably higher than social sciences and humanities.

Figure T2. Distribution of the respondents perceiving the societal usefulness of the different scientific fields as being 'very high' on the externalist/internalist/neutral typology. Percentage.



The politicians' evaluation of the impact of different research fields on the decision making process is equally interesting in relation to the typology distinction and the overall degree of S&T socialisation, as illustrated in figure T3.

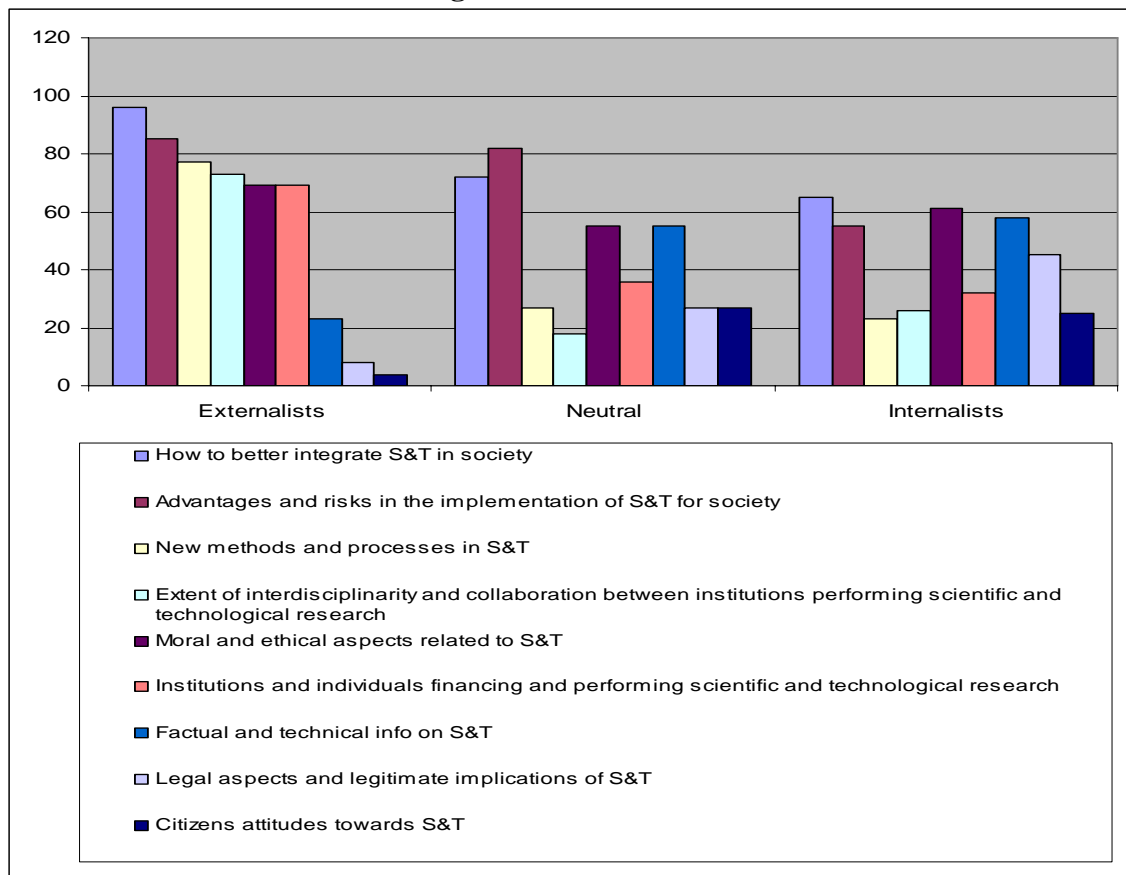
Figure T3. Share of respondents perceiving the impact of the different research fields on decision making as being very high - distribution on the typology. Percentage.



By and large, the picture is similar to the previous figure. The internalists estimate most disciplines to have a relatively equal impact on decision making. In contrast, between 62 and 73 percent of the externalists assess interdisciplinary, technical, agricultural and medical science as having a ‘very high’ impact on decision making. Only 8 respectively 4 percent assess the natural and social sciences as having a ‘very high’ impact on the decision making process. None of the respondents in any of the categories state that the humanities have any impact on the decision process. All in all the analysis reveals significant distinctions in this aspect among the MPs in relation to the typology.

The politicians’ evaluation of relevant information shows a relatively insignificant diversity in the typology differentiated perspective as regards the interest in different aspects of S&T (figure T4). How to improve the integration of science in society is the preferred type of information to acquire among both externalists and internalists. It is also the second most chosen type of information in the neutral category. A noteworthy result, however, is the particular low interest in citizens’ attitudes towards S&T among the externalists.

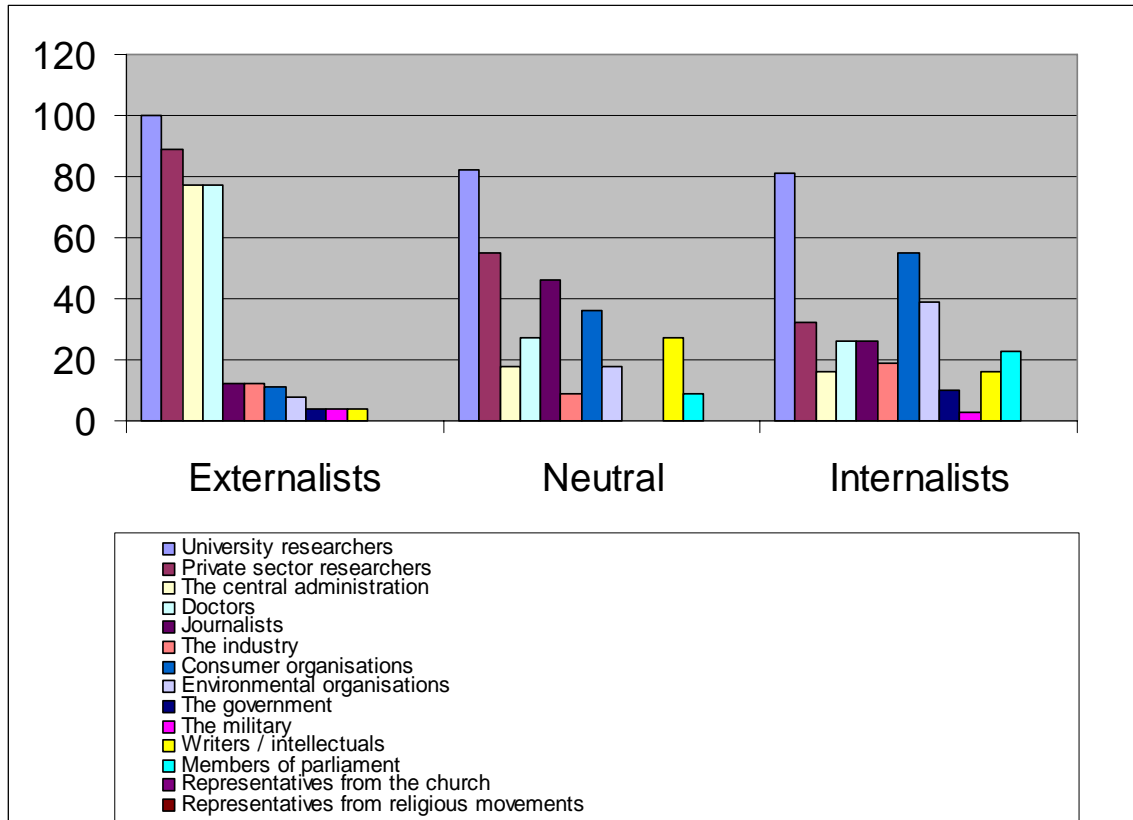
Figure T4. Interest in different aspects of science and technology - typology distribution. Percentage.



As to the reliability of different scientific communicators, the externalists have a particular strong confidence in relation to public as well as private researchers (figure T5). Almost 80 percent of the externalists furthermore put their trust in doctors and the central administration. The remaining scientific communicators are evaluated as significantly less trustworthy. The picture is different among the internalists where the private researchers are considered less reliable than the public scientists. In opposition

to the externalists, the consumer and environmental organisations are among the internalists regarded reliable in terms of explaining the implications of S&T research. Among the neutral respondents, the journalists are perceived as being trustworthy as well.

Figure T5. Trust in different scientific communicators - typology distribution

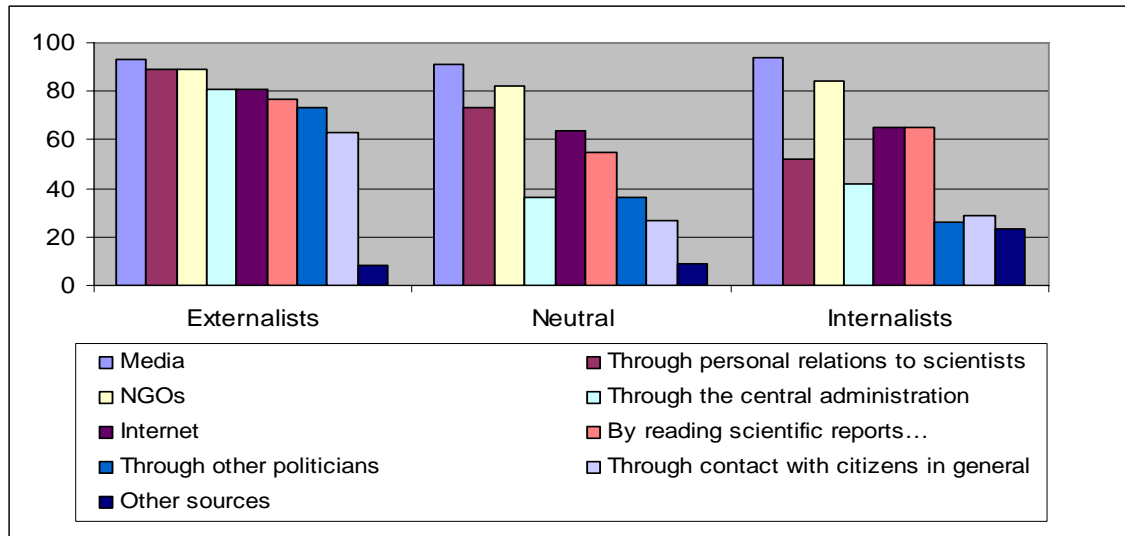


3. Scientific communication in a typology differentiated perspective

The distribution of externalists, internalists and neutrals in the typology in relation to the different information sources used, and modes of communication and contact with researchers is presented and analysed in the following.

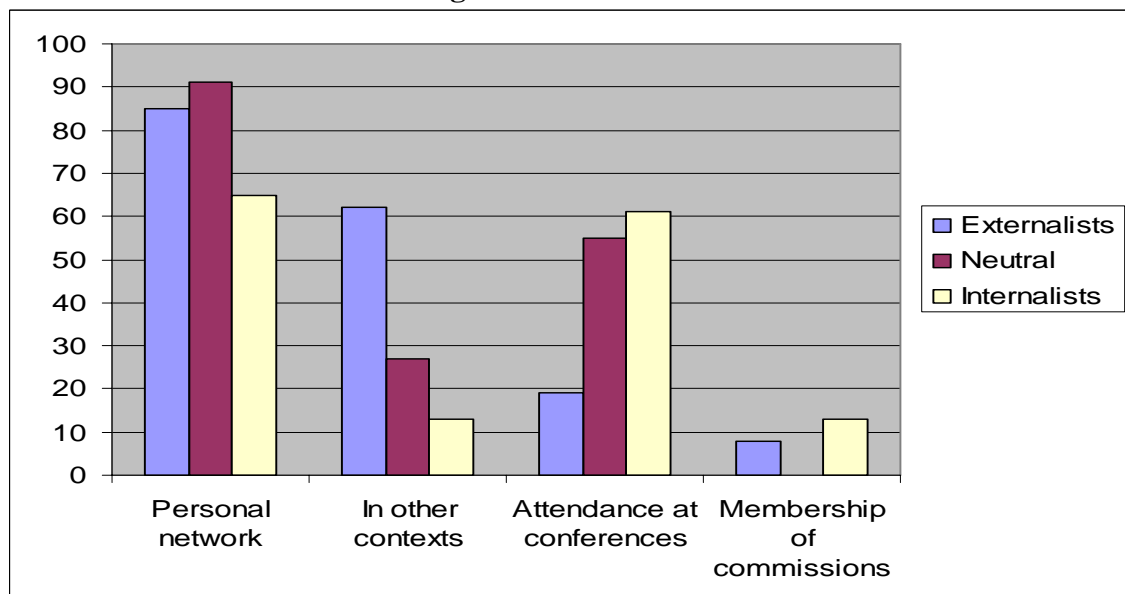
With respect to socialisation of S&T in terms of communication and contacts between researchers and politicians the typology distinction also here demonstrates interesting differences, as figure T6 illustrates. The media is the preferred source of information for all three categories - among the externalists closely followed by relations to NGOs (all the MPs state good relations to NGOs) and personal relations to scientists. 89 percent of the externalists selected this category. In comparison only 52 percent of the internalists use personal relations as sources of information on S&T. The central administration, the internet and scientific reports are other important information sources.

Figure T6. Sources of scientific information - typology distribution



This tendency is further supported by the results presented in figure T7, which reveals that personal network by far is the most common mode of contact between the externalists and researchers. Additionally, 60 percent of the externalists surprisingly stated personal contact ‘in other contexts’ which could be another informal mode of contact. Generally the formal and more official means of contact with researchers are used little by the externalists. 19 percent have contact with researchers by attending conferences and merely 8 percent in connection with memberships of commissions. Generally this is less the case among the internalists. This group of politicians tends to use the formal means of contact and information gathering much more.

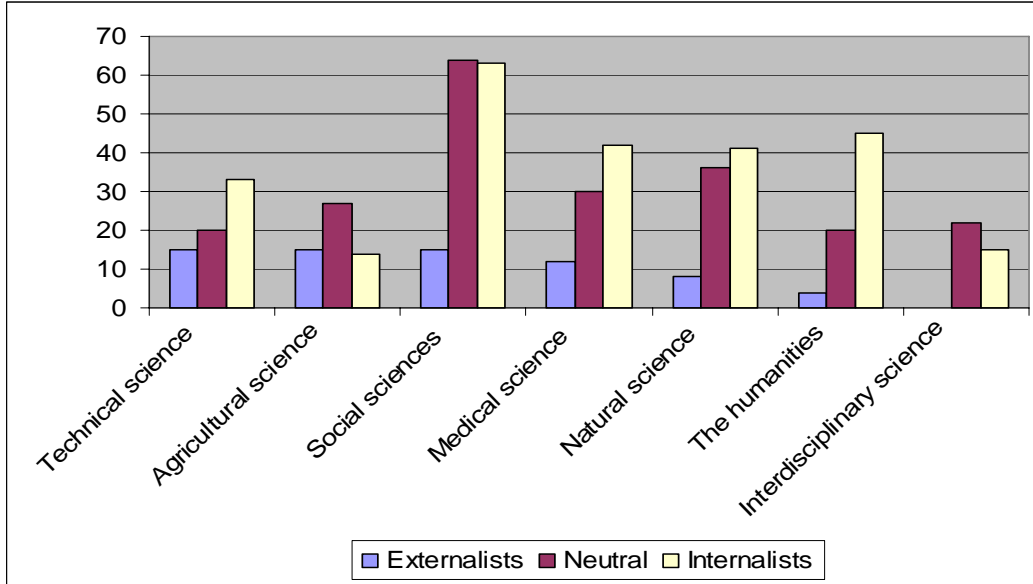
Figure T7. Modes of personal contact between politicians and scientists - typology distribution. Percentage.



The tendency among the externalists to make little use of formal means in terms of gathering information (as in this case scientific reports) is supported in this category. Only between 4 and 15 percent ‘very often’ or ‘often’ read scientific reports and articles from the different research areas. The internalists tend to use this type of information far

more. Between 41 and 63 percent of the internalists 'very often' or 'often' read scientific reports and/or articles from medical science, natural science, the humanities and social sciences. In the case of social sciences, 63 percent of the internalists 'very often' or 'often' read scientific reports and articles in opposition to the externalists where merely 15 percent selected this response category (see figure T8).

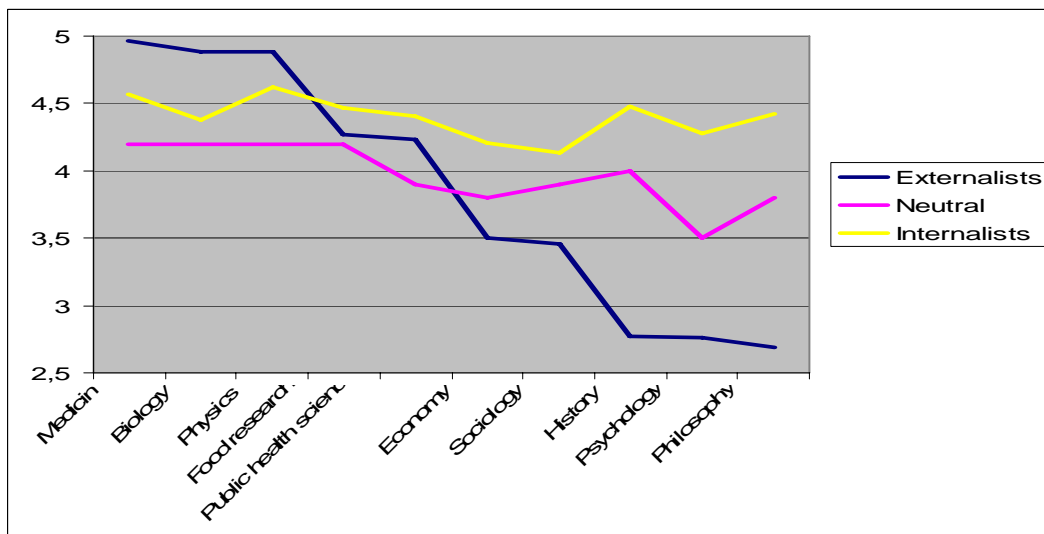
Figure T8. Respondents who very often/often read scientific reports and articles - typology distribution. Percentage.



4. Significance of the social sciences in a typology differentiated perspective

The typology discloses a significant differentiation among the three perspectives on the politicians' valuation of how scientific different research fields are (figure T9).

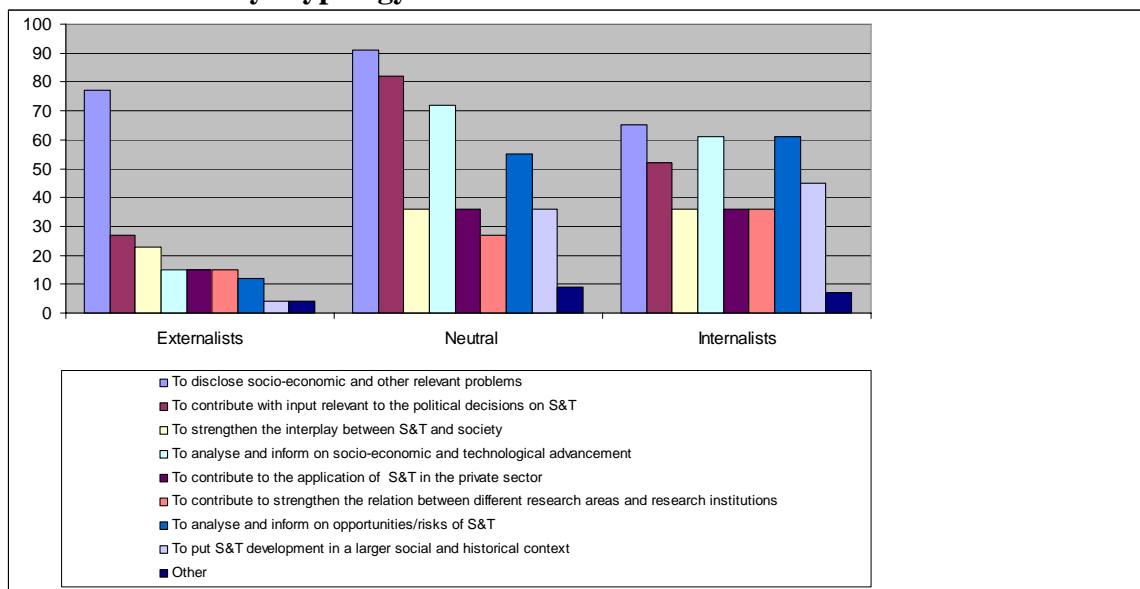
Figure T9. How scientific are the different research areas - typology distribution; mean score on 0-5 index.



As shown in the figure the internalists perceive almost all the scientific research fields as being of the same value. All disciplines receive scores between 4 and 5 which is relatively close to maximum. The externalists, however, make very large distinctions between the disciplines. Research fields such as medicine, biology and physics receive scores close to 5 (the absolute maximum) whereas disciplines within the humanities (history, philosophy) receive comparatively poor scores around 2.7. Within social science the externalists rank psychology particularly low – on the same level as history and philosophy. Economy and sociology are with scores such as 4.2 respectively 3.5 also considered noteworthy less scientific than disciplines within natural sciences.

As to the role of the social sciences, the typology demonstrates some difference in terms of the politicians’ evaluation of the function of social sciences in relation to S&T in the knowledge society, as figure T10 illustrates.

Figure T10: The most important function of the social sciences in the knowledge society - typology distribution.



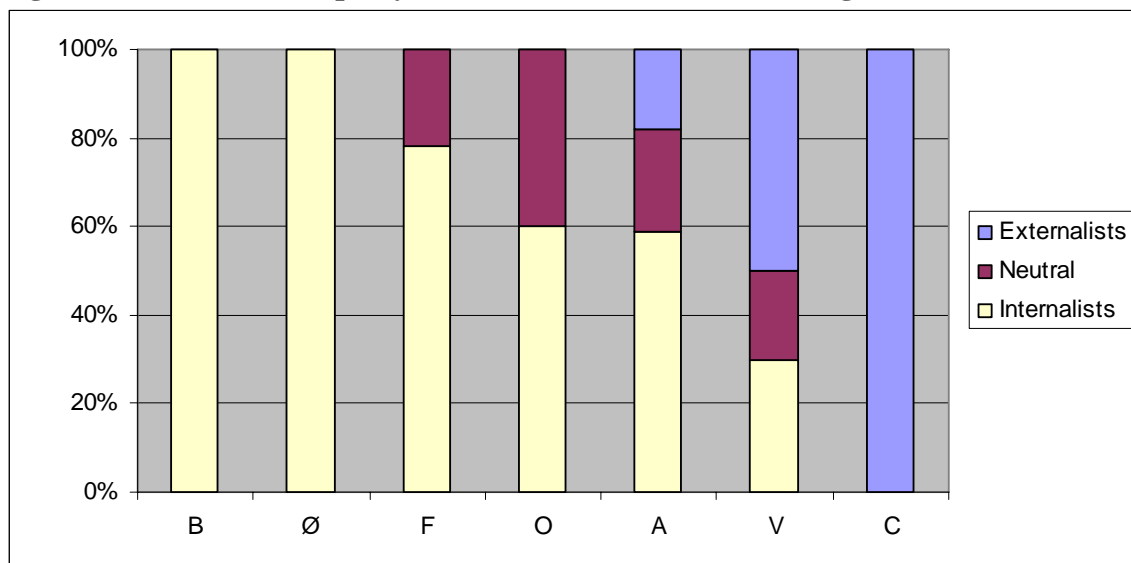
Focusing on the most important function of social sciences, the category ‘to disclose socio-economic and other relevant problems’ is ranked at the top by all politicians. Among the externalists this category is particularly strong compared to other functions of social sciences. The response category second most chosen by the politicians is ‘to contribute with input relevant to the political decisions on S&T’. For the internalists and the neutral category this area is considered almost as important as the former; amongst the externalists, however, considerably less. The functions of analysing and informing on socio-economic and technological advancement, and analysing and informing on S&T opportunities and risks, are strong represented among the internalists and the neutrals. Finally, the figure reveals a more equally distributed perception on the function of social sciences among the internalists and to some degree also the neutrals while the externalists perceive the function of the social sciences as being more interpretative and to a lesser degree functional.

5. Conclusions on the meta-evaluation

In conclusion, as seen from the SS-ERC project perspective alone, the most “interesting” categories of politicians are situated in the poles, namely in the externalist and the internalist group. In particular the externalist category of MPs is of interest: *firstly*, because it represents a renunciation of the traditional internalist ethos that science is able to evolve within a framework independent from societal interests and merely be concerned with the search for truth. This makes the externalist category particularly interesting, seen in relation to strategies aimed at integrating science into society; *secondly*, because the externalists constitute the majority of the respondents from the governing parties within the Danish parliament (figure T11) and are at this point in time, based on the Globalisation Strategy, implementing policies that aim at integrating the different sectors of the economy.

The governing parties are the conservative party “Det Konservative Folkeparti” (C) and the liberal party “Venstre” (V) – both represented to the right in figure T11, while the internalists are to be found mainly among the opposition parties. As illustrated in the figure, the majority of the externalists represent the governing parties, responsible for outlining the Danish S&T policy after 2001.

Figure T11. Crosstabs – party affiliation with index. Percentage.



As analysed in section C and D, a number of findings are particularly interesting in relation to the socialisation of science in society. Summing up the issues in relation to the response pattern, the following response pattern among the MPs can be established:

- high degree of trust in researchers and science as foundation for policy making compared to other factors, such as moral and ethical judgments or public opinion.
- positive assessment of the contribution of research results, specially medical and interdisciplinary sciences but also social sciences, to the political decision making process. Reports from social sciences are the most frequently used to get information on scientific results.

- very high degree of reliance in scientific researchers - public as well as private sector and less trust in other scientific mediators such as environmental organisations and journalists.
- differentiation in terms of usefulness of the various disciplines, revealing a very positive assessment of medical, technical, natural and agricultural science, but also interdisciplinary research opposed to a less encouraging valuation of social sciences and in particular the humanities.
- differentiation in perceptions of the impact of different scientific fields on policy. Accordingly, the impact of medical, technical, agricultural and interdisciplinary sciences is high¹⁸. These perceptions are in contrast to widespread views among MPs on the limited impact of natural and social sciences, and the humanities in particular.
- high interest to base decisions concerning new technology on the advice of experts and not primarily on public opinion.
- high interest to base decision concerning new technology primarily on scientific evidence of advantages and risks involved in S&T than on moral and ethical questions implicated.
- ranking of the key functions of social sciences as follows: the most significant role of social sciences is to identify socio-economic and other relevant problems, analyse socio-economic and technological development, contribute to policy making, and analyse and inform on opportunities/risks linked to science and technology.

After examining the response patterns and conducting the typology analysis, the general impression is a number of unexpected contradictions. A striking fact in this context is that the politicians in the externalist category – who are expected to be characterised by a strong interest in enhancing a more forceful socialisation of science in society – are in fact demonstrating a low interest in a variety of science and society relations issues.

In addition, the externalists are not particularly convinced about the usefulness of social science and the humanities, although these are the areas where a broad interpretation of S&T and its implications in relation to society in general takes place. They similarly evaluate the impact of social science on the political decision process as very small compared to “hard sciences”. What is somewhat surprising about the externalist response pattern in general is that it does not show a particularly strong will to increase the socialisation of science in society. The reason could be that the externalists are confined mainly to the economical aspects of scientific and technological research.

¹⁸ Denmark has a strong medical and agricultural industry.

6. The experimental intervention

In the last phases of the intervention, the typology on the perception of sciences and their role in society among politicians was tested. This was done to assess the validity and reliability of the typology, on the one hand, and “confront” a selected sample of MP representatives with the different perspectives, on the other. This component of the experimentation was organized as a “confrontation” of the chairmen of the research committees of parties in Parliament with the identified paradigms. The chairmen of the research committees of parties in Parliament, involved in the intervention, represented each a distinct S&T socialisation perspective.

The intervention was an attempt to obtain response in terms of reflections on the relationship science and society and the role of science, particularly social sciences can play in policy making. This phase of the experiment aimed to raise awareness on the capacity of science to support policy and actively promote the social sciences as a policy instrument. The aim of the experimentation was hence to contribute to creation of a more favourable environment for social sciences that might possibly enable an increased socialisation of science in relation to policy making.

During the experimentation, the positions in the Danish Parliament were quite polarised, with the externalists comprising the majority of the MPs, including almost all parliamentarians from the government coalition, while the internalists were mainly identified among the opposition parties. The number of MPs with a “neutral” position was limited.

Based on the received responses and the subsequent analysis, three research policy spokesmen were invited to participate in this phase of the SS-ERC project. Each spokesman could be seen as a representative of one of the three perspectives identified in the typology:

- A research policy spokesman, who responded to the questionnaire with a clear internalist approach
- A research policy spokesman, who made a “neutral” response to the questionnaire
- A research policy spokesman, who responded with a clear externalist approach

The experimental “confrontation” was conducted by first describing the three perspectives identified in the typology and the corresponding approaches to the science and society relationship. The politicians were asked to what extent they could confirm the description of the three archetypical approaches to science and research policy and recognise the positions in the parliament and in relation to S&T policy making. A presentation of the typology to the party spokesmen was made as follows:

- The internalists believe that internal scientific processes make up the best fundament for achieving results within a given research area. This means that independent research – set free from political and economical objectives – will deliver the best results in the long run. They find that political and societal goals and influences may jeopardise the scientific process and outcome in case it forces the researcher to focus on other aspects than the internal scientific logic.

Political, economical and societal objectives should be kept at arm's length distance from the scientific process.

- The externalists find that research with benefit can be oriented towards political and societal objectives and priorities – both in the sense that the results the researchers try to achieve reflect the needs of society but also in the sense that scientific processes and framework conditions for research production should reflect the rest of the society. S&T should consider the general societal demands for results, productivity and transferability of outcomes.
- As the notion implies, the MPs characterised as “neutral” are not explicitly advocating for the one or the other approach, and the consequences it has for the way research policy is carried out, but favour a position in the middle, compared to the other perspectives.

Two of the spokesman for research policy who responded to the questionnaire gave a positive response assessing the typology while one stated that it was difficult to recognise the typology categories and that, with very few exceptions, all MPs are in the neutral category.

The research policy spokesman, who initially made a neutral response to the questionnaire, indicated during the “confrontation” a tendency towards a more internalist viewpoint. This is likely a consequence of the recent intensive debate and negotiation process in the Danish parliament regarding allocation of funds for research; in a negotiation process, positions tend to become polarised.

It is of importance to pay attention to the fact that all MPs responding to the project questions focus on issues such as funding, allocation of resources and economical parameters. There are several likely explanations to this. The most obvious is that politicians use funding as an instrument in policy making, taking decisions on allocation of resources, prioritisations etc. At the time of the experimentation, an intensive debate and negotiation process in the Danish parliament regarding allocation of funds for research had just been finalised. The funding issue was therefore high on the agenda of the spokesmen participating in the study.

The “confrontation” with the different perspectives aimed to question and discuss the specific standpoints, in particular the polarisation noticed at the Danish parliament. However, it is evident that at present, although results of the different phases of the experimentation are analysed, it is difficult to assess the outcome of the SS-ERC experimentation as a whole.

7. Wrap-up and concluding remarks

The Danish experimentation comprised four phases: (i) a description of the state of the art in science and technology policy evaluation, which constituted the basis for the following meta-evaluation conducted in the Danish Parliament; (ii) a meta-evaluation of science and technology socialisation in relation to policy making. A questionnaire was distributed to all the MPs, to map perceptions of S&T, interest in and evaluations of different research fields and practical use in policy making; (iii) a typology attributed to particular science paradigms generated on the perception of science and technology and

social sciences and their role and contribution to policy making; (iv) an experimental exercise of the typology performed in order to assess the validity and reliability of the typology on the one hand, and “confront” a selected sample of MP representatives, the spokesmen of the research committees of political parties in parliament with the socialisation models, on the other.

The main results of the meta-evaluation gave the following response pattern:

- high degree of trust in researchers and science as a foundation for policy making compared to other factors, such as moral and ethical judgments or public opinion.
- positive assessment of the contribution of research results to the political decision making process, specially of medical and interdisciplinary sciences but also of social sciences. Reports from social sciences are the most frequently used to obtain information on scientific results.
- high degree of reliance in scientific researchers - public as well as privately engaged, and significantly less trust in other scientific mediators such as environmental organisations and journalists.
- differentiation in terms of usefulness of the various disciplines; a positive assessment of medical, technical, natural and agricultural science, but also interdisciplinary research (as opposed to a less encouraging valuation of social sciences and in particular the humanities).
- differentiation in perceptions of the impact of different scientific fields on policy. Accordingly, medical, technical, agricultural and interdisciplinary sciences impact is high. These perceptions are contrasting common views among MPs on the limited impact of natural and social sciences, and in particular the humanities.
- significant interest to base decisions regarding new technology on the advice of experts, and not primarily on public opinion.
- considerable interest to base decision making relating to new technology primarily on scientific evidence of advantages/risks involved in S&T than on moral and ethical questions.
- ranking of the key functions of social sciences as follows: the most significant role of social sciences is to (i) identify socio-economic and other relevant problems, (ii) analyse socio-economic and technological development, (iii) contribute to policy making, and (iv) analyse and inform on opportunities/risks linked to science and technology.

In the last two phases of the experimentation, a typology on the perception of sciences and their role in society among politicians, was created and tested. The typology identified two distinct perspectives, reflecting the two main socialisation paradigms, internalism and externalism, developed within the philosophy of science on how science is organized, controlled and influenced.

This phase of the experiment was used to raise the awareness on the capacity of science to support policy and actively promote the social sciences as a policy instrument. The experimentation aimed thus to create a more favourable environment for social sciences that might possibly enable an increased socialisation of science in relation to policy making.

Science and technology policy in complex systems ought to be based on systematic approaches of informed actors. Systematic approaches in policy require methodical use of research outcome. Bridging the gap between scientists and policy makers could increase the use of S&T results and improve the level of socialisation of science and technology.

To sum up, the meta-evaluation and experimentation in Denmark has addressed the key question on how to achieve higher socialisation level of science and technology in order to overcome the gap between policy makers and scientists. Social scientists offer tools that enable policymakers to better understand S&T processes and help use research results. The awareness of the conditions for decision and policy making should likewise be increased among the scientists in order for social science to become an effective socialisation instrument for S&T. Approaches as the one used in the SS-ERC framework among the Danish MPs is one way to bridge the gap and achieve higher socialisation levels.

Socialisation implies the need for an increasing awareness of how important it is to strengthen ties between science, technology and society. This awareness needs to be translated into action. It is therefore of vital importance to reinforce the position of S&T in society not only by promoting it, but also by considering the significance of social processes for S&T socialisation. As science and society cannot be seen as separate entities, socialisation ought to be a task for the scientific world, research managers, policy makers and the society at large. Science cannot function if it is not adequately socialised. Low levels of socialisation could result in a scientific and technological deficit, characterised by shortage of scientific competences and technological skills, low quality research, decreasing economic competitiveness, and difficulties to address social, cultural, environmental and other issues.

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