Science Policy

Setting the Agenda for Research

Proceedings from MUSCIPOLI Workshop One

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**The Danish Institute for Studies
in Research and Research Policy
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Foreword

Science Policy - Setting the Agenda for Research

Experience with problems attached to “managing with uncertainty in science policy” is the background for the European project, called MUSCIPOLI, which in august 2001 got a grant from EU to organise three workshops. The project is financed as an additional measure under the Strata program.

In this report we present proceedings of the first of these workshops, which in September 2001 was held at Molskroen in Denmark with the topic:
Science Policy - Setting the Agenda for Research.

The workshop had participation from university researchers, researchers from government research institutes, research administrators, members of research councils, members of advisory bodies and representatives of industry and business, altogether 25 people from 12 European countries, bringing together experiences from the northern, the southern, the eastern as well as the western part of Europe.

On the basis of the presentations collected and presented in these proceedings a number of discussions took place and a summary of the discussions and some conclusions are presented in a separate chapter.

The workshop was organized by The Danish Institute for Studies in Research and Research Policy in cooperation with Heide Hackmann from University of Twente in The Netherlands and Margareta Bertilsson from University of Copenhagen.

This report is edited by Kaare Aagaard and Karen Siune from the Danish Institute for Studies in Research and Research Policy in cooperation with Heide Hackmann from University of Twente.

Karen Siune
Coordinator

November 2001

Chapter 1: Introduction

Managing with uncertainty in science policy

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*" is a relatively new field of government responsibility. It is only in the last 50 years, that this field has been given institutional recognition through bodies, mechanisms, procedures and a bureaucratic and political staff specifically concerned with these questions (Salomon, 1977,43-46).

Not surprisingly in these 50 years of existence, the design of science policy has already seen a lot of changes, of which the most fundamental have been observed in the last couple of decades. Accordingly in the theoretical literature it has been almost commonplace to emphasize how the relationship between science and society has changed dramatically during that period. These developments have been addressed in a number of recent contributions to the field of science policy studies (Elzinga & Jamison, 1994; Gibbons et al. 1994; Ruivo, 1995; Guston, 2000). In these and other contributions it has been emphasized, how the design of science policy since World War II has gone through a number of phases or paradigms, and how the political doctrines have changed accordingly.

Even though there are disagreements in the reviewed literature concerning the distinction between the different paradigms or phases, and even though opinions differ as to which issues are considered most important and deserve to be highlighted, the bottom-line in all contributions are, that the design of science-policy has changed significantly in the last couple of decades.

It is claimed, that these changes have become manifest in all aspects of the science-society relationship, and have affected everything ranging from institutions and disciplines to practices and policies. Among the most quoted are the claims, that the process of knowledge-production is changing fundamentally (Gibbons et al., 1994, 2001); that the organization and functioning of the overall research-system is changing (ex. The triple helix-literature); and that a new social contract for science is emerging, as the political system and the society in general are increasing the demands to the research system.

Along the same lines John Ziman has described how science has been going through a radical structural transition to a much more tightly organized, rationalized and managed social institution. According to him, this transition to quite a new regime started in the mid-1970s, and is still going on. The same forces for change are at work everywhere, and many of the same features have emerged in many countries. His central argument is, that there is no way back to the traditional way of managing the business of research, but there is also no obvious path forward to a cultural plateau of comparable stability. The challenge is therefore to understand properly what is happening to science. He claims that realistically, the most we can usually do is to try to understand how an effective research system actually functions, so as to make sure that essential functions are not impeded as a result of seemingly harmless organizational change (Ziman, 1994, 249-250).

So far, this task has not been accomplished. It is still uncertain exactly how an effective research system functions and accordingly how an effective management-system should be designed. But nevertheless the design and management of science-policy is still rapidly changing across most countries, even though the consequences of these changes are highly uncertain.

Uncertainty has always been an inescapable part of the management of science policy, but in recent years this uncertainty seems to have become a growing factor for science policy makers, as the traditional foundations for science policy increasingly have been questioned during the last decades of science policy research. The traditional system for managing science is to a higher and higher degree being set aside, but it is strongly debated if and how it should be replaced.

The MUSCIPOLI-project
As described, the management of science policy is rapidly changing in spite of an increasing uncertainty as to how this new management-system should be designed. The long-term consequences of the use of new and different forms of organizations, institutions, instruments, processes and procedures are still to a large degree unknown.

As an attempt to reduce this growing uncertainty in the design and management of science policy the MUSCIPOLI project has been launched. MUSCIPOLIS aim is to provide practical insights and develop improved concepts for the understanding of the science-policy decision-making and its outcomes. MUSCIPOLI seeks to improve the understanding and management of the various complex links between science policy aims, policy-making and downstream scientific activity, output and impact.

The first activity within this STRATA Accompanying Measure is to facilitate critical comparative discussions of a selected number of science policy aims or priorities and associated scientific activities at the European level and in a variety of national contexts. These comparisons will be made at a series of international workshops, which will address the design and delivery of three different types of science policy issues, namely thematic, operational and structural issues. *Thematic issues* deal with the content of scientific activity, prioritising particular disciplines, fields and/or applied areas of research and technological development such as environmental sciences, information technology, health care, etc. *Operational issues* specify the way in which scientific activities should be performed by emphasizing principles such as inter- or trans-disciplinarity and academic-industry linkages. *Structural issues* concern the optimal functioning of the system and include, for example, the need to develop a new academic generation, to develop a cross-national research base, or to promote the role of women in science and technology.

Given that the processes involved in science policy making may (and often do) differ from one type of policy issue to the next, a thorough understanding of such processes and their downstream effects requires the examination of each. The proposed workshop series will thus consist of three separate events, focusing on each of the three types of policy issues mentioned: the first on *Priority Themes and Topics*, the second on *Support for Transdisciplinary Research*, and the third on *Building European Research Capacity*.

The three workshops share the following objectives:

- To scrutinize and compare science policymaking processes in different national and/or international contexts. The concern is with how policy is made for new directions in science. What instruments (structures and/or procedures) are used to facilitate the formulation and/or implementation of science policies, and how is the choice of such instruments determined? Which actors are involved, how do they gain access to the policy process, and what is the nature of their influence on it? How do policy actors interact, and what form does the coordination of such interaction take? Has the policy process changed significantly in recent years, and if so, how? By asking workshop participants to explore these and other, related questions, we seek to uncover the different realities of existing science policy processes, and more generally, to identify important trends in the governance of science.

- To contribute towards an understanding of the complex (and often uncertain) relationship between science policies and their downstream effects on scientific activities. Most inquiries into the downstream effects of science policies focus on actual policy decisions, or policy as a product. In addition to this, we draw attention to the possible impact of policy making - or policy as a process - on the production of new science-based knowledge and its eventual socio-economic impact. In other words, having looked at differences in how science policies are formulated and implemented, we move on to consider whether such differences play a role in determining the downstream effects of the policies in question. In terms of achieving science policy goals and/or priorities, what is the impact of different policy instruments and how important are the various actor constellations, relations and forms of coordination? In brief, how does the mode of governance affect the governability of science in various national and/or international settings.

- To address "why" questions where these contribute explicitly to better understanding of the "how". For example, each workshop will include discussion of the national and regional cultural contexts for setting science policy, the extent of cultural policy diversity, and the explanatory power of distinctions between, for example, restrictive, liberal, compensatory, and constructive science policy cultures (Van den Daele, 1993; Fuller, 1999).

- To make use of relevant theory through the preparation of a series of questions about the roles of principals in policy making, the extent of agency, the variety of actors, and the networks in which the various organizational actors are seen to operate. The comparative case studies to be presented at each of the workshops will all be framed within this set of issues.

- To promote dialogue and exchange between science policy practitioners and scholars, and to facilitate knowledge-sharing within and between these two groups of actors.

- To produce a set of papers which will be made public.

- To make recommendations on implications for future science policy decisions and to provide practical advice to science policy-makers for improving the management of everyday science policy uncertainty. This in turn will help them to develop more effective, ambitious and viable science policy programmes. A number of European and national science policy makers will have benefited directly from participation in one or more of the three workshops. Beyond this, one of the main objectives of this project is to produce a handbook of advice for those involved in the various stages of the science policy decision process.

- To contribute towards fine-tuning the broader science policy research and development agenda by identifying areas of enquiry that are relevant - in both applied and theoretical terms - to an understanding of the governance and governability of science.

Participation in the workshops over and above the core project group will be a balance between academics, administrators, policy developers and agenda shapers and stakeholders - representatives of industry and society oriented groups will be invited to play an active part in these workshops.

Workshop 1 - Science policy setting the agenda for research

As described, the first workshop and thus this report address one of the most basic questions in the science policy debate: namely the question of priority themes and topics. Again a quote from John Ziman can provide a good illustration of the starting point of this report. "In the top strata of steady state science, the buzzword is priorities… The trouble is that the goals to be prioritised and the means of reaching them are extremely uncertain" (1994,266-267).

Even though the question of priorities is highly relevant in connection with the recent changes in science policy formulation and management, the debate is definitely not new. On the contrary it is one of the most classical discussions in the field of science policy studies. Ever since John D. Bernal kick-started the discussion in the thirties, one of the key questions in working out a policy for science has been concerned with criteria for choice within science and setting up guidelines for choosing between expensive projects, often in different disciplines (Gibbons et. al,1994, 158). This debate has so far to a large degree been normative: as the so-called Minerva debate between Polanyi, Weinberg and others shows.

The aim of this report is not normative, but rather descriptive. A clear description is always a necessary foundation for a meaningful normative discussion. Accordingly, the aim of the workshop and this report is not to discuss if it is possible and reasonable to make prioritisations, but rather, since prioritisations is an extremely central part of the design of all contemporary science policies, to scrutinize what priorities are and how they are designed and delivered - primarily at the national level but also at EU-level and institutional level. Main questions to be discussed are: what are priorities, how are prioritisations between different disciplines, fields, areas etc. made? What actors and instruments (structures and/or procedures) have influence?

These questions concerning the mechanisms and the instruments in the prioritisation process needs more focus. This project and this report can hopefully be one step of the way.

Participants and contributions
As described, a central aim in the MUSCIPOLI project is to bring together people from different national and institutional backgrounds to examine a number of important science policy questions. Accordingly, the "*Science policy; setting the agenda for research*" workshop had participation from a number of European countries including members of southern and eastern Europe. Similarly the participants represented a number of different institutional backgrounds including EU, National governments, policy advisory bodies, research councils, research centres, academic institutions and the industry. In the following chapters the contributions from these participants in the workshop will be presented. Due to late cancellations unfortunately at least two important types of actors were missing in the workshop: the politicians and the NGO's. We hope to be able to include these actors in the coming MUSCIPOLI-workshops.

The workshop was structured in a number of sessions with different themes, and the same structure is followed in the chapters of this report. Each chapter will start with a short introduction, where the theme of the contributions and the main questions addressed are presented. The report ends with a short conclusion, where the results of the workshop will be summarized and where central questions and more generic aspects will be discussed.

Following this first introductory chapter, the second chapter of the report is titled "**Theory and analysis**", and here three theoretical and analytical approaches to science policymaking are presented. The contributions provide broader frameworks for the more practice- or empirically-oriented chapters that follow. Chris Caswill from the British Economic and Social Research Council presents the principal-agent model as a useful approach to science policy analysis. This is followed by a contribution from Heide Hackmann from the Centre for studies of Science, Technology and Society at the University of Twente, who presents a broader theoretical framework based on governance- and network theories, and finally Margareta Bertilsson from the Department of Sociology at the University of Copenhagen presents a more historical/sociological approach to science policy analysis inspired by the recent book "Rethinking Science".

The third chapter of the report is titled "**Priorities and priority-setting processes in practice at different institutions**". From the institutional perspective, the contributions of this chapter aim to address both the "what" and the "how" of science policymaking. In short: what are priorities and how are they formulated and implemented in different institutions?

The first contribution in this chapter is from Gonzalo Leon from the Polytechnical University of Madrid, who, based on Spanish experiences, presents an example of the prioritisation process in science policy at the national level. This is followed by a number of contributions from representatives of national research council experiences, including Chris Caswill (England), Arvid Hallen (Norway) and Henk Stronkhorst (The Netherlands). Following this Hinnerk Bruhns from the CNRS presents an overview of an alternative structure in the French system. David Grønbæk from Denmark presents an analysis, based on his recent Ph.D, of the attempted reorganisation of the Danish research council system. This chapter ends with a contribution from Hans Skoie from the Norwegian Institute for Studies in research and Higher Education who presents a discussion of the future of the research councils in the Nordic Countries, taken from his report "The research Councils in the Nordic Countries – Developments and some challenges" (2001).

In the fourth chapter "**Different groups of actors in national priority-setting**", the aim is to complement the institutional perspective with the discussion of the involvement of different groups of actors in the priority-setting processes. What is the nature and degree of their influence?

The first contribution is concerned with the role of science policy advisory bodies, and is presented by Enno Aufderheide from the German Science council. Following that, we have Lena Tsipouri from the Centre of Financial Studies at the University of Athens, who presents a discussion of the academic community as an actor in the priority-setting processes. Finally in this chapter we have two representatives from the industrial sector, who give examples of the role of industry in these processes. The contributions are from Bjarne Lundager Jensen from the Confederation of Danish Industries and Maureen Gardiner from Consignia Research Group, UK.

In chapter five "**Policymaking instruments: The design and delivery of priorities**" the aim is to create an inventory of the variety of contemporary science policy instruments, and to examine some of these in more depth.
The first contribution is written by Annamaria Inzelt from the Budapest University of Economics and Public Administration, and it presents an example of the use of statistics as indicators.
Nick Constantopoulos from the General Secretariate for Research and Technology in the Greek Ministry of Development discusses the uses of programmes at the national and the EU level.

Søren Wenneberg from the Department of Management, Politics and Philosophy at the Copenhagen Business School presents a discussion of the role of research management in prioritysetting at the institutional level. Carlos Pinto Ferreira from the Portuguese Ministry of Science and Technology presents an example of the use of evaluations in Portugal. So does Barend van der Meulen from the Centre for studies of Science, Technology and Society at the University of Twente, but his presentation focus on evaluation of societal quality based on Dutch experiences. Finally Karen Siune and Kaare Aagaard from the Danish Institute for Studies in Research and Research Policy present an attempt to give an overview of the current use of instruments in the design and delivery of priorities.

Chapter six "**Researchers reactions to science policy**" aims at discussing how the changes in the formulation of science policies affect the individual researchers. Norma Morris from the Department of Science and Technology Studies at the University College London presents a study of the effect of research council policies on researchers choices. Similarly Kamma Langberg from the Danish Institute for Studies in Research and Research Policy presents a study of Danish researchers reactions to a number of policy instruments.

In chapter seven ”**International trends**” we move beyond individual case studies to examine wider international trends in agendas and agendabuilding processes.

The first contribution is from Aldo Geuna from Science and Technology Policy Research at the University of Sussex, who discusses how the changes in university research funding for a selected number of countries could influence these institutions. Finally Karen Siune and Nikolaj Helm-Petersen from the Danish Institute for studies in research and research policy present an overview and short discussion of some trends in the last twenty years of public funding.

The introduction and conclusion have been written by Karen Siune and Kaare Aagaard with substantial input from Heide Hackmann.

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Chapter 2: Theory and analysis

In this chapter the aim is to identify and discuss the conceptual tools provided by several theoretical and analytical approaches to science policymaking. The contributions are expected to provide a broader framework (or frameworks) for the more practice- or empirically-oriented chapters that follow. We revisit the framework(s), their merits and possible gaps in the final conclusion.

Science Resource Decisions - Principals, Agents and Games

- Thinking about science funding policies, decisions and processes

Chris Caswill [1]
The UK Economic and Social Research Council

This MUSCIPOLI initiative is concerned with the uncertainties of science policy decision-making, and how these uncertainties can be understood, and managed. We see Science Policy as the actions, processes and institutions through which policy actors, individual or corporate, seek to influence and shape scientific activity and outcomes. We will be focusing on the allocation of resources for science, which others have also identified as a key problematic:

"The setting of priorities and the patterns of funding are not self-evident or self-referential; rather they are the result of complex negotiations in a variety of contexts, where expectations and vested interests, unproven promises and mere potentials play a role." (Nowotny et al, 2001).

The origins of the interest in these issues can be found in an earlier debate within a hybrid group of academic social scientists and science policy actors. This may help to explain our mix of practical and academic purposes. Practically, these discussions aim to produce better understanding of resource allocation for science, and guidelines for those who grapple with the issues. Beyond that, more research is in this case most certainly needed, for the empirical research base far too patchy to provide an evidence base. Last but by no means least, we find it helpful to locate our enquiry within a particular set of theoretical ideas, and we want to contribute in them to improving that theoretical underpinning.

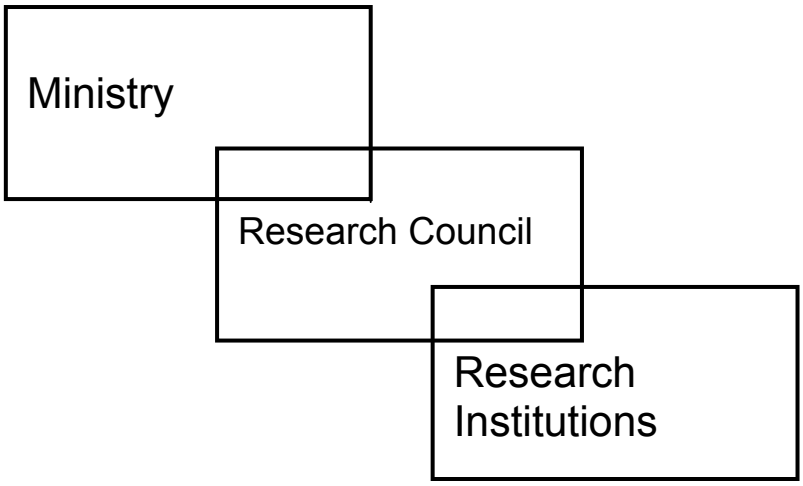
There are two good reasons for the attention to theory. Firstly, many practitioners agree in our belief that good theory, well described, is often as useful and interesting for policy as large bodies of descriptive empirical work. Secondly, taking our cue from James Coleman's master class (Coleman, 1990) the aim is to go beyond individual actors and organisations to look at the interdependency of science policy and larger social systems, to attempt some connection between the micro and macro levels.

This is not solely a methodological concern. A particular set of theoretical insights, primarily those concerned with the relations believes principals and agents, help to unpack science policy processes. The central contributions of Principal-Agent theory, or the "law of agency" (Coleman, 1990) is to outline a general class of social economic and political activities by which an individual or organisational principal pursues his / its interests by employing the services of an agent, to pursue the principal's interests in return for some remuneration. There are many kinds of agency relationship, but these can be seen as a distinct class of social relationships and transactions. The relevance for science policy becomes clear in the following quote from Coleman's review of the theory:

[1] The views expressed in this paper are those of the author and are not to be attributed in any way to the UK ESRC.

"This class of social transactions is fundamental, for it provides a means by which interests can be pursued far beyond the capacities of the original interested party. It is not the only such means but it is frequently used when an actor with interests to pursue has a sufficient quantity of resources, but not those of the appropriate kind to realise the interests (for example, has money but not the appropriate skills). He may then wish to use those resources to provide a kind of extension of self". (Coleman, 1990)

The relationship between a Ministry of Science and a Research Council or other funding agency (sic) can easily be understood in these terms. Research Councils are neither independent contractors nor "servants" (employees) in P-A terms. Braun (1993) has offered the alternative of an intermediary agency, sitting between the State and the Academy:



More recently Guston (2000) has developed the concept of the "boundary organisation", to reflect a more pro-active and independent contractor role.

As developed by Braun and Guston, and within economic contract theory, principal-agent emphases the tensions in the Ministry – funding agency relationship. The Ministry principal will seek to recruit the Council – agent to its own interests and agenda. The Council-agent will seek to maintain its distance and autonomy, whilst at the same time needing to deliver sufficient of the principal's agenda to maintain the flow of remuneration (e.g. its annual budget). The Ministry – principal may have the financial resources, but it also lacks the skills to commission top quality research. Moreover there is an asymmetry of information, with the Council-agency operating closer to academe and to the knowledge base. Each party seeks to market its own agenda to the other, and to bring influence to bear. Without going into detail here, the Principal – Agent concepts of adverse selection and moral hazard can also be used to understand the tensions in the Ministry-Funding Agency relationship.

Principal-Agent also introduces questions about the ways in which rights and resources are transferred between actors, individual and corporate, and about the nature of the authority systems, which the principal seeks to use. This provides large opportunities for empirical research, for example of the distinctions between structural, behavioural and evolutionary interdependence (Coleman, 1990), of types of delegation and of formal and informal controls, incentives and sanctions.

Braun's three level adaptation of Principal-Agent then offers a large increase in the explanatory value of the theory. It can now be adopted to account for the three level relationship between Ministries, Research Councils and University actors. This gives the Research Council a distinctive Agent/Principal role in which it seeks relative autonomy from the Ministry and increased influence over the academy. This adapted theory can also help to explain the readily observable process by

which University academics sit on Research Council decision committees and how anxious both individual and institutional actors are to maintain that role. As potential agents of the Council-principal, they seek to influence the principal with their own agenda. Academics may in turn also seek to act as principals by influencing funding agencies, or individual actors within them, to behave as their agents. Conversely the Council seeks to recruit academic actors to its own interests, and to use their skills and knowledge to increase the information advantage it has over its Ministry-Principal. The Guston alternative of the Boundary Organisation offers the funding agency a more proactive role as it attempts to establish a more autonomous location at crucial boundary points and this model deserves further enquiry in the context of science resource allocation.

Going forward with the principal-agent concept, the next logical step was to ask how the science policy actors would actually behave within Principal-Agent framework. Papers by Braun (1998) and Van der Meulen (1998) have developed the important notion of actors playing interactive principal-agent games, to advance their own interests and to adapt to new circumstances. This is seen to lead to changes in outcomes, as well as in the balance of rights, delegated authorities and interests. The Game is a powerful metaphor (which has influenced the title of this paper!). Game theory must have more to offer in understanding science policy decisions and responses, especially when exploring the different types of games being played, for example whether these are zero-sum or evolutionary games. This kind of work leads however into sensitive territory and empirical data may be hard to get.

This is an appropriate point at which to acknowledge that Principal-Agent is not of course the only source of ideas for review of the science resource allocation process. It will be helpful and indeed important for attention to be given also the explanatory power of contrasting theories of organisation and delegation, including new thinking on institution and contract design; the concept of bounded rationality and its application to the sharing of norms and beliefs; and the potential contributions from actor-network and social network theory.

The test will be the ability of any theory or concept to increase the understanding of the science policy resource allocation process. Thus far principal-agent insights are valuable because they provide different insights into the allocation of resources for science by funding agencies and the downstream impacts on science and scientific outcomes. Following Guston (1996), the starting point here is the challenge of the “how” questions, so often ignored in science policy research, though we aim also to provide insights into “what” (where policy actors have a key role to play) and “why” (because of the need to understand cause as well as process).

This analysis begins with a simplified model of the process of science resource decisions, activities and outcomes:

Aims -- Policies -- Science -- Outputs -- Outcomes

The first challenge which this simplified modes poses is the nature of the relations between the five stages. We can observe that much science policy literature, science policy activity and everyday language assumes a linear left to right causality, i.e:

Aims → Policies → Science → Outputs → Outcomes

This model is built in to the generic statement that "In order to do A, our policy will be to fund B, which will lead to C. The naivety of this policy hubris has been discussed by Rip (1998), who also suggests plausible reasons why it is a popular and convenient fiction. Others talk about an alternative of post-modern disjointed reality, with no attributable effects of policy decisions. This view we believe to be as incorrect as the linear version.

The MUSCIPOLI starting point is that there is a clear set of left to right connections and drivers, often complicated but nevertheless real, and that the process can be better understood through better empirical and theoretical work. These five stages can usefully be isolated, for heuristic purposes, as separate sets of activities and processes. For both conceptual and methodological reasons, we intend to concentrate on the interplay of actors, organisations, interests and resources at the interfaces between the five stages – for example between *Aims* and *Policies*, or *Policies* and *Science.*

This first Workshop focuses particularly on the *Aims / Policies* interaction but MUSCIPOLI will range further than this. Many issues, which will be addressed in the workshops, can be examined with benefit from these perspectives, for example:

- When looking at the multiple aims which influence and became conventional within specific policies, we should learn more about the interactions between Ministry-principals, Research Council-agents and the influence of the academy

- The implementation of policies provides another arena for interplay of interests and the study of the ability of principals to sustain their interests

- There will be case studies which provide better understanding of the terms on which rights and resources are transferred between actors

- Principal-agent contracts can be seen to operate within the decision process, as between Ministries, Funding Agencies and academic scientists, and how contracts are being developed to overcome problems of adverse selection and moral hazard

- European Funding through DG Research may either fit or challenge these frameworks and models

- Notions of asymmetry of information, adverse selection and moral hazard can be tested in real world cases

- As can the extent to which principal-agent transactions in science policy do constitute an "extension of self" for Ministries, Directorates General, or Research Councils

- The uncertainty of the science policy resource allocation process should be reduced by application of principal-agent ideas, but new problematics may also be generated

- Interdependence between science policy organisations will be reviewed, and different frameworks tested, such as Coleman's categories of Structural, Behavioural or Evolutionary relationships

- Actors' games, whether principal-agent games or otherwise, whether conscious or not, should be revealed in the process of creating and implementing policies

- Discussion of the Principal-Agent approach should stimulate debate of other, complementary and contrasting theories of organisation, delegation and policy formation.

Underpinning this adventure is a firm belief in the value of the interaction between theory and practice. The EU STRATA objectives emphasise the need for commitment to positive practical outcomes. The MUSCIPOLI contribution will be a better understanding of the practicalities of resource allocation, and a reduction in and guide to the uncertainties the uncertainties. The aim is to give sound advice on the management of this crucial science policy process. These practical aims sit comfortably alongside the parallel ambitions for a better empirical research base for both policy and theory, for positive feedback to the body of theory, which has catalysed this enquiry.

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Governance theories and the practice of science policymaking

(Draft for comment only — Please do not quote)

Heide Hackmann
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Introduction

One of the objectives that we in MUSCIPOLI have set ourselves is to explore how exactly policy is made for new directions in science and, by implication, to uncover some of the complex realities of the governance of science. I want to approach this issue from a more theoretical or analytical perspective, but in doing so I do not want to lose sight of the empirical problematic. I want, in other words, to move from theory to practice, to use the one to comment and reflect on the other.

With this in mind, my presentation is structured as follows: I start by clarifying some of the existing conceptual confusion surrounding the study of governance more generally, and extracting from it a theoretical focus for examining current issues related to the governance of science. I then move on to present a theoretical typology of modes of science governance that relates directly to the issue of national research priority-setting. In the third part of the presentation I briefly outline how, in an ongoing study of recent changes in such priority-setting processes, I have set about gathering empirical data relevant to the typology described. I also provide an insight into some of the (preliminary) results of this study. In the conclusion, I draw on these results to reflect back on the theoretical typology as well as the challenge that confront us — policymakers and researchers — as we take seriously the how of science policymaking.

Before moving on to the first part of my presentation, it is necessary to stress two points. In the first place, I restrict myself to a descriptive objective. The point — theoretically and empirically — is to try and describe different modes or patterns of governance rather than to examine their causes and/or consequences. Secondly, I focus on only one instance of the governance of science, namely the policymaking processes associated with the formulation and implementation of national thematic research priorities embedded in national research programmes or articulated more explicitly in national research strategies, agendas and/or plans [2].

1. Towards conceptual clarification and a theoretical focus

Given its increasing popularity and prominence in most social and economic sciences, the study of governance has become a real “growth industry”, which embraces a wide range of disciplinary, theoretical and methodological approaches, and has thus spawned a confusing plethora of meanings and usages of the concept of governance itself (Van Kersbergen and Van Waarden, 2001: 15). A number of attempts have recently been made to impose some kind of order on this conceptual chaos. I have relied on two — the one by Mayntz (1998) and the other by Van Kersbergen and Van Waarden (2001) — in order to specify my own understanding and usage of the term, as well as to identify the broader theoretical orientation that I use to explore the governance of science.

[2] It is important to note that I do not consider national priorities as these are manifested in national R&D budgetary allocations or public R&D expenditure profiles.

1.1 The meaning of governance

Mayntz distinguishes between three generic meanings of the concept of governance (Mayntz, 1998: 7). They are:

(a) *Governance as governing by political authority*: Governance has traditionally been equated with the notion of governing, which until the 1980s has itself been understood as referring to the "process aspect of government" and, more specifically, the "steering actions of political authorities". Some authors continue to use the term government to refer to this particular mode of governing.
(b) *Governance as governing in/by networks*: The term governance is often reserved today for what is considered to be a new mode of governing in which policy is made in "mixed public/private networks". It is presented as an alternative to the so-called older mode of political steering.
(c) *Governance as a form of social coordination*: Governance has also come to be understood as referring, more generally, to different modes of "coordinating individual actions". This particular usage of the term includes the two more narrowly defined interpretations of governance: the 'older' mode of governing via political command and control, and the 'modern' mode of governing via networks.

My own work follows the third of the abovementioned usages. I thus understand modes of governance as referring to different forms of social coordination, which are identified with particular modes of governing or ways and means of determining the overall direction and functioning of society or sectors of it (see also Hackmann, 2001: 138).

1.2 The analytical significance of policy networks

On the basis of a meticulous survey of the literature, Van Kersbergen and Van Waarden have identified no less than seven contemporary renditions of the notion of governance (Van Kersbergen and Van Waarden, 2001: 15-23). These differ in terms of their focus on various locations, instruments, and/or styles of governing and governance, and include:

(a) *Good (economic) governance*: Emphasises so-called second generation reforms aimed at improving the overall efficiency and transparency of government, strengthening the success of the private sector and promoting the efficacy of civil society.
(b) *Corporate governance*: Focuses on governance in the private sector, and more specifically, on the systems (institutions, actors and interactions) by which corporations are directed or controlled.
(c) *New public management*: Focuses on governance in the public sector and, more specifically, on a new model of public services which relies on management concepts (such as customer orientation and performance measurement) and conditions (such as deregulation and outsourcing) advocated within the corporate world [3].
(d) *Economic governance*: Concerns the creation and maintenance of institutions (state or non-state) aimed at providing, monitoring and enforcing the rules of economic transaction.
(e) *International or global governance*: Focuses on evolving patterns of cooperation between interdependent states as manifested in international organisations, regimes, treaties and other international or global institutions.
(f) *Governance in/by networks*: Focuses on policymaking within pluri-centric as opposed to multi-centric (market) or uni-centric (state) forms of governance. This particular focus is also associated with the idea of multi-level governance or policymaking across policy areas and government levels in, for example, the EU.

[3] Studies about new public management and corporate governance often embrace a normative or prescriptive element and are thus closely linked to the idea of good governance.

(g) *Self-governance*: Governance as a form of self-organisation of societal sectors, which involves informal, bottom-up regulation (through associations, understandings, trust relations, etc.) rather than formal, top-down state coercion.

Despite their differences, the above versions of the notion of governance share a number of common characteristics. There is, for instance, a shared tendency to emphasise the processes and functions, rather than structures, of government or other governing arrangements. At the same time, the role of policy networks plays an (increasingly) important analytical role in each. This gives ideas about governance in/by networks the status of an overarching framework, variations of which can be traced in most, if not all, contemporary studies of governance (Van Kersbergen and Van Waarden, 2001: 22).

I take up this framework in the study of science governance. In doing so, I draw extensively on the policy network literature of comparative political science and international relations theory, and particularly as it has been developed by the Max Planck Group in Germany. At the core of this body of work lies an interest in the changing nature of the state-society, or public-private, relationship, on the basis of which different forms of social coordination — and hence, different modes of governance — can be identified. In essence, a typology of two opposing modes emerges from this work: hierarchical versus network governance.

2. Hierarchical versus network modes of the governance of science

My attempt to develop this typology in terms that are relevant to an understanding of the governance of science, draws extensively on the work of Rip and Van der Meulen about processes of steering and aggregation in national research agenda building (Rip and Van der Meulen, 1997). I also rely on a more recent study by Crowley, who provides a cultural analysis of governance pertaining to a range of S&T policy issues and objectives, including research priority-setting [4] (Crowley, 2001).

The following discussions about the hierarchical and network modes of science governance begin, in each case, with an examination of modes of governing representing different versions of the public-private relationship. They then outline a number of features, which pertain specifically to the S&T policy sector, and which can be regarded as being typical of each mode of governance. The features include (i) the ways in which the structure of the research system is perceived; (ii) conceptions of what constitutes S&T policy resources; (iii) conceptions of the policy community; (iv) representations of policy; and (v) understandings of the notion of scientific autonomy.

2.1 Hierarchical governance: From centralised to decentralised steering of science

Steering is typically defined as "the influencing, adapting, and controlling by government of specific decisions and actions in society according to certain objectives and by using certain tools or instruments" (Maasen, 1998: 2-3). In this definition, government is posited as the primary locus of policymaking, a central and dominant actor providing both a broad ideological framework, as well as a specific set of instruments, with which to formulate, develop and implement public policies. According to Crowley, this mode of governing — which he refers to as government — was the normative mode of policymaking in most industrialized Western societies from the post World War II period until at least the mid 1980s (Crowley, 2001: 13).

Basing their own understanding of steering on the premises of contract theory, Rip and Van der Meulen assert that it refers to the attempts of a principal to get its agents to work towards its own goals. In theory, the authors acknowledge that any actor, or group of actors, can be a principal or

[4] Crowley reserves his use of the term governance to refer to a (modern) mode of governing which can be contrasted with that of government or political command and control.

central steering subject.[5] Yet it is state, and more specifically, governmental steering that they emphasize in their work on national research priority-setting processes. “Steering”, they maintain, “always has a principal, the state, with its own aims” (Rip and Van der Meulen, 1997: 58).[6] Under this mode of governing, national science policy is seen as being determined at the discretion of political authorities and implemented in a way that reflects their goals.

The centrality afforded government in these definitions of steering does not imply that other, decentralized actors (individual, corporate or collective) have no recourse to influence or control over the policymaking process. At the same time, recognizing the (potential or actual) governing capacity of such actors does not detract from the ultimate centrality of government. Our understanding of centralization and decentralization is, after all, premised on an analysis of the nature and scope of what the centre is or is not doing, the degree of authority and control it exerts, which responsibilities it assumes and which it relinquishes or delegates to others.

The point is that there are degrees (or varying intensities) of governmental steering. This is clearly illustrated in a recent discussion of the two basic steering models found in current policy analyses: the “model of rational planning and control” and the “model of self-regulation” (Maasen, 1998: 3). Given that both are explained in terms of the specific role of government, the author relabels them, calling the former the “state control model”, and the latter the “state supervising model” (Maasen, 1998: 3-6). They refer, respectively, to centralized and decentralized (governmental) steering. Under conditions of centralized steering, government is seen as “an omniscient and omnipotent actor able to rightfully steer a part of society according to its own objectives … by means of stringent rules and extensive control mechanisms” (Maasen, 1998: 5). Decentralized steering, on the other hand, sees government “steering from a distance”, relinquishing detailed regulation and strict control, yet monitoring and occasionally evaluating the rules defining the overall performance of a system of autonomous decisionmaking units (Maasen, 1998: 6/9; see also Dunsire, 1993: 25).

With specific reference to the formulation and implementation of national research agendas, Rip and Van der Meulen conceptualise steering in terms of a continuum, ranging from top-down to bottom-up processes of policymaking (Rip and Van der Meulen, 1997: 58-59). The two poles of the continuum can be equated with centralized and decentralized steering as defined by Maassen and others. Under top-down (centralized) conditions, government is emphatic and authoritarian about articulating and pursuing its own objectives. It overrides the preferences of other actors within the research system — at the intermediary or research performance level — and does not rely on them for input, guidance or support. At the other end of the scale, under bottom-up (decentralized) conditions, government does little more than supervise and endorse agenda-building by others within the system. To the extent that such agenda-building or priority-setting is undertaken by members of the scientific community itself, decentralized steering can be, and often is, understood as a form of scientific self-regulation.

From the above, it is clear that the notion of steering, whether centralized or decentralized, refers to a mode of governing in which government is the actor in whose hands policy decisions are ultimately located. Whether its role is intrusively direct or distant and unobtrusive, it remains what

[5] Schimank makes a similar point by distinguishing between political steering (“politische Steuerung”) and steering by non-scientific users (“Ausserwissenschaftlicher Adressaten”) (Schimank, 1995: 111-112). Whilst the former refers to the activities of those governmental units directly responsible for national science policy (such as science ministries), the latter includes, for example, private enterprises as well as other government departments involved in the business of procuring research. The issue is not, however, discussed by Schimank in terms of processes of national policy-making.

[6] Rip and Van der Meulen qualify the notion of state (or governmental) aims by making the point that the state itself can be regarded as an agent accountable to the *res publica*. As such, the state’s aims are not really its own. Instead, it acts as a spokesperson for the people, translating priorities that are seen to be in the public interest, or reflective of the public will (Rip and Van der Meulen, 1997: 58).

has been called “the crucial, central, hegemonic actor [which] is ultimately determinant” (Marin and Mayntz, 1991: 17). Given this role, government’s relationship with non-governmental (scientific and/or societal) actors is unequal and, hence, hierarchical.

There are a number of conceptions or interpretations of the nature of the research system and the S&T policy process that are either implicit in the above description of the hierarchical mode of governance or that can be regarded as being characteristically associated with it. These include:

- *Perception of the structure of the research system*: Given the hierarchical nature of the relationship between government and other actors in the system, the latter is regarded as being vertically stratified, with the power to govern unequally distributed.
- *Conception of policy resources*: Under conditions of hierarchical governance there is a tendency to privilege not only political power, but power that stems from the control of economic or allocative resources. It is, in other words, government’s status as a sponsor, and the concomitant resource dependency of the scientific community, which affords it a position of centrality and ultimate control.
- *Conception of the policy community*: Ideas of who is and who is not a policy actor are restricted to government and its agents, including (arguably) research councils. Others — scientists, representatives from industry and members of civil society — may well get involved in policy processes, but they do so as consultants, advisers, counsellors rather than decisionmakers.
- *Representation of policy*: With government regarded not only as the central actor, but also one that is external to the system, S&T policy itself is represented as a set of rules, an orientation that is imposed on the research system.
- *Understanding of scientific autonomy*: In line with this understanding of policy, scientific autonomy is understood as a right, which is or can be threatened by the imposition of policy.

2.2 Network governance: The centreless coordination of science

Since the early 1980s an increasing number of scholars have utilized the concept of policy networks to describe features of modern policymaking, which they argue, comprise a new mode of governance. Eising and Kohler-Koch call it network governance (Eising and Kohler-Koch, 1999). Its primary characteristic is a shift away from ‘state-centrist’ or ‘government-focused’ to ‘centreless’ processes of policymaking. Government is no longer perceived to be a central steering actor, and interactions between the public and private spheres are said to occur on a more equal footing. The state-society divide, it is claimed, has become blurred (Marin and Mayntz, 1991).

Despite an enduring ambiguity about the exact meaning and use of the concept, there is what one may call a mainstream understanding of policy networks and the governing processes it refers to. This emphasizes four key features. Firstly, policy resources (including information and expertise, or what may be called cognitive resources) are widely dispersed and actor- or context-dependent. Secondly, the distribution of policy resources ensures that a mix of public and private actors are drawn into the policymaking process.[7] Thirdly, these actors share a common interest in a particular policy sector. They are inter-dependent, yet formally autonomous and not hierarchically related. And finally, although inter-dependencies can be asymmetrical (in that policy resources can be more or less concentrated), there is no a priori principal, no dominant or focal actor. Instead of being centered, the policymaking process is centreless, or ‘polycentred’, involving several dominant actors whose dominance is, however, contingent and not to be taken for granted. (Marin and Mayntz, 1991: 15-17; see also Börzel, 1997; Van Kersbergen and Van Waarden, 2001).

[7] In much of the literature, policy networks refer exclusively to inter-organisational relations (Mayntz, 1993). In a broader interpretation of the concept — such as is presented here — policymaking processes can be understood to involve a combination of individual, corporate and collective actors.

In many ways, the ideas embedded in policy network literature are similar to those expressed by Rip and Van der Meulen in their use of the concept of aggregation. They define the latter as "a process of socially distributed agenda building", a science policymaking process which relies on the resources, capacities and interactions of a wide range of inter-dependent actors, including research performers, government, industry and other users of research (Rip and Van der Meulen, 1997: 59). Government is perceived as one of a number of policy actors, no more and no less, and the policy process itself is characterized by the fact that "there is no external configurer, but all actors attempt to configure each other, and in doing so create overall direction" (Rip, 1998: 36).

Despite the obvious similarities between the concept of aggregation (as defined above) and that of policy networks, the two cannot simply be equated. For a start, the former refers to a process, and the latter to a structure. But more importantly, aggregation refers to a particular kind of process, one that differs from those — like bargaining and negotiation — usually associated with policy networks. As such, Rip and Van der Meulen's work could be regarded as an attempt to tailor the networking paradigm for purposes of understanding the business of science policymaking, and more particularly, the nature of national research prioritisation in the absence of a steering principal. The question, then, is what the process of aggregation actually means, what makes it different from negotiation and/or bargaining?

Beyond the policy context, the authors use the concept to refer to what they regard as being the self-organizing dynamic of the internal development of science. The emergence of a new scientific paradigm provides a useful illustrative example. What is involved here, they argue, is a process (aggregation) whereby local ideas, produced by local actors (researchers within universities, for example), are collected, widely circulated (via conferences, publications, etc.), selectively transformed, and eventually synthesized into a global composite, the scientific paradigm in this case (Rip and Van der Meulen, 1997: 55; see also Disco and Van der Meulen, 1998) [8]. Within the policy context, they claim that a similar process of aggregating (collecting, circulating, transforming, synthesizing) the ideas, opinions, views and interests of a range of local actors can generate a global composite: science policy itself. In this regard, however, they acknowledge that aggregation is not necessarily a self-generating or spontaneous process. It can be an induced and modulated process, one that is purposefully instigated and, to a greater or lesser extent, managed and supported by the development of infrastructures such as (formal or informal) networks. The establishment of foresight exercises as instruments of explicit national priority-setting, which rely on widespread consultation and dialogue, is one of their favourite examples of induced aggregation (Rip and Van der Meulen, 1997: 55/59/67).

Is (induced) aggregation any different from what happens under conditions of decentralized or bottom-up steering? Not necessarily. Are we then talking about a new (or at least different) mode of governance here? Yes, but the point is that the process on its own does not define the mode. The same is true for other policy or decisionmaking processes, like negotiation or bargaining. To be able to distinguish between the two modes of governance being considered, we need to look not only at the processes, but more importantly, at the forms of societal coordination within which these processes are embedded. Such forms are distinguished on the basis of the role of the state or government, and the nature of its relationship with scientific and/or societal actors. Aggregation, negotiation and/or bargaining can all take place in what Scharpf calls "the shadow of hierarchy", or "the shadow of the state" (Scharpf, 1997: 197-200). When it does, government is seen as a third party, able to exert authority and control over the policymaking process and its outcomes. It can unilaterally impose its preferred solution should the attempt to negotiate fail, or should it disagree with the outcomes of processes of induced aggregation. This is the steering, or

[8] Defined in this way, aggregation is intended to capture the transformative nature of the process whereby global composites emerge. This meaning is not conveyed by the conventional usage of the term, which posits aggregation simply as the collecting of units or parts into a mass or whole.

"hierarchical state" (Kohler-Koch, 1999). Under conditions of network governance, government is itself a party to the process (be it aggregation, negotiation and/or bargaining), and restricts its responsibility to the task of creating arenas within which it may take place. It represents the "negotiating state", or what one might call the 'aggregating state' (Scharpf, 1997: 201; see also Kohler-Koch, 1999).

This discussion suggests that the term aggregation is useful in terms of highlighting important differences between policymaking processes in science policy and those in other policy sectors. Without further qualification, however, it does not enable one to distinguish between different modes of governing, and hence, governance. Steering is a mode of governing, which implies hierarchical governance. Induced aggregation is not a mode of governing, which necessarily implies network governance. Instead, it is a policymaking process, which can feature in either mode. Although Rip and Van der Meulen do not clarify this, it is in fact 'induced aggregation under conditions of network governance' that they are talking about when presenting aggregation as a way of science policymaking that differs fundamentally from steering.

In sum: The network mode of governance emphasizes cooperative modes of governing (including processes of negotiation, bargaining, aggregation) within informal or formal networks, which bring together a mix of governmental and non-governmental actors. Government does not intervene in these networks. Instead, it either serves to facilitate or activate them, and/or it participates in them. In line with this understanding of the network mode of governance, the following interpretations can typically be associated with it:

- *Perception of the structure of the research system*: With the relationship between government and other actors in the research system on an equal footing, the system itself is perceived as being horizontally distributed rather than vertically stratified.
- *Conception of policy resources*: Under conditions of network governance it is assumed that S&T policy depends strongly on information and knowledge (about what is going on in the field), as well as broader public opinion. By implication, policymaking accentuates cognitive resources, and the power to govern does not depend exclusively, or even primarily, on political and/or economic power.
- *Conception of the policy community*: Governing in/by networks assumes a broader, more inclusive conception of policy actors. The network is the decisionmaking unit and, hence, the plurality of actors involved in it (including scientists, users, interest groups and the broader public.
- *Representation of policy*: If regarded as the outcome of interaction within policy networks, S&T policy is inclined to be understood as an emergent rather than imposed orientation.
- *Understanding of scientific autonomy*: Autonomy is recognized, no longer as a right, but as a responsibility to observe the objectives that the scientific community itself has been involved in voicing. In these terms, autonomy can also be thought of as a policy resource (Crowley, 2001: 17).

3. The formulation and implementation of national research priorities

Having outlined and elaborated a theoretical typology of modes of science governance, I now want to turn towards empirical realities of S&T policymaking and, more specifically, to the realities of how national research priorities are formulated and implemented. In this section I give a brief overview of the type of data that I have been (and still am) collecting in a study of national priorities in a number of European countries. This is largely a heuristic exercise, intended to set out some of the ingredients that an empirical approach to the question of science governance could/should include. I then try to give a sense of some of the preliminary results and tentative conclusions that have emerged from the study thus far.

*3.*1 Data gathering

My data gathering efforts are based on fieldwork interviews with national S&T policymakers as well as documentary analyses, and focus on two categories of information, namely:

(a) The type and nature of *policy instruments* (structures, routines and/or arrangements) used to facilitate and/or organise the processes involved.

Policy instruments used in the formulation of priorities include, for example, consultation, policy advice, expert reviews, and foresighting exercises. Beyond enumerating such instruments, I look specifically at the nature and degree of consultation: how open or closed the process is, the type and numbers of actors it involves. I also record whether or not new structures intended to deal specifically, and exclusively, with priority-setting have been established; who is included in their membership and what degree of independence from government they have.

As far as the implementation of priorities goes, I restrict myself to examples of intentional and explicit attempts at implementation, that is to instruments or "policy levers" designed and established with the express purpose of ensuring that priorities are realised (Crowley, 2001: 18-19). These include, for example, national research programmes, other funding schemes, the establishment of new research centres, as well as ministerial orders and calls for implementation via sectoral, organisational and/or individual policymaking. They exclude, for example, the ongoing commissioning of research by public and/or private actors on topics that may well coincide with national priorities.

(b) The *policy roles and relations* of the actors or groups of actors involved in processes of priority formulation and implementation.

In line with the theoretical discussion of hierarchical and network governance provided above, my primary interest lies in determining the role of government (S&T ministries or departments) in these processes. Does it act unilaterally, does it intervene or exercise any form of authority and control over others involved in the processes, or does it facilitate, activate and/or participate in them? At the same time, I examine the nature and degree of involvement of the following groups of actors:

- Policy advisory bodies
- Research councils and other intermediary organisations
- The academic and broader scientific community
- Industry
- Other users and/or stakeholders, organisations of civil society, the broader public

To really get as accurate a picture as possible of policy roles and relations in what are complex policy processes, I use a type of process-tracing approach, which involves unravelling policy responsibilities, actions and, by implication, interactions in each of the component parts or sub-processes of priority formulation and implementation [9]. These sub-processes — which are not necessarily sequentially related — include:

For priority formulation:

- Generation: Raising ideas and putting them onto the agenda as potential priorities.
- Specification: Interpreting, particularising, synthesising, structuring and re-structuring ideas into specific priorities.
- Selection: Selecting specified priorities for inclusion in a final listing.

[9] This approach is based on, and represents and adaptation of work done previously by Rip and Hagendijk (1987).

- Authorisation: Selectively approving of, and/or endorsing (rubber-stamping), the selected priorities.
- Presentation: Making selected priorities known, articulating or expressing them in official policy documents.

For priority implementation:

- Design: Choosing an instrument, and determining its substantive content (a process which highlights the fact that policy implementation can, and often does, involve policy formulation or re-formulation).
- Responsibility: Managing (coordinating, administering) an implementation instrument.
- Attainment: Fulfilling or carrying out the tasks (such as project selection, monitoring, and evaluation) associated with the instrument.

3.2 Data gathered

Not surprisingly, preliminary results generated by the above outlined data gathering efforts highlight just how complex the policymaking process really is. What we see is that there is not always or necessarily one mode of governing or governance per country or per instance of priority-setting, but more commonly, a mix of modes. This mix can be due to one or more of the following factors:

- Differences between instances of contemporary priority-setting in one national situation: An example would be the differences between processes related to the United Kingdom's Foresight Programme (which seems to lean towards a network mode of governance) and those involved in the selection of themes for its new cross-council research programmes (which falls within the spectrum of an hierarchical mode).

- Differences between the formulation and implementation of a particular set of priorities: This can be seen in the case of the Netherlands and, more specifically, its 1996 initiative aimed at producing a set of national knowledge themes. The processes followed in the formulation of these themes — planned and coordinated independently of government by the Consultative Foresight Steering Committee — could be regarded as an example of network governance. At the same time, the implementation of some of those themes — by government via its announcement of national research programmes to be established by the Netherlands Organisation for Scientific Research — has distinct elements of a hierarchical mode.

- Differences between sub-processes within either the formulation or the implementation of priorities: In Denmark, for example, the nature of government's role appears to change during the various sub-processes that have lead to the formulation of priorities attached to the Danish national strategy. Whilst it relies on networks of public and private actors for the generation and specification of themes, it essentially takes the task of selecting and authorising the latter into its own hands. Strictly speaking, this example reveals elements of both network and hierarchical modes of governance.

Given the above, two potentially significant conclusions present themselves. In the first place, it is clearly very difficult to unambiguously pigeonhole national policymaking processes into the neat, mutually exclusive boxes provided by the theoretical typology outlined earlier. To make matters worse, the data reveals that even when particular modes of governing can be pinpointed (either in different instances of priority-setting or at different stages of the processes associated with one such instance), the other characteristic features associated with a particular mode of governance may be missing in reality. Thus, for example, governing in/by networks does not necessarily go hand in hand with the perception of science policy as an emergent orientation, or the under-standing of scientific autonomy as a policy resource rather than a scientific right. The case of the

1996 Dutch knowledge themes provides a useful example in this regard. Although formulated via processes that, to all intents and purposes, resemble those of a network mode of governance, many of the Dutch researchers, I interviewed, regarded them as an attempt on behalf of government (the Ministry of Education, Culture and Science) to determine directions for science, to impose an orientation towards certain types of research, and hence to interfere directly with their right to autonomy and, ultimately, self-regulation.

A second conclusion is that there is a significant level of diversity within and between national case studies in terms of how and by whom national research priorities are formulated and implemented. Whereas there is a convergence between these case studies in terms of the actual priorities that are advocated, one cannot talk conclusively about a convergence in terms of the policymaking processes associated with such priorities (see also Hackmann, (forthcoming)) [10]. Even where similar policy instruments (such as foresighting exercises or, more generally, consultative procedures) are used, the roles and relations of different groups of policy actors they involve can, and do, differ from one context to the other. The example of consultation is instructive in this regard. Many interviewees claim that there is a tendency, within their own policymaking arrangements, towards more, and more open, forms of consultation. At face value this would suggest a possible process of convergence towards a more cooperative and, some would say, network mode of governance. At the same time, however, there appear to be significant differences between the cases studied in terms not only of how many different groups of actors are drawn into consultation processes, but how, and by whom, their access to such processes is determined, and what influence their involvement in them has on the final lists of priorities that appear in national strategies, agendas, plans and/or programs. In some cases, consultation with a wider group of actors (within and beyond the research system) occurs in the shadows of hierarchy. In other cases it is an expression of governing in/by networks, a process which government participates in and abides by. As far as modes of governing and, hence, governance are concerned, the result is one of diversity rather than convergence.

4. Conclusions

There are other discussions, other conclusions embedded in the results of my study, but the above two must suffice for purposes of this paper. At the very least, they serve to draw attention to some (related) challenges confronting theorists of governance on the one hand, and science policymakers and researchers on the other.

With regard to theories of governance, the challenge has to do with the apparent mis-match between theoretical modes of governance (and their associated typical features) and the realities of science policymaking in practice. What such a mis-match can be regarded as highlighting, is the need to develop a more grounded theory of governance, one that can handle, and account for, the more complex realities of governance that an empirical study of the issue reveals. The point is even more consequential if one keeps in mind that my work reflects only one aspect of the (empirical) complexity of the governance of science. I am, after all, going only part of the way towards capturing this complexity. For a start, I am looking at one of a number of policy issues that could be selected for discussing governance. It is possible, for example, that the way in which other priorities — operational and/or structural priorities — are formulated and implemented will reveal different patterns or mixes of governance to those involved in policymaking associated with thematic priorities. There is, in addition, the fact that my treatment of governance adopts a particular perspective. It basically reflects the official version of how things are done: policymaking

[10] Unger and van Waarden define convergence as “a long term process, not a state. Convergence means that two variables approach each other as time elapses … There must be movement over time towards similarity. This is important to stress, because the term is often used erroneously to merely indicate a state of differences and similarities rather than changes towards a common point” (Unger and Van Waarden, 1995: 3).

as presented and justified largely by governmental S&T policymakers. Other perspectives may well yield different results to the ones discussed here.

For science policymakers and researchers alike — and, hence, for those of us involved in MUSCIPOLI — the challenge is, I think, to take seriously the task of unravelling and understanding the policy processes that link policy products and their downstream effects on scientific activity, outputs and outcomes. What is significant about these processes, why do we need to examine (or worry about) who is involved in them, how they are involved, and how they interact with each other? These questions are particularly important if one considers that the diversity of policymaking processes within and between national contexts tend to generate and revolve around a similarity of national research priorities. If the policy products are (more or less) the same, what is it about the policy process (differences in accountability, legitimacy, etc.) that may, or may not, determine how those priorities are received and, ultimately, realized by the scientific communities of different research systems?

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From Honoratiores to Bureaucrats: Research Counceling in transition

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Introduction

Research councils were once formed as important mediators between the academic community and the government in channelling increased resources at the same time as making the academic community more responsive to the needs of governments. For the most parts, at least in the Nordic countries, the emergent research council system after WWII was kept close to the academic communities (Skoie 2001). Academic *honoratiores* acted as scientific advisors to the governments. As time passed, and research development (R/D) became more and more strategic to social and industrial planning, a new sectorial research system emerged. This targeted approach took shape either by government ministries developing their own research committees or else by the institutionalisation of special research units. Government or industry could also enter into contractual relations with individual scientists or groups of scientists, thereby bypassing the traditional research council system.

Today, national research councils find themselves in yet another prospects of tightening. The rapid emergence of a European Research Area (ERA) sets pressures upon national systems either to conform with European targeted research in order to increase on shrinking research funding, or else survive in an environment where national resources demand more effective research administration.

These are structural processes in the developing of a common Europe where knowledge and research are cherished as necessary factors in wealth production and in global competition. Research councils find themselves under great strains. The aim and purpose of this contribution is to reflect upon these larger structural changes from within a more sociological framework informed by Weber´s classic distinction between *honoratiores* and *bureaucrats*. The problem of governance in the modern knowledge society poses problems in general for what constitutes (scientific) knowledge in general, and for research- and knowledge administration in particular.

My empirical point of reference will be informed by my previous work in the Danish Social Science Research Council (SSF) in the years 1992 – 1997, and my recent experience (from 1998 – 2001) as a member of the advisory board of the social sciences of the Swedish Research Council.

Changing governing models of science

An often cited text in recent science theory is the collectively authored book by Gibbons, Scott and Nowotny (1994) where the discussion of *Mode 1* and *Mode 2* as two governing forms of science first was introduced. In a more recent book by the same author collective (Nowotny et. al. 2001) these two governing models of science have been even further developed in terms of their implications. Also the strains of present research council system are now seen as essentially a consequence of the transition from *Mode 1* to *Mode 2:*

Mode 1	***Mode 2***
context of justification	context of application
restricted	widened
science	society
validation	innovation
truth	utility

Mode 1 model is now thought of as the traditional and strongly science-governed type of knowledge production. It was driven either by disinterested curiosity or else by urges to validate or corroborate previous hypotheses (in the language of Karl Popper). This model if also thought of as the autonomous model of science, as scientific growth is seen to be essentially an internal scientific process. Furthermore, this model of science is strongly oriented towards methodology as securing carefully controlled and explicated intersubjective knowledge over time. The search for truth is the goal of such autonomous science.

In terms of science policy, the autonomous model can be applied to a plurality of externally formulated "problems" in order to see whether or not these problems can be illuminated, and eventually given a scientific solution. Such policies may be conceived of as government by science, or else as scientific engineering. In the case of post-war Sweden, the strong link between segments of the Social-Democratic Party and the Scientific Elite has often been characterised as resulting in either "the scientisation of politics" or the "politicisation of science". In both instances, accusations arose that it was essentially the rule of "technical-instrumental rationality". The strong belief on behalf of government in expert advice from the academic community, the critics often claimed, resulted in the "depoliticisation" of the general population (Habermas 1968). Whatever was the critique directed against this governing model of science/politics, it is important to take notice of the strong legitimisation claims that pure science exerted at the time. The problem of government was seen to reside in its overly strong reliance on science to solve social problems.

Mode 2 model is very different both in forms and in contents, especially with regard to the link between science and politics. As a model of science, it is much less driven by disinterest and curiosity than *Mode 2*. Science is now seen as contextualised in a larger setting, and the search for knowledge is essentially driven by strategic needs of developing such contextual networks. Methodology in terms of restricted rules no longer plays an important role. A number of methodologies is utilised in the search for knowledge, and the choice of one over that of another is essentially argued along lines of utility and strategy. Previous claims of restricted knowledge are now giving room to a much more widened "discourse of knowledge" where the important thing is "newness". The new research language discards previous models of "science". Research is evaluated in terms of its innovative capacity:

> "This unrestrained belief in innovation which generates, binds together and helps to maintain the many interfaces that have arisen between science, technology and society, the world of finance, information and politics, and the domain of everyday life, comes at a time where several conditions shaping this co-evolution are coalescing." (2001, p 67).

Here we can clearly detect a very different model of the intersection between science and politics than the traditional *Mode 1*. Both science and politics have lost their autonomy and both spheres are subjected to a wider context of business, finance, constant development and competition. The *Sovereign State* has now lost its primacy to the emergence of global market societies. Legitimacy claims are no longer secured via pure science, or for that matter via pure politics, but are viewed as prospective steps in an ongoing development chain.

Nowotny et al (2001) provide a number of causal processes, which are responsible for the transition from Mode 1 to Mode 2 in Science Governing. Amongst these are:

1. *The information revolution.*

The explosive growth of information technology now permeates the world of business and finance, and that of research alike. Clearly, the information revolution leads to a very different form of science and research communication than in the time of traditional publishing. Most important, science information is much more available to the general publics and to target groups than ever before.

2. *From military goals to economic objectives*
The first half of the 20th century was strongly marked by the military endeavours of two world wars and the consequent impetus for science development. In the latter half of the 20th century the strengthening of the national welfare state also had implications for science, especially in terms of the development of the social sciences on a wider scale. Now, around the turn of the millennium a new rationale of science developing is that of "market competitiveness". In Europe, the EU is particularly strategic in such regards, although the "European Model" prides itself for also seeking to embrace the strengthening of social cohesiveness.

3. Societal de-differentiation
Nowotny et. al. also take notice of what they see as processes of societal de-differentiation between the previously separate spheres of state, market, society, science, and culture. The "marketisation" of society clearly breaks down the previous restricted rules of bureaucratic governance. Society is no longer conceived of as uniform culture(s) adjacent to a nation-state, but as a plurality of more or less intersecting spheres of global cultures. These wider transformative processes of globalisation of course affect Science.

4. *From science to research*
The label science is now seen as restricted to the old university settings, while research in very large measures is conducted outside these restricted settings. As a very large share of the total research budget is located to sources and settings outside the university, the label research is now seen as a more appropriate term than old science. It also signifies a new ethos of knowledge production and dissemination. Research is no longer governed exclusively by the academic communities in their *closured* search for "privileged knowledge".

5. *Greater uncertainties, greater risks*
The new knowledge production systems, not the least in industry and in communication settings, lead to uncertainties and to great risk-taking. Shared ventures are required to develop and secure research-based business such as in biotechnology. Not all of these ventures will succeed, and therefore much venture capital is required. No one university, or no one restricted state can afford these ventures by themselves. However, future breakthroughs are heavily dependent on such ventures, and the willingness to take great risks.

What is noticeable in *Mode 2* of science governing is the emphasis upon *innovation* as the centrepiece of the new contract between science and society. This emphasis puts considerable stress on the older types of research agents, such as universities, to be much more active, and to strive for contract research. As a consequence of this new racing for contracts, some universities will be left behind. "The winner takes it all" is yet another consequence of the increasing focus on "centres of excellence" in the science communities. Nowotny et.al. speak of the "logo-fication" also of science, as "branchnames" will distinguish among competitive candidates.

As for knowledge institutions in general, such as universities, science laboratories, whether governmental or corporate, and for traditional university-oriented research councils, the new mode of science governing will have profound consequences. In fact, many of these consequences are already felt as each one of us science practitioners now have to write detailed "contracts" between individual departments and the university, and between the university and the Ministry of Research and/or Education. In the language of the now old-fashioned Marxism one may be allowed to speak of the new tendencies as a process of ongoing proletarization of research and university work.

An organisational consequence of the new currents is that small or medium sized organisations are preferred rather than the older large-scale universities or research laboratories. Small or medium sized organisations are much more flexible than the older bureaucratic type. A Schumpeter-inspired enterprise with perspiring boundaries as to a changing environment is indeed

the favoured model of research- and knowledge organisation. Hence, the emphasis on (research) management is stressed in an extent which was previously absent in the former type of self-managed research organisations. The authors here speak of a rapid de-centring among previously authoritarian knowledge institutions. Knowledge is no longer a privileged resource among the very few but a commodified resource in a competitive research landscape. Intellectual property rights (IPR) was a foreign term in the traditional research landscape with focus on "commonality" and "organised scepticism" secured through a publicly available research process.

Given the new currents and pressures upon traditional research bodies, one can clearly detect measures of both distress and dismay with regard to keeping with the old model, on the one hand, while at the same time adapting to the new demands of strategic and innovative research.

Industrial Research
In former times, industrial research was as a rule organised on a large-scale basis, and with tight links to the university and technical colleges. Examples from the Nordic countries are the electricity- and utility-companies. In Sweden and in Finland, these were typically "state-like" and often commissioned with very close links to Government and Big Business. In Sweden, the production and distribution of atomic energy developed as a shared and intensively controlled venture between business and the national state. In Denmark, as a contrast, small and co-operatively owned business controlled energy and utility.

Presently, strategic research and development affect very large portions of modern industry. In the case of the Nordic countries, notably Finland and Sweden, industries such as *Nokia* and *Ericssons* have become national symbols, although many of their productive research sites are found outside state boundaries. In the extent to which these companies no longer can compete on the world market, and develop proper research strategies, failures will affect the national economy drastically. In the case of Denmark, *Novo Nordisk* has a strategic business interest in promoting bio-technology, and secure that research competencies are guaranteed on the national level.

The global survival capacities of such central industrial research and developments units are dependent on their being sufficiently trained manpower educated at the universities, and such demands certainly affect the traditional self-organisation of national universities. Huge lay off among educated scientists may be the result of failures of these companies to compete effectively. Such strategic research also sets great pressures on what is "ethically" correct to research. The case of embryo research, and of gene-manipulated organism, is often mentioned as national destinies. Within the contexts set by new industrial technologies and research demands, science is no longer a "public venture" but a strategy of corporate research business to "patent rights" in order to secure world competition. However, the consequences of such private or shared (university/business) ventures are in a sense very public, as national economy depends heavily on the successful outcomes of such research endeavours. Both with regard to bio-technology and information technology, close co-operation between industry and university research is a prerequisite.

Government research
In our Nordic countries, government research as that of industrial research, was long conducted in close co-operation with the university. In Denmark, the institutionalisation of social research (Socialforskningsinstitutet) after the Second World War paved the road for a long and continuous empirical research tradition within empirical social science that, due to various academic infighting, never had a chance to develop within the university setting. Social science was here clearly understood as social problem-solving, both long-term and short-term, with a strong belief in a "unified scientific method" to be applied to concrete social problems. It was a science-driven approach to solve problems set by the social and the political community. This science-driven approach is still favoured by The Danish Social Research Institute. Present pressures on

“performance criteria” has led to increasing efforts to utilise academic track records, as publishing in reputed journals and securing professorial positions. In this regard, a *Mode 1* approach is clearly still in operation, at least in some sectors of applied science in Denmark.

But there are indications of a break up from the previous uniform model of applying traditional academic criteria also in applied science. In wider fields of social planning, such as building research, town and landscape planning, much more innovative research crossing traditional disciplinary fields has taken root. In some of the newer universities in Denmark, such as in Roskilde and Aalborg, research in social planning is clearly following the course of *Mode 2* research. In consumer and culture research, the same stress on innovative research rather than traditional science can be traced.

Government research in Denmark has long employed targeted research within ministerial frames. The Ministry of Culture has its own research division with ties both to the university and to practitioners. The same principle of targeted research is conducted within the frame of various government divisions, such as the Ministry of Energy and of Industry.

The plural system of financing substantial research – outside the traditional research council system – has often been the target of criticism both by university researchers and by policy researchers, as it gives rise to what the Danes call “cigar kasser” (cigar boxes). Such a plural funding system is certainly convenient from the point of view of special government interests in order to promote short-term research aims. Yet, when seen in the total research landscape the existence of many such “cigar boxes” gives rise to non-transparency. It has also been criticised for the danger of lowering the quality of the total Danish research system, as it is kept outside the purview and critical screening of the academic research community. Whether such criticism is valid or not is at issue here. What is of interest is rather the perennial tension, which tends to be at an increase, between the strategic aims of government-steered research, on the one hand, and the claims of independent and high-quality research, on the other hand, issued from within the academic community.

Government research in Sweden has pursued the line of a strong principle of “sectorial research” with the establishment of the welfare state after the Second World War. Such sectorial research was in the beginning strongly linked to university research and to university professors, but sector research has since developed as parallel, and in some instances, as competitive to university research. Such competition was especially pronounced in the late 1980´s and early 1990´s with a change in government. The standing critique against the state-operated sector research from the bourgeois parties was focusing on the link between such research upon politically driven views of the formulation of social problems and, in turn, modes of solving such problems. Many central government research institutes were either broken up in much more decentralised and regionalised institutes, or else driven closer to academic, and “non—governed” research. Considerable change in (scientific) problem-formulation, for sectorial and academic research alike was also introduced as an effect of contract budgeting. Significant in the Swedish setting in the late 1980´s were the attempts to de-mantle the Central Statistical Bureau from its previous privileged position in centrally gathering and analysing statistical trends of importance for the nation as a whole. Efforts were under way to de-centralise such statistical record-keeping into more regionalized and “problem-sensitive” smaller units. Research governance then turned into a political and inflammatory issue dividing the Bourgeois parties from the Social Democrats. The former wanted de-centralisation of state administration *tout court*, also of research councils, while the latter persisted in the belief of a strongly centralised research system.

Clearly, the new budgetary system of more competitive contract-research, and active involvement on behalf of research practitioners, have drastically changed the modus operandi of previously state-owned research institutes. Instead of guaranteed bureaucratic funding, many research units

on the state- and county levels now have to compete for research funding in a highly competitive setting.

Research councils
Given the new currents of governing research more generally, from state bureaucracies to market-like contracts, also research councils have to operate in a new landscape. In the Nordic countries, research councils were institutionalised on a large scale after the Second World War (Skoie 2001). This was the time when the emerging *Welfare State*, for its own evolution and surveillance operation, became strategically dependent on targeted research. At the same time, large-scale research, also in the social sciences became much more costly and dependent upon financial support from outside the academic community. As an example, large surveys are costly means of data collection, and support must be secured from outside the academic community.

Research councils turned out to be an eminent method of concentrating and distributing state research support to the academic communities. In their first decades, research councils became primarily an important apparatus for the academic community to select and secure research support for itself. At the same time, research councils allowed for some political control both with regard to better surveillance and with regard to channelling scarce research money to those settings, which academic peers had selected. It seems correct, as also Skoie suggests to view the first decades of operation of research councils as that of the epoch of gentlemen scientists. The number of scientists was still small, and there were close ties between the *honoratiores* of the academic communities and that of government advice and policy.

With the advent of the “mass university” and further demands for more targeted research, the previous self- governing by honoratiores no longer sufficed. A period of bureaucratisation followed, and this was especially marked in Sweden during the late 1960´s and in the 1970´s. There were needs of full scale secretarial operations within research councils employing an increasing number of academically trained personnel exercising bureaucratically specified functions. With the emergence of such secretariats, there is also a risk of a changing power structure. More centralised bureaucratic research councils with strong secretariats tend to weaken and overrule the voices of the traditional and dispersed academic community.

However, there is still considerable variation between the Nordic countries with regard to the emergence of such full-scale bureaucratic council operations. In comparison, Denmark has, at least up to now, had the least bureaucratised council organisation, whereas Norway and Sweden, especially through recent reforms, have gone in the direction of establishing more or less autonomous bureaucratic research agencies employing a great number of academic research personnel. For that matter, in large countries such as Great Britain and France, research councils have as a rule developed as large-scale bureaucratic agencies with considerable numbers of academic employees. CNRS in France and the Social and Economic Research Council in Britain are illustrative cases.

With the development of such bureaucratic research council agencies there are also adjacent demands to centralise previously specialised councils operation. Such centralisation is often seen as a better and more effective utilisation of existing financial and personnel resources as it is also allows for a better “surveillance”. Centralisation is also seen as an effective instrument to combine academic endeavours across academic disciplines, thus strengthening the research council functions as over against the academic community. Especially with regard to an emergent European Research Area (ERA), it has been argued that a centralised national system is much more effective in the co-ordination and response to European research needs (Skoie, p 19).

Organisational reforms of research councils have clearly been on the agenda of Government efforts in the Nordic countries for several decades. Such reforms can either take the form of drastic

decentralisation into more “area-oriented” areas, or else take the form of greater organisational centralisation. In Sweden a polemical legislative effort in the early 1990´s conducted by the ruling bourgeois coalition at the time led to a splitting up of the Wage Earner’s Funds (a Social Democratic initiative) into a large number of research foundations outside the purview of Government Control. However, present efforts have again led to a large-scale centralised research agency (*Vetenskapsrådet*) so as to weaken the effects of a split up council system outside the purview of government control. Reforms in Norway in the 1990´s have also resulted in a strongly centralised Research Council.

Danish Resistance – but how long?
Denmark is of interest in the extent in which centralisation of the six existing research councils has long been resisted. These six councils and their budgetary volumes are shown in the table below:

Table 1. *Research councils and other funding agencies in Denmark 2001* (from Skoie)

Name	*Founded*	*Ministry*	*Budget (2000)*
A. Research Council			
Natural Science Research Council	1968	Research	149.7
Medical Research Council	1968	Research	196.9
Agricultural and Veterinary Research Council	1968	Research	54.6
Social Science Research Council	1968	Research	65.6
Research Council for the Humanities	1968	Research	67.3
Council for Scientific and Industrial Research	1968	Research	105.2
B. *Related Bodies*			
National Foundation of Basic Research	1991	Research	
FUR – Research Training	1986		
C. Innovation Agency			
The Danish Agency for Trade and Industry	1973	Industry	

The Research Council System in Denmark goes back to 1968 (The Technology Council with roots back to 1946). All six research councils, with the exception of Agriculture and Technology, are essentially university-oriented, although, as Skoie notes, a strong top-down element with prioritised research programs is evident in recent years.

The two remaining research bodies, National Foundation for Basic Research and Danish Research Training Council (formerly The National Research Academy), are much more recent, and they were enacted as a lead to increase the body and volume of high quality research. The Research Training Council had as its aim to make graduate training more effective via the institutionalisation of a new doctoral program. The launching of the Foundation for Basic Research was not received all that well by the traditional research councils, as these wanted the money to be channelled through the already existing bodies. Appointment to its Board of Governance is undertaken directly by the Ministry on recommendation, and is much less controlled by the Danish university-community than is the case with the traditional councils.

Skoie, in his discussion of the Nordic Research Council System, points out that Denmark has had less powerful research councils in comparison with Norway and Sweden. The reason, according to Skoie, is that they have had less money at their disposal, and that they are very close to the

Ministry of Research. Their secretariats are, on the whole, much smaller than in the neighbouring countries, thus reducing their possibility to take their own independent initiatives. He also notes that the Danish Government has required the research councils to develop “strategy plans” so as to co-ordinate long-term research policies. Thus, the government had a possibility to “police” the council activities, as budgetary funding was given in accordance with how government approved of these council strategies.

However, during the last two decades, there has been a continuous line of governmental policies as to reshape the Danish research landscape. The Danish Research Agency (*Forskningsstyrelsen*) was launched just a few years ago in an attempt to bring the various council activities closer together and to form a joint Secretariat with a government-appointed Director. The present landscape also contains a special Forum (*Forskningsforum*) with Council Chairs co-operating with external experts. There have been some discussion, also noted by Skoie, whether this Forum has been successful or not.

What is noticeable in the Danish case is the long-term resistance by the six councils to cut down on their numbers. There have been countless proposals to do so in order to make academic Danish research more effective and competitive both with regard to Danish industry and with regard to an emergent European research setting. The existing council system has been seen as responding more to an isolated academic community rather than to strategic research plans from above.

However, in a very recent policy recommendation (*Forskningskommissionen 2001*) there are proposed changes in the direction to strengthen strategic research outputs. Three academic councils (instead of the six now existing) are recommended corresponding to broad research areas (social science and humanities; natural and technological science; medicine and health). Three further councils are recommended: Basic Research Council; Research Training Council; Strategy- and Innovation. These six councils are to have a joint organisation and secretariat, similar to what we already have in Norway and in Sweden. This new organisation is to be headed by a new Board: Danish Research Council (*Danmarks Forskningsråd*). This central council is to have an independent and overarching role in steering and co-ordinating a more effective Danish research landscape. It will have an advisory role with regard to the Government. It will also have to be responsive to the needs of the wider society, the demands of which it will have to channel via investment in and development of research. This new body, presumingly, will include a wide body of societal representatives, from industry, interest-organisations, politicians and, of course, from the university-communities. It will be assisted by a full-time professional Secretariat.

As of yet, these changes are merely recommended, and not yet legislated. Although details are yet to be discussed, and eventually modified, these overarching changes probably signify a new epoch in the Research Council System in Denmark. The old gentlemen agreement system, the reliance on honoratiores, and the close reliance upon the traditional academic community (a prolonged arm of university faculties) seem to be coming at an end, also in Denmark. What comes in stead, if the proposed changes are to be enacted, is the emergence also here of a much more bureaucratic and professionalized council system with an independent, and perhaps strong, secretariat. In this regard, Denmark seems to converge with the evolution of bureaucratic and professional research councils that we already see in most major West European countries.

DISCUSSION

Both Novotny et. al. (2001) and Skoie appear to take a gloomy look on the future of national research councils. In the case of Novotny, the national research council system is looked upon as strongly dependent on *Mode 1* of science governing. Peer review in selecting proposals has been strongly advocated. The strength of this method in selecting research proposals, noted also by Skoie, resides in its capacity to fund mainstream academic research, and to sort out bad proposals. It is not optimal in selecting the most innovative research proposals because of its reliance on "scientific method". Innovative breakthroughs, and scientific risk-taking, as a rule receive a step-motherly treatment in such bodies of *honoratiores*. Novotny and her co-authors find that the re-modelling of science councils from Mode 1 to Mode 2 is a complex and difficult process. They recognise a number of variations in counselling operations: the state-model; market-model; mixed model.

The state-model is illustrated by the recent evolution of Nordic councils: a more centralised research council operation with a strong and unified secretariat tends to overrule the traditional academic bottom-up approach. A centralised system is much more efficient at setting priorities, eventually in co-ordination with the new European Frame Programs. Its weakness resides in its eventual distanciation from the wider academic community, as it tends to respond more to top-bottom initiatives than to those from bottom-up. Another weakness, according to Novotny et.al., is its seeming reliance on a linear model of linking research to practical policy endeavours. The serendipity pattern, to see the unexpected and to follow a new lead, is not much favoured by this linear approach.

The market-model of research is primarily employing the contractual model between the buyer of research (industry) and the producer (the researcher). This model has its strength in venture capitalism: when large resources are needed in order to profit from, i.e., and recent advances in bio-technology. Its weakness, however, resides in its negligence of non-strategic research. If its model of operation were to be enacted in the case of the academic research community, large areas of traditional science, not the least in the humanities, risk death from starvation.

The mixed model, advocated by Novotny et.al., deploys both bottom-up selection, as traditional research, while being sensitive to top-down initiatives. However, such mixed models suffer from instability, as the various competing demands on research are hard to combine in the long run.

However, the real danger for national research councils, in the view of these authors, lies in the rise of a European Research Area. They suspect that a new expertise cadre, close to strategic ERA strategies, will overhaul the national expert system of *honoratiores*.

Skoie´s gloomy perspectives on the future of national research councils derive in part from some different considerations. He fears that the tremendous demands now put on research and development, channelled through the national council systems, lead to exhaustion and fatigue among their members. He also notes that there are recent tendencies from within the academic university community to view national research councils as competing (and unnecessary) bodies. Universities want to have money channelled straight into their operations rather than mediated by research proposals administrated from above. He also notes a new mentality climate developing among researchers: the signing of a research contract aiming at a specific target is done from a utilitarian perspective. If such research strategies develop among academic researchers, the goals of large-scale government priorities are efficiently undermined – and weakened. Such tendencies on behalf of the research community also actualises the old question as to what extent research really can be governed from above over a longer period of time.

Nowotny et.al. is probably correct in diagnosing the great strains felt by national research councils in going from a *Mode 1* to a *Mode 2* form of governing science. It is difficult for any member of a

scientific council to discard high quality research for accidental and popular demands from the political community, whether on the national or the EU-level. What is not discussed in any depth in the popular book by Novotny et.al. is the transition, clearly discerned in the Nordic setting, from the traditional honoratiores mode of governing (Mode 1) to a much more bureaucratic form of research administration (also Mode 1). In the last case, however, traditional scientific criteria are also employed as methods of selection, but the bureaucratic form demands much more standardisation and also routinisation. As in the case of the mass university, the administration and governing of mass research also demands more bureaucratic and impersonal criteria of selection. Such bureaucratic forms of governing will have problems in responding to Mode 2 criteria in the governing of science.

If there were to be a drastic change in governing science, from Mode 1 to Mode 2, traditional research councils would be imperilled. However, such a radical transition is not likely, and neither is it desirable. More traditional forms of science governing, by honoratiores and by bureaucrats, will remain important research agencies. An extreme form of Mode 2 is utterly unstable, and amounts to no real governing, as research selections are undertaken on a more *ad hoc* basis.

Research bureaucracies serve important functions both for the research community and the wider social community, as their secretariats become containers of social power: research bureaucrats, if employed on a stable basis, secure a collective memory and they have wide social contacts. Research bureaucrats are much better players in the ERA setting than are traditional scientists, not accustomed to reading EU-documents, and not tuned into the hidden agenda at EU-meetings. At the same time, such research bureaucrats in the national setting often preserve some solid contacts with their own academic community. The question arises as to what extent a process of bureaucratisation, and the emergence of a special cadre of research bureaucrats, not also become a steering factor in the governing of research in the long run. The alleged transition from Mode 1 to Mode 2 in science governing is not sufficiently sensitive in covering the very special demands that result from an extensive process of research bureaucratisation. It is certainly true, as Skoie notes that such bureaucratisation can lead to fatigue and exhaustion among academic players. Nevertheless, the large scale institutionalisation of research council secretariats, and of specialised academic functionaries, have perhaps the unforeseen consequences to mediate over time wildly discrepant needs of the political, the industrial, and the academic communities. From such a point of view, it becomes difficult to foresee a future where research councils have lost their role all together.

The social role of research councils as buffer zones between wildly discrepant research claims ought to be given more serious attention.

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Chapter 3: Priorities and priority-setting processes in practice at different institutions

The purpose of this chapter is to explore the main lines of current issues and debates about priorities and priority-setting processes (formulation and implementation) as experienced in different institutional contexts and by different groups of actors.

From the institutional perspective, the contributions aim to address both the 'what' and the 'how' of science policymaking, in other words, the content and nature of priorities and the actual ways in which policy is made for new directions in science.

The prioritisation process in science and technology: lessons learned in the definition of the Spanish National R&D Plan

Revised version of Position Paper

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1. Introduction

This position paper is aimed at describing the rationale behind the prioritisation process carried out in the definition of the Spanish National Plan on Scientific Research, Development and Technological Innovation. The paper is based on the author's experience in the formulation of the mentioned plan and also on contributions made to a number of regional R&D programmes.

To clarify the context, it is important to say that "national systems of science and technology" are not isolated systems, but rather form part of multiple and complex cross-country interconnections. The present dramatic increase of dense inter-linkages accompanying the globalisation process has been a reality in S&T fields for some time. A rich set of relations are clearly visible among all actors involved over the world. These factors condition as well as constrain policy and decision making processes.

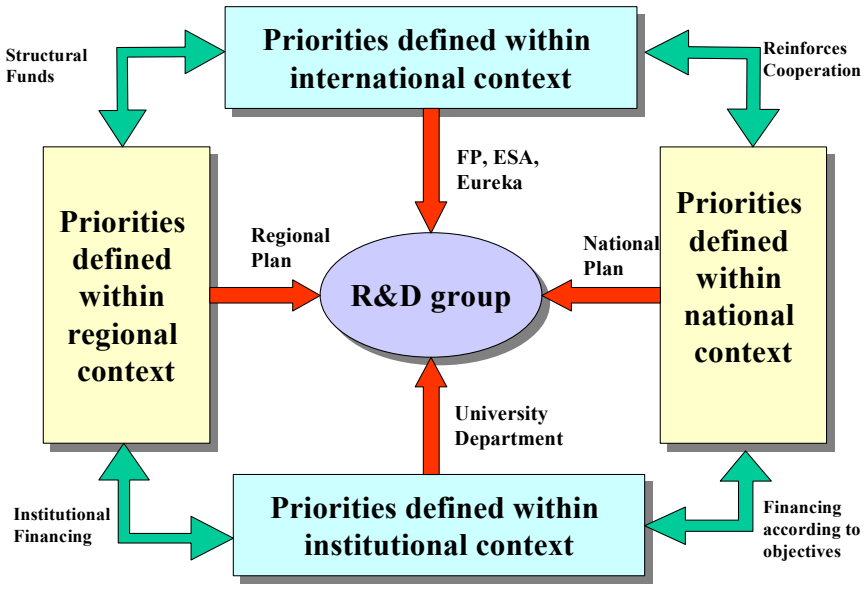
Nevertheless, scientific and technology prioritisation remains a national level decision by governments. Although, it is well recognised that it receives some influence from other levels, where Spain is not an exception in this situation. This multiple level approach is also related to the way that subsidiarity is understood and implemented. As it will be mentioned in the paper, some difficulties found in implementing this multilevel approach avoids higher levels of efficiency.

Priority setting in science and technology can be viewed from two levels, the research organisation level and the policy planner level. From the perspective of an organization or more specifically a research group, the priority setting process is limited by the existence of multiple constraints, as it is represented in figure 1, and thus provokes the need to ensure that its research lines are well covered by a number of programmes.

Overall, this is a dynamic and changing process, but the conditions to satisfy in terms of a research group are relatively known and understood. Research groups try to maximise outcomes (not only scientific ones) and simultaneously to reduce risk of lack of funding from a medium or long term perspective.

When taking consideration the policy or programme level, however, prioritisation is more complex. Priority setting for programme managers involves many dimensions and has a much wider set of conditioning factors. This position paper will address this issue from the policy makers' perspective.

Figure 1. The influence of priorities on the research group



The position paper begins by addressing the general context and approaches used in the prioritisation process for policies related to science and technology. The third section briefly discusses the experience of Spain and how different levels of administration have played a direct role in priority setting in the definition of its S&T policy. To conclude, some final remarks are made concerning this topic.

2. Priority setting in science and technology

2.1. The context

It is widely accepted in Western democracies that scientific and technological knowledge has a high potential value to transform society and is the basis for the sustainable improvement of citizens' welfare. From the consciousness of this importance, public policy makers have felt the need to influence on these areas, in particular because of their higher or better capacity to transform society. Conceptually, these became priority areas for attention (OECD, 2001).

National or regional governments also wish that priorities focus on some areas and not on others, in order to find the correct balance that will stimulate growth and therefore contribute to socio-economic progress and long term sustainability. Decisions are taken as a function of the available resources and the pursued societal model, but within the wider context of S&T trends.

The selection of priority areas is conditioned by the main mission of public administrations as "keepers" of the common good (a duty implicitly granted to them by citizens in Western democracies or taken upon as a natural responsibility). The cases such as national defence, food security and safety or the protection of natural resources are well known examples of concerns high on the political agenda.

Today's economy is based on a knowledge society , where the development of innovative products, processes and services, in a context of global markets is essential for improving productivity and competitiveness. This sets aside the traditional assumptions of classical economics where factors such as economies of scale and price reduction are important. Nowadays, intangibles production and appropriation makes the difference.

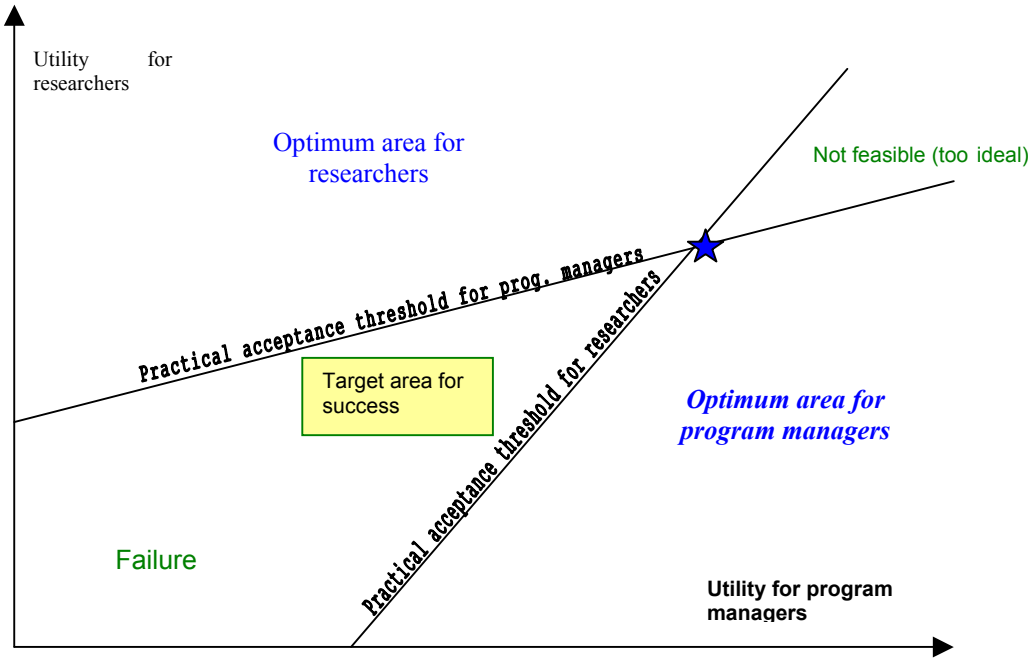
Consequently, policy makers must increasingly promote research, development and innovation in strategic sectors since knowledge has become the main production factor. However, all these pressures also impose a legitimisation process for determining priorities. Within this context prioritisation becomes essential but a difficult task, especially in the areas of science and technology.

The determination of priorities is a process, which entails the identification of objectives that are credible, acceptable, shared and respected collectively. This implies a commitment, or social contract between the policy makers whom establish them, the scientific community whom execute them and finally the citizens whom take advantage of their benefits.

Finally, program managers have to determine the best set of priorities based on those that are useful for society but also useful for researchers. Figure 2 depicts this utility relationship. As we can notice, utility from researchers is not the same than for managers of S&T programmes. Both stakeholders try to be sure that their decisions place expected outcomes above some thresholds (even if the thresholds change with time).

Figure 2 suggests that it is not possible to optimise utility from both researchers and programme managers, and a compromise is sought for acceptance of the prioritisation process and then the associated policy measures. Programme managers feel that the optimum for researchers cannot comply with global societal interests, meanwhile researchers feel that full acceptance of managers' views is against the basis of their work (i.e. in terms of freedom). In practice, this is quite difficult to determine and unless there is an adequate monitoring, evaluation and feedback process, finding the areas that will produce successful outcomes is difficult to achieve. As a consequence, priority setting is always a compromise (Van der Meulen, 1998).

Figure 2: Priority setting utility diagram



2.2. Dimensions to priority setting

There are three dimensions of priority setting that policy makers face, the *thematic issues* which concern the selection of research lines, areas, or problems (what to fund), the *type of instruments* to employ (the modality of the funding and participation) and the *budgetary issues* which concern how much money is available and how much to allocate to specific priorities.

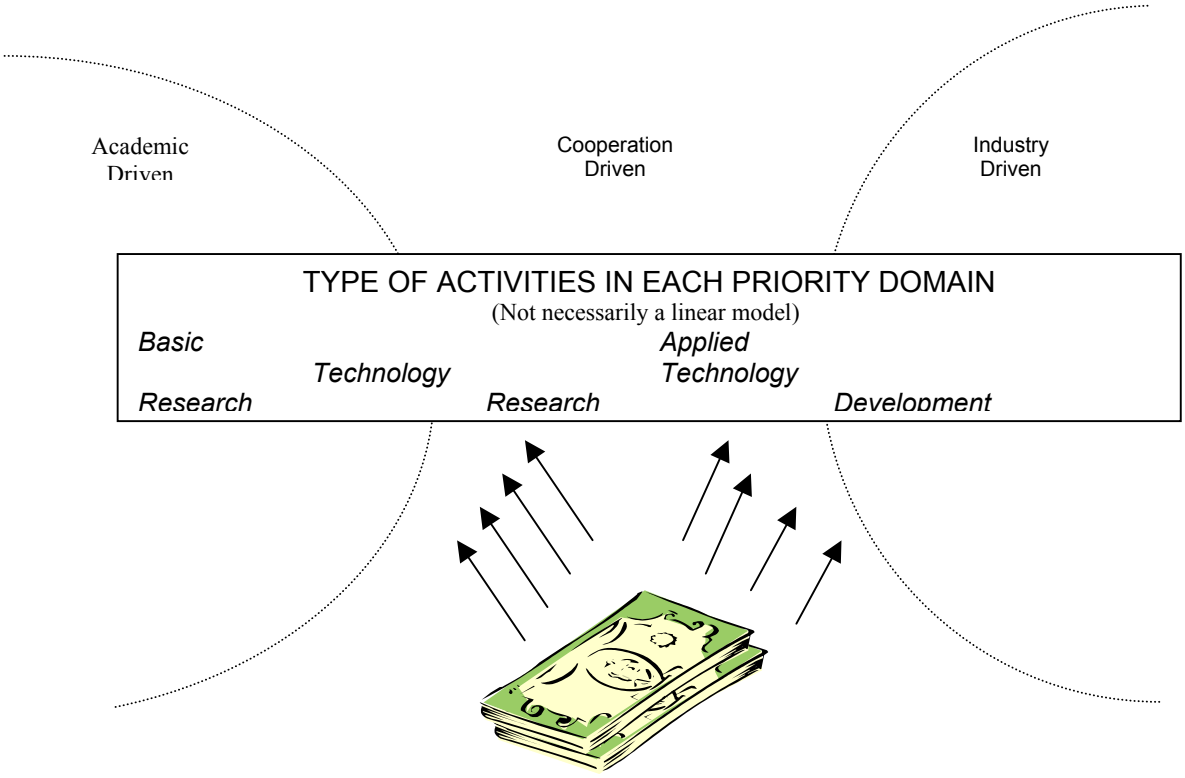
Governments try to redirect the effort and activity of research groups towards the selected thematic priorities. The efficiency of the process is, however, constrained by the attractiveness of the policy instruments made available to participants and the budgetary weight allocated among the areas.

The type of potential activities in each of the prioritised thematic areas could range from basic research to the applied research that aims for absorption of technology in private companies. This extremely wide range of potentially funded activities precludes the use of a common strategy to define priorities or participation instruments.

Some policy measures try to favour the percentage of funding allocated to common or general activities under the assumption that these type of instruments, such as networking, have an intrinsic benefit, although they could complicate things for participants.

Several forces play a role in priority setting, which can be academically driven by the scientific community, or industrially driven by firms (see figure 3). Cooperation lies in the areas that can serve the interest of both, however the "bottom line" is the actual amount of financial resources allocated.

Figure 3: Drivers influencing the priority domains for S&T policy



After determining the thematic dimension, the next step is the allocation of resources. Priorities although defined do not have a weight until a “monetary” value is given. Therefore, the prioritisation process not only involves deciding the scientific or technological area or determining a specific problem, it also involves committing a value and gives a relative importance with respect to the other issues or problems or that have been defined as priorities.

In terms of budgetary prioritisation, after allocating funds to a specific thematic area, it is necessary to decide the internal allocation from basic research to technological development or technology transfer. The consequences on how this is achieved and what is determined affects the potential participants.

Instruments are closely linked to the type of activities that policy makers intend to stimulate; activities closely related to the scientific or technological domain considered. Types of instruments range from plans that finance research projects, provision of equipment and infrastructure, funds for human resources, training and education, etc.

Nevertheless, the restrictions on the availability of economic resources are the main conditioning factor that limit, in practice, the number of priorities supported and the means by which these should be achieved. This limitation is based on the fact that it is necessary to guarantee that priority lines can be addressed in a proper way, with the adequate amount of resources. If not, false expectations among the potential candidates or interested parties could arise.

As a result, thematic priority setting cannot be isolated from instrument prioritisation and budgetary prioritisation. The main drivers for policy action are moving along these three axes and finding an equilibrium point.

Figure 4: Priority setting dimensions for programme managers

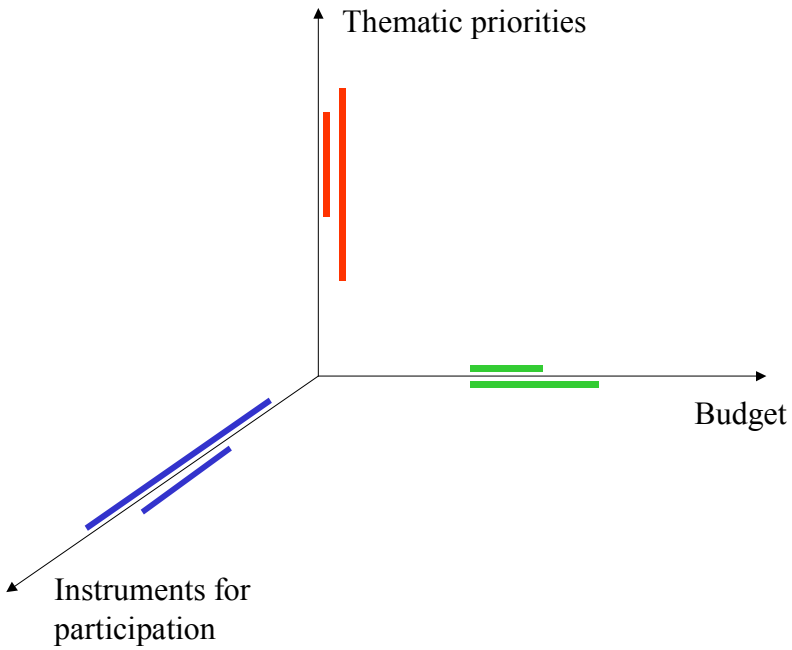


Figure 4 depicts how the definition of a specific programme should be done along the mentioned axes with a broad or narrow range of instruments for participation, with more or less funding and with very specific priorities or more horizontal ones. The combination of these decisions also influence the number of potential users of the programme.

The figure also suggests that some balance is necessary. To define a programme with various instruments and many thematic priorities, but then with an allocated budget that is too small, impedes the satisfaction of the intended goals. The same situation appears when enough budget is allocated to a broad scientific and technological domain but the instruments of participation are very limited.

2.3. Approaches used for priority setting

The determination of priorities can use approaches that range from a *problem-solution* perspective or a *horizontal- vertical* perspective. The aim is to provide a specific configuration or map.

To have a "map" means to establish a set of priorities that will guide researchers in their activities and permit the policy makers to allocate the resources available in an organised manner over time. In terms of policy makers, their mission is to direct the activities through coordination and "steering" or control mechanisms (Rip and Meulen, 1996). They are driven by the interest of pursuing the common good and improving the competitiveness of the industrial and S&T systems.

Researchers have their own interests and needs also, and prefer a bottom up approach for establishing priorities in science and technology. These interests are based on the skills and capacities that are available to them. The underlying aim for researchers is to advance and contribute in the production of knowledge.

There are extensive discussions on whether basic research should be part of the prioritisation goal. These approaches focus on a horizontal perspective which covers all areas and fields. Academia has a strong feeling that freedom in research is the best procedure to get results. Solutions to future problems are what they seek. Past experience has demonstrated that science as "the endless frontier" has produced decisive advances in mankind, nevertheless cases of duplication of efforts cannot be ignored.

Furthermore, public accountability and scarcity of resources have pressured policy makers to take a more vertical approach where specific fields are selected, in particular, the idea to solve current social problems.

A delicate balance between the above mentioned freedom and the need to solve societal problems should be achieved. An equilibrium between a top down approach that may be too focussed and a bottom up approach which may end up looking like a "shopping list" is needed.

Decisions must be made continuously on what future steps need to be taken and the possible alternatives. However, there may be a conflict in what is the interest of the researchers and the desires of the policy makers. The conflict is evident and the prioritisation process is difficult to achieve because often the points of view differ.

This has been evident in the recent discussions for the Sixth EU Framework programme (EU, 2000). In the case of scientific community the desires focussed on finding "solutions for potential problems" where priorities and importance are given to certain areas (such as nanotechnologies, proteomics or bioinformatics to mention some hot issues).

Meanwhile public actors were concerned to prioritise based on a "problems that need a solution" approach. For them, the issues of interest have been closely linked to sectoral policies. Examples of this approach are: food safety, treatment for neurological degenerative diseases, prevention and prediction of natural disasters, etc. where "society" is waiting for help from researchers.

Also, the support to strategic industrial sectors (like aeronautics) is considered looking for a strengthening of the R&D in sectors with a huge importance for the competitiveness of a region and with the capacity to attract R&D activities in other sectors (like ICT, materials or energy). Notice that this situation happens when historical records of failures in supporting specific sectors are common.

Therefore, a balance is found when consensus is achieved through both aggregation and coordination mechanisms, that is, when both bottom-up and top-down approaches are used in the prioritisation process.

Decision making for all actors related to science and technology, including research groups or policy makers, therefore involves a complex process of gathering information, setting future expectations, defining interests, determining what the problems are, and matching solutions to these problems (Sanz et al., 2001). The whole processes involve interactions with others and depends highly on a set of limited resources using the capabilities and skills that are accessible.

3. The priority setting in the Spanish S&T system

3.1. The definition context

Although differences in size, type of actors, quality level, or volume of funding are factors which make the Spanish system of S&T different from other systems, the main drivers in the world scenario, and international trends also affect national policy as occurs in many other countries. However, as we will see later on, the strong influence of the EU has been predominant and has conditioned priorities in S&T.

The territorial contexts in which the prioritisation process takes place is very important to keep in mind. The global, European, national, regional, local and institutional levels are influencing and simultaneously acting upon the decision making process. We should not interpret this as a hierarchal order where one level is below or above the other, but rather as dimensions that set the "rules of the game" and define the policy arena.

As a result, the main difficulties lie in establishing the competencies clearly limited within a territorial or institutional setting for specific areas of science, technology and innovation. There is a clear need to set up mechanisms that permit interaction among the administrative levels. Scientific and technological cooperation is the area that one will witnesses the most international collaboration. These cooperation measures have been used as a means to reduce the gap among countries, to assure the existence of strategic alliances that permit improvement in the development of industrial activity and added value. Coordination for the selection of priorities, creating a modulation process of interests, becomes necessary

In Spain this is clearly evident because although the central administration is who defines the national R&D science and technology plan, the Autonomous Communities (regions) have competencies in S&T anchored in their specific Law.

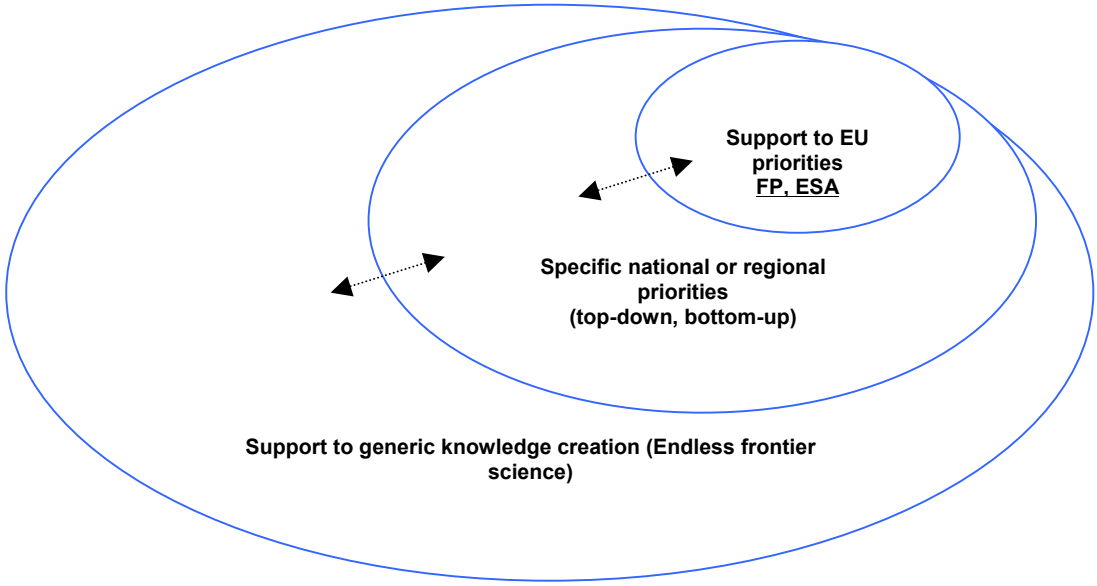
In addition, Spain forms part the European Union, which consequently exhibits these types of conditioners. Consideration must be taken for the international, national and regional levels, not

only as a subset of one another but rather as a dynamic interaction process that exhibit interdependencies.

The dynamics of prioritisation for policy makers at the different administrative levels involves subsidiarity process where research actors pressure their interests “up” to become part of the set or “circle” of priorities within a given plan or programme, while policy planners try to limit and move areas “down”. For Spain (see figure 5) this subsidiarity process occurs with the research community, national and regional administration and the European level programmes.

Pressures from researchers to see their desired priorities within inner circles (i.e. accepted at the European level because it also implies acceptance at the national level) are also confronted with the view of complementarity that policy makers like to see in the general map.

Figure 5: The subsidiarity process in priority setting



When some research activities are not selected in the European or national levels as specific priorities, researchers feel that they should be considered under the general framework of “support to generic knowledge creation”. This challenge is accepted by governments although budget allocation becomes a common problem.

The four year National Plan of R&D and Innovation (now in its fourth edition) (MCyT, 1999) was influenced by past experiences accumulated in previous plans, and by the basic structure and conception of the European R&D Framework programmes.

Its priorities include issues and research topics that have been the main concern of public decision makers, while at the same time, aggregated most of the demands of the research actors involved on the consultative and decision making processes.

Priority selection in Europe has been increasingly conditioned by public accountability and legitimating of public funding. This has also been the case in Spain, but not until more recently.

In Spain the development of the National R&D Plan has involved three main policy elements:

- The need to include all activities carried out by all ministries in an integrated view. It was considered an important instrument to enforce coordination inside the central government and also with regional governments.
- The establishment of priorities combining sectoral perspectives with scientific or technological approaches driven by disciplines.
- The coverage from basic research to innovation (note, this is the first time that technological innovation emerges in a visible way).

The combination of all these elements defined the structure of the National Plan.

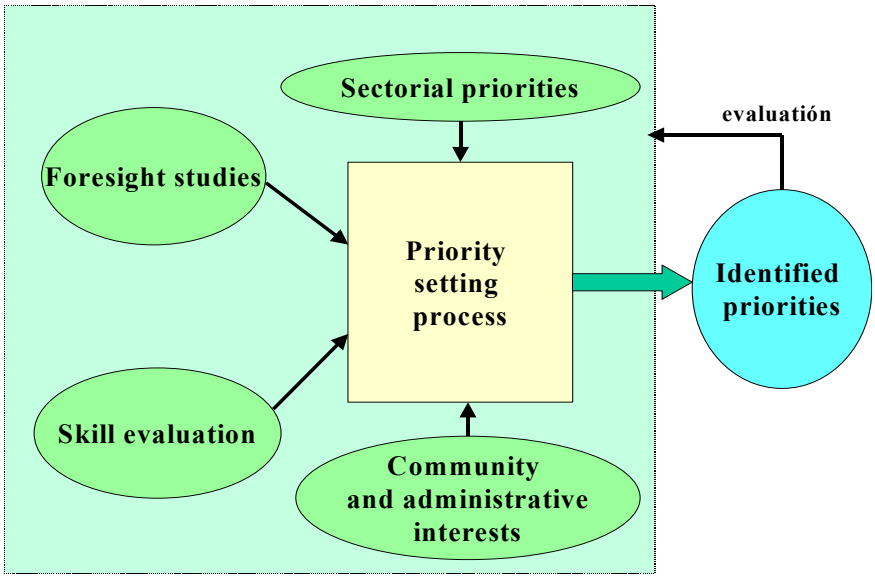
3.2. The definition process

From the operational standpoint, after an initial identification of priority areas proposed by the Office of Science and Technology (attached at that time to the Presidency of the Government) and approved by all ministries concerned, groups of experts were set up to identify specific priorities within each of the areas. Another group was working on instruments. The result was finally approved by the Inter-ministerial Commission and then by the Council of Ministers.

The need to establish an intermediate step between expert groups and formal decision making at the Inter-ministerial Commission was identified from the beginning. It was addressed by the Office of Science and Technology with the creation of a Planning High Level Group of officers from all ministries involved. This group, without any formal mandate was, however, essential in facilitating the approval process.

The prioritisation process was backed by a number of studies on different aspects. One specific foresight study in some areas was conducted with the help of IPTS (a EU JRC institute located in Seville). Figure 6 depicts a general view of the process.

Figure 6. Elements for the prioritisation



In spite of these studies, pressures to include everything (by adding additional issues) and the pressure to focus the resources (by defining strategic projects) were not too far from similar attitudes at the European level. The main difference was to the need to listen to the experts in a visible way (a traditional setting up of panels of experts). Then, bottom up and top down approaches were simultaneously used.

The interaction with the Framework Programme was considered from two different perspectives: to complement the issues not covered by it, and to stimulate the participation with a set of measures in the areas covered by the framework. The structure and priorities were very important elements for discussion (FP5 was approved months before) but it was also evident that the concentration effort in FP5 let room for many areas in the National Plan.

3.3. Interaction with regional governments

The definition process also affects to regional governments (conceptually, it should be also affected by decisions taken at the regional level but from my experience this interaction is very weak).

Priority setting processes at the national level is not synchronised with other similar processes at the regional level. Theoretically, different priorities can be set up limiting in practice the effects of some priorities. Nevertheless, coordination is one of the goals in the Spanish Law regulating these processes.

From the budgetary effort perspective, regional governments devote a total amount of 20% of the effort in the General State Budgets. This effort is, however very heterogeneously distributed amongst communities.

With this goal in mind, the Spanish NP has included a specific chapter about the coordination with regional governments (the so called “Autonomous Communities” in Spain) where bilateral agreements were proposed to consolidate a stable relationship. Nevertheless, they are not mandatory and then subject of political will.

3.4. An initial evaluation

It is still too early to know the effects of the current prioritisation process in the behaviour of the actors involved. A personal evaluation of the implementation process discover some difficulties to set up the goals and the slow evolution of the research at the European level is not influencing at this stage.

The first point addresses a general gap commonly found between the objectives established during the definition process of any S&T programme (priority setting) and the decisions taken at the implementation process (during the management of the S&T programmes). Difficulties are motivated by the slow change mentality of officers in charge of implementing programmes to identify and accept the hidden new rationale behind the definition processes. This is a consequence of lack of tradition and a lack of involvement of managers in the process.

The second point refers to the construction of the European Research Area. Its slow advances avoids a greater level of internationalisation in the National Plan. Problems in the opening of national programmes or simply clustering of similar projects funded in different countries show the internal practical barriers that appears in spite of general objectives. Here, pressures from outside is too weak to change attitudes.

4. Final Remarks

From the experience with the Spanish National R&D Plan, some ideas of the prioritisation process can be extracted. These are:

The process of prioritisation is continuous. The process does not end with the publication of a specific regional or national plan. The surrounding conditions and the general context in which the priorities were defined are constantly changing, where the actors within the system must be aware and prepared to detect. It is necessary to set up mechanisms to assure that the priorities remain in force for the whole time period of the plan. It important to be aware of other plans at other levels which may affect.

Design for change. Based on the fact that everything changes, the internal structure of a plan that defines a set of priorities should be designed to facilitate its durability. In that manner, differentiation should be made between those issues or items that are essential and permanent, from those that are accessory and transitory.

Participative prioritisation. This relates to the aggregation of ideas, desires and needs where interested actors participate in the prioritisation process. Not only should those actors that belong to the specific settings or region but "external" actors be consulted as well as societal and the needs of end users be taken into account.

Concentration of priorities. There is not enough resources for everything, neither economic nor human. The prioritisation process should be just that, include things and exclude others where the options are clearly defined. Plans cannot end up being "shopping lists" because the biggest risk is that it becomes useless, too little for too much.

Coordination and cooperation. Mechanisms for coordination of actors should work together with mechanisms of cooperation in activities concerning priority selection. These are fundamental to guarantee success.

Human resources are a necessary condition. Often once the thematic area is defined and the budgetary conditions set, the human factor which makes everything possible is forgotten. The timescales that make things possible often take longer than what a policy makers desires, or within the time period established by the plan.

Towards a pro-active administration. The prioritisation process also involves a "selling" of the ideas to the citizens and motivating the actors involved in science and technology.

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Setting priorities in a national Research Council

(Draft, not for quoting without the consent of the author)

Chris Caswill [11]
The UK Economic and Social Research Council

The UK Economic and Social Research Council (ESRC) is the principal public sector funding agency for social science research. It currently has a budget of £ 76 million, of which £46 million is allocated for research. Within that research total, £24 million (52%) is used to fund research in priority areas identified within the Council. This paper gives one brief account of the decision process, which led to the current arrangements for this priority funding.

When the UK Government published its "Realising Our Potential" science policy White Paper in 1993, (HMSO, 1993) ESRC already had a structure for funding research priorities. There were four Boards to make funding decisions – Grants, Training, Centres and Programmes. The last three were responsible for research. Grants and Centres were mainly responsive but Programmes promoted the ESRC research agenda, and commissioned new projects in priority areas.

The 1993 White Paper introduced important changes to the UK Research Council (RC) system. It gave each of the Councils a Mission Statement it required all the RCs to "meet the needs of users of (their) research and training output" it proposed "A new partnership" between Government, industry and what it called "the science base". It established a new post of Director General for the Research Councils (DGRC), and replaced the role of full-time RC Chairman (which had been in effect Chairman, Chief Executive and Accounting Officer) with a part-time Chairman appointed by the Minister, and a full time Chief Executive. The Chief Executive would no longer chair the Council meetings.

Much has been written elsewhere about these changes, and this paper will look only at the process of transformation into a new ESRC policy on priority setting. It is worth noting that the 1993 White Paper can be seen as an attempt by a Ministry-principal to re-establish its primary role after several years of policy uncertainty, and to ensure that national Research Councils were better identified with its (and the Government's) interests. The changes to the top management arrangements provided stronger representation of its "principal" interests, and can also be seen as reducing the moral hazard that RCs might "shirk" on the new White Paper commitments.

An interesting early indication of this was the statement by the incoming Chairman that he saw himself as the holder in the public interest of the "golden share". He made it clear and that he would lead a positive ESRC response to the White Paper. One of his first actions was to set up and chair a working group of Council members to respond to the demand "to meet the needs of users".

The eventual outcome was the creation of a set of ESRC "Themes" and Thematic Priorities. The Themes were nine broad policy areas, which were seen as collectively describing the research interests of UK social sciences. (ESRC, 1995; ESRC,2000). They were established as a mechanism for setting, presenting and reviewing the Council's strategic directions.

Amongst the many interesting questions, which can be asked about this policy innovation is why this form of response to the 1993 White paper emerged, and why it emerged in the form it did. These are serious research questions and the research is still to be done. For the moment, some

[11] The views expressed here are those of the author and are not to be attributed to the UK ESRC.

insider insights may help to begin the analysis of the interplay of interests that led to the new policy.

This paper reviews four aspects of the processes of creation and implementation, and proposes some conclusions for science policy decision making. There were many contributions to the eventual outcome but the key elements can be found through analysis of:

- the Council Working Group which produced the initial proposals
- the other responses within ESRC
- the role of the Office of Science and Technology (the ESRC's "Ministry")
- subsequent interpretations and uses of the Themes.

The Council Working Group was convened by the new Council Chair and included the Chairs of the four Boards, all of whom were Council members. The Chief Executive was also a member, but he was new and only came in part way through the process. Three of the Board Chairs were senior academics. They represented that interests of their Boards, of the academic research communities as they saw it, as well as the ESRC's policy interests. This seems to have shaped the outcome in an important way. For example, the new Themes were presented (and implemented) as providing the ESRC Boards with a "broad steer", rather than explicit directions. The responsive Grants Board, which is highly valued by academic researchers, was largely left untouched by the new Themes. It remains exempt from any policy direction. The (postgraduate) Training Board was the other Board which provides large resources to Universities through responsive process, organised on the basis of disciplines. It too was highly valued in the academic community and has for the most part also continued to decide on its allocations of studentships without following Theme priorities. Here the academic community's interests can be seen to benefit from the way in which leading academic actors had reached in to participate in ESRC's internal processes (Braun, 1993, Braun, 1998, Caswill, 1998, Caswill, 2001).

The Themes did however make some important changes to the Council's structures and behaviour. A new, powerful Research Priorities Board was created, replacing the former Centres and Programmes Board. On the way, this new Board acquired a larger budget than any of the other Boards, and became the main instrument of the Council's Thematic priorities. It was set up with almost half its membership from outside academe. The Themes themselves were to be established and prioritised through a large national consultation in which research "users" – Government, private sector and public sector - were to be given a large part to play. And Council members, appointed by the Minister, now had at their disposal a mechanism for setting the main directions for future ESRC research. The interests of Governmental principals now had more routes into the Council's decision making. Looked at as an institutional change, the Themes have led to important but often subtle changes to the Research Council, some of which have probably not yet been worked through to their full extent.

The Theme proposals made their way to Council after lengthy discussion within the Council staff, and between staff and Council members. The outcome was also to some extent mediated by those discussions. There were for example differences of view within the ESRC permanent staff about the challenge of meeting the needs of users. This was not a new question for ESRC (or for the social sciences). In one sense the Themes proposals sought to limit interaction with users to discussion of high level strategic ideas. This was indeed the clearly held view of the new Council Chair. There was a strongly held alternative view that users needed to be engaged directly with social science research (Caswill and Shove, 2000). The latter view was also adopted and developed by the new Priorities Board. In practice therefore the Research Council has adopted a multi-level response to the White Paper and policies of both strategic and operational user engagement are still being actively pursued.

The Council and its staff were of course formally constrained in their implementation of the " Realising Our Potential" agenda. The White Paper was the jewel in the crown of the Office of Science and Technology (OST), which at that time had direct representation in the Cabinet via Britain's only post-war Cabinet level Science Minister, William Waldegrave. Yet the OST seems to have had little direct impact on the Themes or their implementation. They were not represented (or even present) at the Council Working Group. Little if any of the subsequent policy bears their imprint. There may be several reasons for this. The then Science Minister seemed genuinely to believe in the importance of separation of science decisions from government and politics. The so-called Haldane principle is after all enshrined again in the White paper (HMSO, 1918; HMSO, 1993, p. 32). The OST had in any event established a stronger long term principal relationship with all the Research Councils, and no doubt had confidence in the newly appointed Council Chair. This was also a small Ministry with too few staff to engage with the detail – and ESRC was the smallest Council. In any event, the Council was left to work out this key element of its own post-White paper future.

Having done so, the Research Council established a new and distinctive science policy. Its significance and interest lie as much in its implementation and interpretation as in the process by which it was created. This aspect of the policy process will also repay careful enquiry but here again some initial insider insights can be offered. The impact and indeed the nature of the Themes was visibly influenced in interesting ways the interpretations of different stakeholders. For the ESRC as an organisation, it quickly became clear that the Themes could be an excellent marketing tool for the Council and for the social sciences, because they set out the range of social scientific interest in a new and persuasive way. So the Themes became, for some, a marketing process, though they were certainly not conceived in that way. Many social scientists, already alarmed by widely perceived Conservative Government disdain for social science and for academe, saw the Themes as an expression of Government influence on ESRC and its policies. The Council and its staff saw the Themes in quite another way and recognised the need to justify their White Paper response to those who it still saw as its key suppliers. On the other hand there was a growing conviction within ESRC of the need to persuade social scientists of the importance and value of the positive use of their research. And so the Themes became for several years a battleground for the hearts and minds of the social science academy. Conversely, the Thematic Priorities seem to have been welcomed by users in both public and private sectors, perhaps because of the improved presentation of the social sciences and the explicit recognition of a legitimate role for contributions from outside the academic world.

Seven years on, much of the dust of the debate has settled. ESRC's Themes seem now to be neither very controversial nor to be the major drivers of change in UK social science. They have been absorbed within the normal processes of Research Council decision-making. It seems now to be widely accepted within academe that good research often deserves an audience outside the academy. Themes are also bedding down within ESRC, where the Council has just agreed to extend the period between major Theme reviews from three years to five. The close range account given here of the early phase of this policy change has inevitably been partial both in its understanding and in its emphasis on differences of view. Nevertheless some tentative conclusions for the study of science policy decision making can be attempted:

(a) It shows how a variety of aims influenced the creation and implementation of an important (social) science policy, which was in turn a response to a high level Ministry principal intervention.
(b) It also illustrates the penetration of ESRC discussions by academic interests of a particular kind.
(c) It confirms the ability of individual Council members and permanent staff to shape an important policy development to the organisation's perceived needs.

(d) The intentions and behaviour of the various actors can be seen as a set of principal-agent games (Van der Meulen,1998).
(e) The eventual response to Themes can at last in part be explained by the principal and agent responses of those who played these games.
(f) The eventual outcomes probably do not conform to the expectations of even the most powerful of the policy authors, nor of those who managed the implementation.
(g) The range of contributors to the policy helped to ensure its appeal to several audiences and its incorporation into mainstream Research Council policy.

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Priority setting in the Norwegian Context

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Introduction
Thank you for the invitation to give a presentation at this workshop.
As a former researcher in organisational studies I see the question asked well chosen. As a current practitioner in the field it would be a short way to adopt a practical and normative approach. Instead I will give you a descriptive presentation of the context of implementation of thematic priorities in Norwegian research policy.

In 1993, the former five Norwegian research councils were merged into one single organisation – The Research Council of Norway. Thus, one created a strong instrument for forming and implementing overall research policies – and priorities - in the Norwegian system.

A considerable centralisation on the Council side was not followed by parallel reforms at the ministerial level. The previous five councils received their major funding from four different ministries.

This structural characteristic was maintained in the new system. Hence the RCN receives its government funding from 15 ministries, each with different strings attached according to their ”sector policy interests”. This can be seen as a structural imbalance in the system. Obviously it is a challenging set-up in relation to implementing overall priorities in research funding.

I will give you an outline of the system in which priorities are formed and implemented. My contribution will be a case study illustrating the complexities facing an implementation process.

White paper priorities
A main worry at the research policy level has been the fragmented character of the research system and the lack of strong overall priorities even if we had a lot of prioritising activity.

In 1999 a new White Paper on Research Policy was delivered and this paper introduced some new strong priorities. First, a main priority for the use of public funds was to strengthen long term basic research. The motivation for this priority was a view that the applied research had become to strong, compared to the resources for free, basic science. This may be seen as the priority advocated by the Ministry of Research.

Secondly, four thematic priorities should be set; marine research, medical and health research, information and communication technology and environment/energy. This was the other major “Research Ministries” part of the agreement.

From where did these priorities emerge?
The Research Council had made proposals for thematic priorities and some of the areas were rather obvious. It is reported that this priority setting was heavily debated in the Government, esp. the ambitions to have a few and strong priorities.

Structural context of implementation
What are the preconditions for implementing such priorities at the Council level? How can these priorities be implemented? Let me first elaborate a bit more on the organisational set-up, which constitutes the Norwegian context of priority setting?

Having created one research council one could expect a simple relationship between one Research Council and one Funding Ministry. This is not the case. The Government side is fragmented in accordance with the so-called sectorprinciple, that is, all the different ministries are supposed to fund research within their own policy area. The funding pattern is thus constituted of 15 ministries funding the Research Council with earmarked contributions. The major players are the Ministry of Trade and Industry and the Ministry of Education and Research with the latter in a (weak?) co-ordinating role.

One the other hand: We have apparently a centralised system on the Council side. But of course, the decentralised funding pattern produces a strong basis for maintaining a system where the sub-councils are given considerable autonomy. A closer look identifies distinct sub-councils operating in complex sets of relationships with all the different ministries.

Who are the main actors in the implementation process?
The different Ministries are actors in the implementation process. And of course, they have all their own research policy agenda. Main cleavages are already displayed in the structure of the priorities.

At the Research Council we have the Executive Board as a primary actor. At the sub-council level we find the strongest element in the implementation system; the intricate and complex interaction processes between the different sub-councils and the different ministries.

One should then believe that strong priorities have been introduced in a landscape characterised by fragmentation and a large number of ”priorities”. What can be expected to be the most important obstacles to a smooth implementation of these priorities?

Interpretation: Definition/redefinition
Every policy decision is the subject of interpretation and possible redefinition. In our case the decision was obviously based on a compromise, and this compromise will be instrumental in forming the implementation process.

The Ministry of Research would claim that the main priority should be basic research (this would be to increase their own budget, and invite the other Ministries to strengthen their long-term research at the expense of more mission-oriented research.

The sectoral Ministries would interpret the priorities differently; they would stress the thematic priorities and indicate that the basic science part only indicate the weighting within the themes.

At the council level, the Executive board has the authority to frame the priorities at the sub-council level. In general the Research Council by its Executive Board has adopted these priorities and expresses them in budget proposals and strategy documents. But the differences at the ministerial level will also be mirrored in such a body. One would therefore expect processes of definition and redefinition, and the framework for the next operational level can be designed in quite a number of ways.

The context of priority setting at the subcouncil level
The structural set-up as described, indicates that operational priorities are set in the interaction between each sub-council and the different Ministries. The overall priorities are processed and filtered through several phases in the implementation chain. An influential Executive Board has to

acknowledge the key elements in the processes of priority setting, and introduce an agenda built on the character of these processes. Unless this takes place, it will be in danger of having only a marginal effect on the prioritising processes.

This is exactly the challenge for the sub-councils, a broker between the research community (having the capacity to perform research and the competence to indicate where new possibilities would be) and the society at large with specific knowledge needs. The research council can in this context acquire a strong influence.

While everyone is sympathetic to stronger priorities, the operation of such priorities must take into consideration the fact that each subcouncil – covering different parts of the research system – must develop their own priorities within the overall framework. Adherence to the overall priorities may in place even the top four for each subcouncil do not reproduce the most important themes at the national level. It would then be fair that a social science council proposes it's own priorities only partly overlapping the overall priorities.

In short; supporting the Muscipoli's perspective that the implementation processes should be better understood, I have tried to illustrate how an implementation process is dependent on the established structures of operation. I have focused at the relations between the sub-councils and the different ministries. The overall thematic priorities are modified in the interaction process with the different Ministries.

Priorities and priority setting by the Research Council of the Netherlands

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1. Introduction

Under the umbrella of NWO, the seven research councils of the Netherlands have just gone through a cycle of priority setting and will now continue to implement the various priorities that have been set. In paragraph 2 the priorities for the coming years are summarized, and the interactive process in which these were reached is mentioned briefly. Three priorities are evident: emphasis on a limited number of nine research themes, emphasis on grants to be obtained by individual researchers in an effort to make the academic career more attractive, emphasis on an increased international operation of the research councils. So this is a description by the organization of the current issues and debates, thereby skipping policies concerning the institutes of NWO.

The intention of the Muscipoli project is also to study science policies empirically. For this purpose it may be needed to focus on priorities that have been set in the past and find out what has come from them. With this in mind, paragraph 3 gives a summary of priorities for the period 1996-2001 and recommendations by an external evaluation committee of NWO in 1996, and gives an indication by the organization of what has and has not been achieved. During the workshop a point of discussion might be the timeframe, which is going to be studied.

2. Priorities of NWO for the years 2002 - 2005

The statutory mission of the Netherlands Organization for Scientific Research (NWO) is to promote quality and innovation in academic research and to encourage the transfer of knowledge gained through research, which it has initiated and helped to fund. In May 2001 NOW has published a ‘Strategic plan 2002-2005’ with the title ‘Themes plus Talent’. This strategic plan identifies aspects of NWO’s mission, which the organization feels, on the basis of current research and social trends, it should emphasize in the period to 2005 and indicates how NWO intends to translate these emphases into concrete policies.

NWO’s main priority during this period will be to contribute to the renewal of the research agenda in the Netherlands. Advances in cutting-edge areas of research are proceeding ever faster and international competition continues to grow. This means that substantive choices have to be made. In international terms, Dutch research still occupies a leading position. But immediate investment is required if we are to maintain and perhaps even improve that record. Because academic research is increasingly capital intensive, substantial injections of funding are needed in virtually every field. The Netherlands will have to be selective in identifying the themes on which to concentrate that extra spending.

However, if NWO is to continue identifying up-and-coming new research themes, it must not devote all its funding to pre-selected themes of current interest; it must also continue to provide support for exploratory and more disciplinary-based research across the entire field of academic endeavor. Failure to encourage such exploratory research would mean that the stream of Dutch innovative research would quickly run dry. A considerable proportion of this latter type of funding will be focused on creative young research talent. The present increasingly tight labour market and the approaching wave of retirements among Dutch academics of the baby-boom generation call for a concerted effort to persuade young people to opt for a career in academia. NWO will cooperate

with the universities and the Royal Netherlands Academy of Arts and Sciences (KNAW) to ensure that such a concerted effort is made.

Innovation is therefore one key term in the NWO mission. Others are quality, international cooperation and transdisciplinarity. Quality has always been an absolute precondition of NWO funding. The organization has never supported sub-standard research merely because it was trendy and will not do so in future.

The benefits of greater European integration are making themselves felt in the field of research policy as elsewhere. Europe can no longer afford to maintain a host of parallel and largely uncoordinated national research systems. The European Council has now become aware of this fact. NWO will exploit the new opportunities, in particular by focusing on programmed cooperation with its counterpart organizations elsewhere in Europe.

More and more frequently, cutting-edge research is occurring at the interface of different disciplines. For this reason, NWO will give priority over the next few years to supporting pioneering transdisciplinary research.

The organization will maintain its concentration on fundamental research, but will take new scientific and social trends into account when setting its research priorities. It will actively seek to establish cooperation and co-funding arrangements with potential external users of scientific research and with other intermediaries in the research world. Motivated by the belief that positive communication is the only guarantee of continuing public support and funding for academic research, NWO will actively invest in communication between the research world and other relevant sectors of society.

Main features of policy
Over the next few years, NWO will increase its efforts to promote innovative research themes. This will require a concentration of resources and talent. To achieve this, a small country like the Netherlands must make choices. NWO has selected nine research themes to subsidize in the period to 2005. The selection of the themes (listed below) involved both a careful interactive process of identification of trends in science and extensive consultation and coordination with other stakeholders (including bodies involved in the conduct of foresight studies, such as the Science and Technology Advisory Council (AWT), KNAW and the sector councils for research and development). The chosen themes are:

- Cultural Heritage
- Ethical and Social Aspects of Research and Innovation
- Shifts in Governance
- Cognition and Behaviour
- Fundamental Processes of Life
- System Earth
- Digitalisation and Computerization
- Nanosciences
- Emerging Technologies

NWO will provide details of progress on each of these themes in its annual reports. In the course of the period to 2005 it will also organize a broad-based conference on each of them. These will be used to present the state of the art in research on the particular theme and to consider what further research needs to be done on it.

Alongside this emphasis on theme-based research, NWO will also take action to increase competitive funding for research unconnected with the pre-selected themes. The aim of this will be to guarantee the identification of future research themes and hence the Dutch contribution to innovation in the longer term. The increase in funding will mainly take the form of incentive grants designed to encourage talented young researchers to commit themselves to a career in academia. NWO will take this action in cooperation with the universities and the KNAW by converting the existing joint Innovational Research Incentives Scheme into a programme targeting individual researchers. The new-style Innovational Research Incentives Scheme will involve resources of over 68 M€ per year and will focus on researchers at three stages in their academic careers:

- researchers who have just obtained a doctorate but have already demonstrated an infectious talent for research (approx. 80 places a year);
- experienced researchers with a proven ability to generate new ideas and bring them to fruition (approx. 50 places a year);
- established researchers with a proven ability successfully to develop their own innovative lines of research and to coach young researchers (approx. 20 places a year).

In this way, the Innovational Research Incentives Scheme will give approximately 150 outstanding researchers a year the chance to spread their wings in their chosen fields. By giving these three categories of researchers the freedom to develop their talents to the full, NWO, the universities and the KNAW hope to ensure a continuing flow of high-flyers into the world of academic research. In addition, NWO will continue its successful SPINOZA subsidy scheme for top researchers.

The increasingly capital intensive nature of academic research means that proper equipment is ever more essential to the conduct of top research. The cost of such equipment is steadily rising while the depreciation period is declining. Taken together, these two trends mean that more money has to be invested both in physical apparatus and infrastructure and – increasingly – in matters such as the development of databases and acquiring access to them. Accordingly, NWO wishes substantially to increase its budget for investment in research equipment.

In addition, NWO will accelerate the internationalisation of its work, basing itself on the concept of the European Research Area advocated by European Commissioner Philippe Busquin. NWO sees particular potential for increased international cooperation at meso-level (i.e. between research councils). In this respect it will focus on programmed cooperation, working with the most appropriate partners for each individual theme in accordance with the principles of variable geometry. One of the mechanisms to be developed right across the organization is EUROCORES, whereby national research councils work together to develop common research programmes. By 2005 NWO will participate in at least ten EUROCORES.

3. Priorities of NWO for the years 1996 – 2001 and appraisal

In 2000, NWO celebrated the 50th anniversary of its foundation. The organization started life in 1950 as ZWO, de 'Netherlands Organization for Pure Scientific Research'. In 1988 the name was changed to NWO and the terms of reference of the new organization were amended to include the promotion of applied and socially inspired research in addition to its original task of promoting top-quality fundamental research. NWO's last strategic plan, *Knowledge Enriches*, was published in 1995. In the following year the organization was evaluated by the Rinnooy Kan Committee. This section summarizes both the policy plans contained in *Knowledge Enriches* and the main conclusions and recommendations of the Rinnooy Kan Committee, and indicates the extent to which those policy plans and recommendations have been achieved.

Knowledge Enriches

A key feature of NWO's strategic plan for 1995-2001 (*Knowledge Enriches*) was the updating and refining of the organization's mission. To help with this, the document introduced a diagram of mission characteristics, which divided research into two aspects and two categories. Research was subdivided firstly on the basis of inspiration (into scientific curiosity-driven on the one hand and society or environment-driven on the other) and secondly on that of approach (monodisciplinary as against interdisciplinary). The result was a matrix containing two pairs of quadrants, with monodisciplinary science-driven research at bottom left and interdisciplinary, environment-driven research at top right. The central thrust of strategy in *Knowledge Enriches* was to shift the emphasis towards interdisciplinary, environmentally inspired research, or in other words to move in the diagram from bottom left to top right. The document did, however, note that NWO would continue to attach great importance to the balance between the four quadrants and that activities in the bottom left quadrant (the monodisciplinary curiosity-driven research on which NWO had traditionally focused) would continue to make up at least half of the total funded.

This general strategic trend was then translated into a number of specific intentions, the most important of which was a greater focus on high-risk research (combined with clearer administrative agreements with the institutions conducting it) and an effort to raise the profile of NWO funding, primarily by allocating resources in 'larger chunks'. In addition, the instruments used were to focus more on individuals, programmed subsidy schemes, broader application of utility criteria, supporting national facilities and international cooperation.

Rinnooy Kan Committee

In 1996 the Rinnooy Kan Committee evaluated the performance of NWO over its first seven years. Its main conclusion was entirely positive: despite financial constraints, NWO had managed both to address and develop its new terms of reference and to continue successfully pursuing its core business of promoting excellent research. On the other hand, the committee saw room for improvement in a number of respects and formulated twelve concrete proposals to this effect. These may be summarized as follows:

1 **Increase NWO's budget**. The committee felt that the 1995 budget was inadequate to fund the original task of promoting the best fundamental research, let alone to permit the organization properly to address its new terms of reference.
2 **Create a more active role for the Ministry of Education, Culture and Science**. The committee felt that the ministry was playing too little part in defining the Netherlands' research priorities.

3 **Introduce a 'one-stop' system for applications**. The committee felt that NWO had no proper mechanisms in place for shifting funds around between its foundations and advocated a one-stop system for applications as a solution to this problem.
4 **Create a two-tier system of administration**. In 1995, NWO had three tiers of administration: a Governing Board, Councils and Foundations. The committee recommended that the lowest tier should be eliminated.
5 **Formulate an explicit strategy for the institutes**. Bring the institutes directly under the aegis of the Governing Board to prevent any possible conflict of interest at the level of the Foundations. Explicitly formulate the reasons for the existence of each institute, evaluate these and draw practical conclusions (including, where appropriate, the dissolution of individual institutes).
6 **Make the Governing Board more broadly representative**. Because of the need for the Governing Board to some extent to oversee the entire field of academic endeavour and because of its proposed new responsibility for the institutes, the committee felt that the Governing Board should be expanded.
7 **Incorporate funding to cover overheads into NWO subsidies**. The committee suggested that NWO's budget should be increased to include the resources so far allocated to the universities to cover the overheads of projects funded via NWO, so that NWO could also allocate funding for these overheads.
8 **Pay special attention to top research schools**. The committee recommended that NWO should promote the emergence of real centres of excellence, first and foremost by considerably expanding the appropriate programmes targeting individuals (SPINOZA and PIONIER).
9 **Re-introduce the Huygens programme**, which had previously given researchers the chance to work out their own research ideas independently at an early stage. The committee suggested that it should be re-introduced at the same time as reducing or eliminating the KNAW researcher programme.
10 **Take the employment situation in academia into account when awarding subsidies**. The committee felt that NWO should take expected future surpluses or shortages of staff into account when deciding the balance between subsidies for different categories of researchers (for example, PhD students or post-docs).
11 **Increase support for applications for international funding**. The committee felt that NWO should play a more active part in supporting Dutch applications and applicants, especially in relation to the European Framework Programme.
12 **Introduce a system of ex-post evaluation of programs and projects**. Primarily with a view to improving public accountability, the committee suggested annual evaluation of all subsidized projects and programmes, or at least of a representative sample of them.

Results

The results of the last few years show that NWO has successfully implemented the intentions expressed in *Knowledge Enriches*. A number of examples are summarized below. The effort to subsidize more multidisciplinary and socially inspired research has led to the design of a large number of integrated research programmes. Wherever possible, NWO has sought cooperation with and co-financing by external partners. The total budget for these programmes in 2001 is over 41 M€, compared with around 20 M€ in 1997. Financial contributions to these programmes now come not just from 11 government departments, but also from the private sector, charitable collections and the Netherlands' two immediate neighbours (Belgium and Germany). Topics range

from the Spoken Dutch Corpus to Gene-Environment Interaction, from Mental Fatigue at Work to Materials Research, and from Nutrition and Chronic Diseases to Energy Research.
The increased funding for multidisciplinary research is making new demands on the NWO organization. For this reason, NWO followed the recommendation of the Rinnooy Kan Committee and conducted a reorganization designed to produce a two-tier organization. The result of the reorganization has been to reduce internal administrative divisions, making it easier to work in a multidisciplinary way and to allocate funds more flexibly between closely related disciplines within the same NWO Council area.

In addition to adopting a more programmatic and multidisciplinary approach, NWO has committed itself more heavily over the last few years to the provision of subsidies focused on individuals. Many different subsidy schemes of this type have been developed, often in response to specific problems. One example is the Van der Leeuw programme, which seeks to help those disciplines finding it most difficult to retain extremely good young researchers. It is designed to encourage such researchers to stay within Dutch academia by offering them overlap-professorships in the period leading up to the retirement of the current occupants of suitable chairs. Another is the ASPASIA programme, which is designed to encourage the promotion of female researchers to senior academic posts. A combined effort by NWO and the universities led to an increase of over 30% in the number of female associate professors after the first round (the second round being due to take place in 2002). In addition there have been other schemes, such as the Innovational Research Incentives Scheme, directed at offering maximum opportunities for creative young researchers. So much high-quality talent emerged during the first round of this scheme that NWO decided, in consultation with the VSNU and the KNAW, to bring forward the second round. Within 12 months this will allow almost 100 young researchers to set to work on their own ideas for a period of five years, each with a grant of around 0.7 M€. Finally, there is the SPINOZA programme, directed at the absolute cream of the research profession in the Netherlands. SPINOZA grants are awarded each year to three or four stars in the Dutch academic firmament and guarantee sufficient funding to give them the freedom to pursue new, high-risk avenues of inquiry over a period of five to seven years. Alongside the new programmes, successful programmes like TALENT and PIONIER have been maintained. Over the last few years, NWO programmes focusing on individuals have clearly met a need. However, the problem of attracting and retaining research staff is now no longer confined to a few isolated disciplines or particular categories of staff: it extends right across the board. For that reason, this strategic plan expresses NWO's intention to work with the Ministry of OCenW and the universities to expand the relevant programmes under its control.

In 1995 NWO expressed its intention to raise the profile of its subsidies by awarding them in 'larger chunks'. To achieve this, several of its Councils have made it possible for researchers to submit larger applications alongside normal project applications. In addition, there has been an across-the-board shift to larger subsidy applications. The Technical Sciences Council has conducted a separate analysis of this and found that, while in the 1991 – 1993 period less than 30% of project awards were for 0.5 M€ or more, the figure for the 1997 – 1999 period was almost 60%. The same trend can be discerned in figures from the other Council fields. The reason is that cooperation (often of a transdisciplinary type) is an essential feature of increasing numbers of research projects. A higher profile also offers better opportunities for public accountability. NWO will continue awarding subsidies in larger chunks and will concentrate them more strongly on pre-selected research themes in order both to reflect the need for more rapid input into cutting-edge areas and to improve public accountability.

Over the last few years, NWO has largely succeeded in achieving the ambitions expressed in *Knowledge Enriches*. The Rinnooy Kan Committee's evaluation was useful in identifying possible obstacles and many of the committee's recommendations have therefore been implemented. However, its first (and in its own view key) recommendation has not yet been satisfactorily implemented. This flowed from the committee's observation that NWO's budget was so low in comparison to the volume of direct government and third-party funding, that it was actually impossible for NWO to exercise any real influence in many fields of science. The committee coupled this to the fact that NWO's original 1988 terms of reference had included new responsibilities without any additional resources to fulfil them and recommended a substantial increase in NWO's budget. In recent years, NWO's budget has indeed increased, but the proportion it represents of the overall budget for university research has remained virtually unchanged. The ambitions expressed in the strategic plan for 2002-2005 cannot be fulfilled without a substantially larger budget. NWO therefore calls on the government to invest extra resources in the future of academic research in the Netherlands.

National Research Councils, Funding Agencies and other intermediary Organizations: the case of France

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CNRS

A. General presentation:
The title of this session permits to point directly to a specific feature of the French research system, concerning in particular Social Sciences and Humanities:
- there is no “National research council” in France ;
- there is no real funding agency ;
- as to other “intermediary organizations”, they may exist, but it is not sure that they have a real function in the “priority-setting process”.

Nevertheless, there is a French research system and we may suppose that there are at least functional equivalents to what Research Councils are in the UK or the Nordic countries, or to funding agencies like the DFG in Germany.

It is characteristic for the traditional view of the French model:
A) It is a highly Centralized, colbertist system,
B) The organization and funding of the largest part of fundamental research through a special institution, the CNRS, distinct from higher education entities.
C) A dual high education sector: Universités Grandes écoles - producing a technical experts’ elite of engineers and industrial managers.

This traditional view corresponds no longer to the reality: during the last twenty years the French research system has undergone some very profound transformations.
These transformations are analyzed in a forthcoming book edited by Philippe Laredo and Philippe Mustar**:** *Research and Innovation Policies in the New Global Economy, An International Comparative Analysis.* Edward Elgar**:** Cheltenham, UK, Northampton MA, USA, 2001. Concerning the subject of our workshop, I would like to insist on the following transformations analyzed by Laredo & Mustar:
1) The near disappearance of the role of large programs realized by a supposed central actor;
2) The rapidly increasing, not to say systematic, intertwining of the CNRS and the Universities;
3) The transformation of mission-oriented research institutions which have progressively converged towards the paradigm of “collaborative academic research”;
4) After the failure of the so-called “mobilizing” programs, the re-orientation of support for industrial research towards SME’s.

For the sector of Social Sciences and Humanities, the most important of these changes is the one which has profoundly transformed the relationship between CNRS and Universities and which has led to what can be called now “The mixed system of the CNRS and the Universities ” (cf. Laredo/ Mustar 459 sqq.).

An institutional system of partnership between CNRS and Universities exists in fact since the middle of the 1960’s: From this time on, University research groups (in fact often very small groups) had the possibility to compete for association with the CNRS and, if successful, to obtain financial or staff support. Setting beside several stages in the evolution of these institutional arrangements, the result of this process of rapprochement is as follows:

Currently four out of five CNRS Units are mixed units (Unités mixtes) between CNRS, Universities and also Grandes écoles. “Mixed unit” signifies that these research units are founded and funded in common by CNRS and, in general, a University. Inside such a mixed research unit, CNRS researchers and University teachers (*enseignants-chercheurs*) are working together. On the global level, the result is a sort of hybridization between Universities and CNRS, and as such a situation that is completely different from the relationship between Universities on the one side and institutes of the Max Planck Society in Germany on the other side.

The average CNRS unit comprises now more university teacher-researchers than dedicated CNRS researchers. This situation has been reinforced by the growth in the research potential of Universities in the last years. A parallel evolution is the increasing involvement of the *Grandes écoles* in research, which also often leads to the establishment of mixed research units with the CNRS.

This transformation has marked the disappearance of one particular feature of the so-called “French model”. The dualism between research and higher education no longer exists: “Higher education is playing an increasingly central role in the public research system”. Laredo and Mustar conclude their analysis: “Taking this analysis to the extreme, the CNRS could be considered, following the example of the Anglo-Saxon research councils or the NSF, as a research support agency, but more specifically an agency concerned not with projects, but with structures and which makes its contributions in the form of human potential and large technical resources rather than financially.” (p. 461).

This is a paradoxical statement, which has its virtues, but in detail, things are much more complicated and even the general characterization of the system by Laredo & Mustar is not really helpful as long as this very particular type of “research support agency” is not analyzed in detail. Let us take the most important point, the support for research “in the form of human potential”: here you have to add immediately that the “human potential” (researchers, technicians, administrative staff) allocated by CNRS to Universities via the mixed research units is itself employed for lifetime by the CNRS. This is completely different from the allocation of money to Universities by a real funding agency, which enables University research groups, for example, to employ junior researchers for time-limited periods. In this respect, the ministry of higher education which allows to the Universities an important amount of so-called “allocations de recherche”, i.e. doctoral fellowships for two or, in general, three years, could be considered with better reasons as a functional equivalent to a funding agency. But here again with important differences: the selection of the doctoral students is done by the Universities, but the whole administrative procedure is fixed in a very narrow way by the State, and these doctoral students (“allocataires de recherche”) in fact do not receive a fellowship but a salary**.** And what is very different from the normal procedures of a funding agency is the fact that the employer is not the University, but the Ministry (through its regional structures: the “Rectorats”).

I will now concentrate on a few points, concerning the Humanities and Social Sciences in the mentioned special relationship between CNRS and University. This partnership CNRS-University is now embedded in pluri-annual contracts between Ministry of Research, Ministry of Education, the CNRS and the University. 90 % of the research budgets of the Universities come through these contract negotiations with the State.

The following tables, concerning the department of Humanities and Social Sciences in the CNRS, will illustrate the dimensions and the complexity of this French research organization, very different from what we are accustomed to consider as a funding agency:

Table 1: CNRS : Département Sciences de l'Homme et de la Société (SHS)

- Staff:
  - 2183 researchers (full-time), without those temporarily attached to other administrations;
  - 1756 engineers, technical and administrative staff (among the 1260 engineers many are in fact, but not by their status, researchers);
  - 6201 "enseignants-chercheurs", i.e. mostly university teachers accomplishing their research tasks (part-time) in the mixed-units, or other researchers .
  - 2050 non permanent personal (without visiting researchers)

- Units:
  - 386 operational structures among which 218 UMR (Unités mixtes de recherche), 66 GDR (Groupements de recherche), 19 UPR (Unités propres de recherche).

- Funds:
  - 126 MF (2001 budget) among which 80,2 MF for basic support, 17 MF for scientific operations, 22,6 MF for running costs et 6,2 MF[12] for "politique de sites". (Figures from the year 2001).

N.B. For more details and actualized figures see: http://www.cnrs.fr/SHS/

Table 2: Units/ town:
The 386 units are distributed on the whole French territory and even some are located abroad.

Table 3: Disciplinary domains:

Humanities	**Language, Knowledge, Creation**	**Social Sciences**
Archeology Prehistory History Anthropology	Language Sciences Literatures Philosophy History of Sciences Artistic creation (musicology)	Sociology Law Political sciences Economy Management Geography Architecture, Urbanism

Let us shortly come back to the question of the priority-setting process. What is the central problem for the scientific direction of this complex organization, which has under its head nearly 400 research units, most of which depend not only from the CNRS but also from a second, sometimes a third institution? To say it very simply: To manage this "complexity" in a way that it will produce high quality and innovative researches and satisfy in the same time the social and political demand. In some respects, this may be a more complex task than the management of a funding agency or a research council. The CNRS is an administration and an enterprise with life-time personal, trade unions, evaluation procedures and committees, state intervention, and so on. One of the most important factors which has to be taken into account in the priority setting process is

[12] MF for million Francs.

the interaction between the research interests of individual researchers or groups on the one hand and the objectives of the institution on the other hand.

Concerning the definition of its strategies and priorities, it may be interesting to have a look on the representation given by the department of Social Sciences and Humanities itself:

Objectives of action:
- To make the scientific quality of Humanities and Social Sciences be recognized.
- To proceed to the necessary disciplinary, thematic and territorial readjustments
- to encourage international integration

Strategic orientations:
- to reinforce collaboration with other departments
- to develop interdisciplinary exchanges within the Humanities and Social Sciences
- to strengthen research sectors where the CNRS is the project manager.

It is clear that "a scientific policy cannot be decided once and for all: it needs to be constructed day after day. In CNRS-language, this is expressed in the following words: "faire évoluer le dispositif", "to make the system evolve" between the triangular relation of:
- disciplinary communities,
- the capacity of researchers and technical and administrative staff
- the structures and research networks.

As to the disciplinary communities, it is an evidence that the presence inside the department of more than 15 disciplines makes it necessary to concentrate on interdisciplinary co-operation on interdisciplinary priority themes as for example:
- city and crisis of social cohesion ;
- public politics,
- social change and work.

Specific instruments of intervention which may be employed by the department are, for instance, the creation of interdisciplinary research units and corresponding research positions; but this is a very exceptional measure. A more utilized instrument are "federative structures": "groupements de recherche or the newly created "Maisons des sciences de l'homme" (see below).

Interdisciplinary co-operation is not limited to co-operation inside the department. Here are some examples of interfaces between different departments of the CNRS, involving Social Sciences or Humanities:
- Information society;
- Cognition;
- Nature and Society.

B. Two examples of "policy-making instruments":
The specific logic of the French research system may be illustrated by a very short sketch of two structural policy-instruments. The most important concerns:

1. A new mode of structuring research on the local and regional levels:
The so-called "politique de sites" concerns research structures and infrastructures and it represents a specific mode of structuring research in Humanities and Social Sciences. It comprehends in the same time aspects of:
- Territorial politics (or governance)
- Concentration of resources
- Creation of research infrastructures on a local level.

This “politique de site” is actually one of the most important priorities of the department of Social Sciences and Humanities. It is implemented in the framework of the quadri-annual contracts between the State, the University and the CNRS. It is reinforced by the means of a recently created “Network of the Maisons des Sciences de l’Homme”. This network (Réseau des MSH) is based on a formal contract between the Ministry of Higher Education, the Ministry of Research, the CNRS, the concerned Universities, and institutions which are themselves Maison des Sciences de l’Homme with legal status, and among them in the first place the Foundation Maison des Sciences de l’Homme in Paris (FMSH). The table in annex n° 1 shows the importance of the funding of these Maisons des Sciences de l’Homme by the CNRS; it also gives the number of researchers from CNRS and from Universities working in these new structures. The “Network” itself is funded essentially by the two Ministries (funding for research projects, international exchange, etc.).

From the viewpoint of the CNRS, under the aspect of its politics, the MSH’s are considered as a new mode of structural intervention into research. They:
- have an interdisciplinary vocation (in concrete terms: they host research groups or units specialized in different fields, offer them infrastructures and encourage the development of common projects with an important interdisciplinary and international dimension);
- are the expression, on the local and regional level, of a scientific partnership between CNRS, universities, local state administrations and enterprises, etc.
- are training sites for doctoral students and junior researchers.

The Actions concertées incitatives (ACI) are a new instrument by which the government wants to re-orient the efforts of research to domains, which have been defined as priorities by the Comité interministériel de la recherche scientifique.
There are two types of ACI: a) ACI’s with thematic and b) ACI’s with structural priorities.

The ACI’s are implemented by the way of call for proposals (research projects, doctoral or postdoctoral fellowships, etc.). The programs are run by the Ministry itself, acting here as a funding agency. There is, in France, a debate on this type of programs. As dangers are identified:
- a global effect of reproduction of always the same type of research;
- the case that researchers utilize the call for proposals in order to realize a research which he would have realized in any case and without this support. In this case, the danger is that the desired innovative effect will be very low.
- “The Matthew Effect”,studied in particular by Robert K. Merton: i.e. the fact that a large part of the new public funding is captured by already well equipped research groups who by this way continue to expand and to capture more public funding. So, the “action incitative” risks to fail to reach the aims: redistributing opportunities (chances?) and restructuring the research domain.
- the instrumentalisation of public action.

Potential positive effects are:
- the restructuring of the scientific community (by favoring the diffusion of new projects to a wider community and by favoring the building of a stable basis for high quality research)
- the ACI’s may contribute to the renewal of the big questions to which the society is confronted

The debate goes around the question how to find an articulation between demand and offer, which may avoid two perverse effects:
- le pilotage par l’offre that takes the form of an expert knowledge which integrates the demand coming from the outside world only after having selected and translated it following the rules of its sole internal coherence.
- Le pilotage par la demande, i.e: the scientists accept the definitions of problems given by the social actors and delivers in exchange a directly operational knowledge which doesn’t suppose a modification or revision of the ‘kingdoms’ of the social actors.

The solution proposed: la réponse décalée, différée et reformulée par les scientifiques
The essential question: programs like those on 'city or 'work' or 'school': do they shift in a significant way our routinized way of formulating these questions?
Some ways of doing so:
- Interdisciplinarity
- Recomposition des collectifs de travail
- Internationalization

2. A new founding instrument: Actions concertées incitatives (ACI)

The Actions concertées incitatives (ACI) are a new instrument by which the government wants to re-orient the efforts of research to domains, which have been defined as priorities by the « Comité interministériel de la recherche scientifique ». There are two types of ACI:

a) "Thematic" ACI's: in the field of Social Sciences and Humanities, recent examples are:
- ACI Cognitics
- ACI Labor
- ACI The City
- ACI Quantitative ecology (at the interface between Life sciences, Earth sciences and Social Sciences and Humanities)

b) ACI's with structural modes of intervention.
- ACI Young researchers
- ACI Internationalization of Humanities and Social Sciences

The ACI's are implemented through calls for proposals (funding of research projects, doctoral or postdoctoral fellowships, etc.). The programs are run by the Ministry itself, acting here as a funding agency.

There is, in France, a debate on this type of programs[13]. Indeed, several dangers are identified:

1) A global effect of reproduction of always the same type of research;
2) Researchers may use the call for proposals in order to realize a research that would have been done in any case and without this support. In this case, the desired innovative effect may be very low.
3) "The Matthew Effect", studied in particular by Robert K. Merton: i.e. the fact that a large part of the new public funding is captured by already well equipped research groups which by this way continue to expand and to capture more public funding. So, the "action incitative" risks to fail two aims: redistributing opportunities and restructuring the research domain.
4) Instrumentalisation of public action.

Potential positive effects are:
1) The restructuring of the scientific community (by favoring the diffusion of new projects to a wider community and by favoring the building of a stable basis for high quality research)
2) The ACI's may contribute to the renewal of the big questions to which the society is confronted.

[13] cf. Alain Suppiot, Conseil national du développement des sciences humaines et sociales. *Premier rapport annuel d'activités, juin 1999.* Ministère de l'Education nationale, de la recherche, de la technologie. Paris,1999 p. 52.

The point is to find an articulation between Demand and Supply in order to avoid two perverse effects:

- “Le pilotage par l’offre”, which takes the form of an expert knowledge which integrates the demands coming from the outside world only after having selected and translated it following the rules of its sole internal coherence.
- “Le pilotage par la demande”, i.e. scientists accept the definitions of problems given by social actors and deliver in exchange a directly operational knowledge, which does not suppose any modification or revision of the ‘social actors’ kingdoms’.

Such perverse effects can be avoided if the scientists do not hesitate to re-appropriate and reformulate the questions posed by other social actors. The point is always whether programs like those on ‘city’ or ‘work’ or ‘school’ **–** research priorities in nearly all European countries - shift in a significant way our routine way of formulating these themes. It seems clear that, in order to obtain such reformulations, inter-disciplinarity and internationalization have to be reinforced, and it will also be important to assure a permanent “recomposition” of the research collectives.

Conclusion:

If we want to compare the priority-setting process and its implementation in different countries, we need a model able to integrate complex structural differences and constraints. One of these constraints is, if we take the French example, the complex relationship between the Ministry of Research and the CNRS, characterized simultaneously by hierarchy, partnership, not an always clear and logic division of labor (as said before, the Ministry acts in some respects as a funding agency). We may also add the fact that the CNRS and the corresponding department in the Ministry, the “Direction de la recherche” with its subdivision for Social Sciences are managed by the same type of personal: researchers who accept to take over administrative tasks for a time, and then return to their research or their Universities. The temporalities of these leading persons in the most important French research institutions are more (mostly) or less linked to political changes. The differences, some times conflicts, then are linked to the different logics and cultures of these institutions. As to the question of priorities, the configuration of the French research system seems to entail the consequence that thematic priorities have often to be translated into structural priorities.

Annex 1: Maisons des sciences de l'homme fundings'/ Moyens attribués aux Maisons des sciences de l'homme en 1999.

Units/Town: Nombre d'unités par ville

LES PERSONNELS **EFFECTIF PERMANENT***				LES MOYENS FINANCIERS (EN KF)			
MAISONS	**CNRS**	**UNIVERSITETS**	**CH. ASSOCIES**	**DOTATION DE BASE (HT)**	**VACATIONS (TTC)**	**APN (HT)**	**INSTRUMEN-TATION (HT)**
MRSH CAEN	36	66	0	953	5	0	91
TOULOUSE LE MIRAIL	80	198	0	1.187	9,5	100	10
MSV TOURS	18	35	0	1.008	0	0	90
MSH POITIERS	34	110	1	678	9,5	0	0
MSH ALPE	93	213	0	1.424	19	0	455
MAISON RENE GINOUVESS	159	143	5	4.805	74,1	150	390
MOM LYON	90	126	1	2.023	47,5	240	1.462
MMSH AIX	156	169	1	2.712	85,5	250	304
ISH LYON	104	344	4	2-205	172,5	210	333
GIP ANGE-GUEPIN	14	75	0	60	0	0	38
TOTAL GENERAL	784	1.479	11	17.055	422,6	950	3.173
TOTAL SHS	3.834	7.022	45	64.947	2.491	3.645	10.184
PART DES MAISONS	20,4%	21,1%	24,4%	26,3%	17,0%	26,1%	31,2%

* Source Labintel/Icare

Adapting Research Councils to Strategic Priority-Setting: The Case of Denmark[14]

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Setting the scene: The problem of "sectorisation"
In the 1980s the idea gained ground in Danish research policy circles that the country's research system had become too fragmented. The public research effort was seen to suffer from disintegration between the sectors of the various funding ministries, hampering cooperation, mobility and competition between researchers, research units and institutions. The problem of fragmentation also applied to the universities which were financed by the ministry for education. They were seen to be too isolated from practical reality, too introverted in relation to the policy-relevant sectoral research sponsored by the other ministries and research and development in the private sector. This was a serious dysfunction considering the widespread policy belief that renewed industrial growth would be based on "generic" technologies for which basic university research played a key role, such as information technology, biotechnology and materials science.

A strategic, integrative research policy
On this background, and influenced by an international policy trend, it was concluded that publically financed research had become too important economically and socially to be left to the parochial preferences of individual ministries, research institutions or the researchers themselves. Instead, there was a need for a new type of strategic, integrative research policy. The objective would be to open up the research system, internally as well as externally, and to strengthen and mobilise university research in areas of "strategic" priority for industry and society. Institutional barriers were to be brought down to increase interaction between ministerial research sectors, between public and private research and between scientific disciplines and research areas, notably between the technical and natural sciences.

In the Danish ministerial system it was the minister for education and, after the establishment in 1993 of a ministry specifically for research, the minister for research who assumed responsibility for the new cross-sectoral and cross-disciplinary research policy. Parliament was willing to allocate considerable funds for the purpose, primarily in the form of large-scale research programmes. Cooperation was initiated between ministries and with the Danish research councils. But this also lead to some tension between the involved ministries and with representatives of the research councils and the universities. The latter were wary of further political encroachment on what they considered to be the time-honoured right of the scientific community to govern itself.

Research council reform
Tensions between the ministry and the research councils intensified when, in 1988-89 and in 1995-97, the government proposed to restructure the research funding and advisory council system.

[14] This paper is based on my doctoral thesis*, Mellem politik og videnskab: Reform af det danske forskningsrådssystem 1994-1997 (Between Politics and Science: Reform of the Danish Research Council System 1994-97)*, Department of Political Science, Copenhagen 2001. The Ph.D.-project was financed by the Danish Research Council for the Social Sciences.

Since 1968 the system had consisted of two levels:

- Six research councils which, within their respective disciplinary areas[15], allocate funding for research projects and advise the government on scientific matters.
- A general advisory body for research policy which advises the government on the research system as a whole, including both university, sectoral and industrial research, emphasizing the social and economic value of science and technology.

The research councils were considered part of the problem of fragmentation in the sense that they were closely connected to the universities, reflecting the academic organisation into departments and faculties based on disciplines. Traditionally a tool for the autonomy of science, the councils were expected to play more of a mediating role between politics, society, industry and research. The changes proposed by the government aimed at loosening the disciplinary and institutional linkages of the councils and, correspondingly, strengthening relations between disciplines and with sectoral and industrial research. For this purpose governments sought, among other things, to increase the representation of applied research in the councils and to merge existing councils into more interdisciplinary and strategic configurations. At the same time it was attempted to distance the advisory research policy body from the research councils, and thereby from the universities, attuning it more to the policy needs of the ministry for research.

In the most recent round of research council reform, from 1995 to 1997, the research minister proposed to establish a new advisory body, to be called The Danish Council for Research Policy ("Danmarks Forskningsråd"). This was supposed to be more closely aligned with the research ministry than its predecessor, e.g. by having its secretariat incorporated into the ministry, in the hope that it would underpin the ministry's function of priority-setting across the government. Moreover, the minister proposed to reduce the number of research councils from six to three. Finally, at a later stage in the legislative process, the research minister added that the research councils should be provided with a board. This would have the power to set up programme committees to fund projects independently of the research councils. After lengthy and difficult negotiations with parliament, it was rejected to merge councils, but accepted to establish a new advisory research policy body and a board for the councils.

Historical stability and change

In a historical perspective, the legislative changes of 1996-97 confirm a pattern in the development of the Danish research funding and advisory system: While the general advisory bodies have been coming and going, the discipline-based research councils have remained remarkably stable. Thus their number and basic structure are the same as when they were first established in the years following the second world. In contrast, there has been a succession of research advisory bodies, each attempting to strike a new, more stable balance of relations with the research councils and the ministries.[16]

[15] Natural sciences, technical sciences, agricultural and veterinary sciences, health sciences, social sciences, and the humanities.

[16] Beginning in 1965 there have been four such bodies, with varying degrees of representation by the research councils: No such representation in The Common Committee for Research (Forskningens Fællesudvalg, 1965-1972); seven out of fifteen members of The Council for Research Policy and Planning (Planlægningsrådet for Forskningen, 1972-1989), including the representative of the Atomic Energy Commission; no representation in the Council for Research Policy (Forskningspolitisk Råd, 1989-1996); one member of the Danish Council for Research Policy (Danmarks Forskningsråd, 1996-) but that was soon changed to none. The commission report of October 2001 (see postscript) recommends that the research foundations which are to replace the research councils will be represented by one member in the Danish Council for Research Policy.

The instability at the advisory level can be seen to arise from the difficulty of finding a tenable organisational position amid the cross-pressures of the politico-administrative system and the scientific community. On the one side the politicians expect science to be visibly useful for society and contribute to the solution of politically defined problems – on the other side the research councils express the researchers' demand for freedom to determine their own research problems and to build their careers within the scientific disciplines.

The government has repeatedly attempted to correct, or compensate for, the traditional disciplinary structure of the research councils: It has proposed the reconfiguration of research councils and the establishment of various advisory horizontal bodies, as analysed in this paper; it has chosen to channel research funding through "strategic" interdisciplinary programmes, involving several research councils, ministries, agencies as well as private companies; and it has required the research councils to implement interdisciplinary priorities by means of multiannual "strategic plans".

Explaining stability and change 1996-1997

So how do we explain the changes, and non-changes, in the Danish case of research council reform from 1996 to 1997? More precisely, why did the Danish government propose to change the research funding and advisory council system? And why was it possible to institute change only at the level above the research councils, in the form of a board for the councils and a new advisory council, while the research councils themselves remained fundamentally unchanged?

The governments' proposals for changes in the council system reflected the need of the newly created ministry for research to establish itself among the other ministries and the need of the changing research ministers to attract political attention. The direction of the proposals was also influenced by the remit of the new ministry. This was more concerned with sectoral and industrial research than with university research which belonged under the ministry for education.

The new ministry for research attempted to formulate and implement an agenda for research council reform by organising the decision-making process to include some political actors and exclude others. Initially the ministry enlisted the cooperation of a private consultancy firm and the OECD secretariat in evaluating the Danish research system. But the ministry was soon compelled to include senior representatives of the other ministries in drafting the official report which served as the basis for legislation. In contrast, the research councils were marginalized and subjected to proposals for their restructuring to which they were opposed. However, it backfired on the ministry that by failing to sufficiently include representatives of the research community in the process it also failed to develop convincing arguments in support of the mergers. Such arguments could have helped prevent or surmount the opposition to the proposals which manifested itself both in the government itself and the parliamentary committee.

The research ministry's proposals for mergers, the marginalization of the research councils and their adamant resistance should also be seen in the context of the general frustration which characterized the relationship between the ministry and the councils. While the ministry was disappointed by the councils' reluctance to cooperate in the annual budget negotiations between the ministries, the councils often felt taken advantage of in the ministry's "political power games". The councils had the impression that the ministry was generally more interested in getting them to rubber-stamp its initiatives than in giving them real influence, compromising their scientific integrity in the process.

In setting forth its proposals the ministry for research benefited from the fact that the research councils did not agree among themselves. The council for the technical sciences, and to some the councils for the natural and agricultural sciences, were more positive than the other three councils. But eventually even the councils which were initially sympathetic to the proposals turned against them. However, they were unable to decisively use their resources of expertise and organisation to block the proposals because, being totally dependent on government funding, they could not credibly threaten to withhold those resources. Nor did the ministry for research consider the backing of the research councils necessary for the legitimacy of the proposals. Instead, in the end, it proved decisive that the councils had connections to influential parliamentarians whom they could mobilize against the proposals.

This is not to say that the disagreement over the proposals can be reduced to a simple conflict between a ministry striving to build up its position and an equally self-interested council system defending its privileges. The two parties were also motivated by different ideas, or models, of research policy. While the ministry, supported by the technical council, wanted to establish the institutional prerequisites for a more strategic, integrative research policy, the research councils generally subscribed to a more responsive, disciplinary type of policy. This gave pride of place to the bottom-up initiatives of the scientists and the use of internal scientific and disciplinary criteria for funding decisions, rather than strategic priority-setting in terms of social and economic relevance.

However, the actors' behaviour defied the dichotomy between the policy models in three respects. First, the disagreement over the proposals concerned to a considerable extent the balance between the two policy models which most of the actors did not perceive to be mutually exclusive. Second, in some cases views diverged over policy instruments and procedures rather than over policy principles. So to some extent it was the specific proposals for mergers and the lack of thorough preceding analysis and consultation which caused resistance, rather than the principle of mergers per se. Third, some of the positions of the actors transcended the two policy models. For example, the ministry for education, like the ministry for research, supported the idea of mergers, but with less of an industry-oriented bias.

Conclusion

It can be concluded that from 1995 to 1997 the Danish ministry for research proposed changes in the research council system in order to consolidate its own position, but also in the belief that this would increase the social value of science in accordance with a more strategic, integrative research policy. The research councils opposed the changes because they wanted to maintain a more responsive, disciplinary type of research policy, but possibly also because the ministry tended to ignore them in the decision-making process. The councils managed to block the mergers thanks to their connections in government and parliament where the ministry was also unable to state its case convincingly. When the proposal for mergers was rejected the ministry instead proposed to establish a board for the councils. This could be adopted because it did not to the same extent threaten the vital interests of the research councils as they perceived them. Finally, it was possible to establish a new advisory body for research policy because also the research councils wanted the old advisory body replaced and because this did not seriously threaten the interests of the other ministries. In this way, on the one hand the research councils succeeded in maintaining their traditional disciplinary structure while on the other hand the research ministry succeeded in establishing a board for the research councils and a new advisory board with stronger links to the ministry.

POSTSCRIPT

It should be added that in October 2001 a commission set up by the research minister published a review of the Danish research system.[17] It recommends that the six research councils should be merged into three interdisciplinary foundations which will fund research projects in a responsive, bottom-up mode. In addition, there will be three other foundations, concentrating respectively on large-scale centres of excellence, research training activities and strategic and innovative programmes. The six foundations will be coordinated by meetings of their directors and the head of the secretariat. This is a rather week structure of coordination compared to the introduction of an independent, externally appointed board which, this time, the research councils have agreed among themselves to propose. On the other hand, the report recommends the strengthening of the independent position of the advisory body (The Danish Council for Research Policy). It should have a stronger secretariat and a more central role as an advisor to the government on strategic priorities and appropriations for research. The implementation of the recommendations will be decided by the new government after the general elections of November 20 2001.[18]

[17] Forskningskommissionens betænkning, bd. 1-2, www.fsk.dk.
[18] *Research Europe,* 15 November 2001, p. 6.

Another 50 years of success?
Problems and challenges ahead for the research councils

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We shall now point to some developments and questions which in general terms may influence the future role and well-being of research councils – i.e. to what extent the council system is kept, expanded in funds or scope, changed in important ways, seen to do well, etc.

A different policy climate
The general climate in research policy has in important respects changed and even deteriorated in recent years – in my view. It is also the central point in the recent book *The New Production of Knowledge* (Gibbon et al. 1994).[19] The extensive growth and complexities of the R&D endeavour have complicated R&D funding, so has increasing appearance and awareness of ethical dilemmas and other consequences of modern research efforts. At the same time, the people of the *gründer* generation in the formidable post-war R&D build-up are gone, and the cumulative interest and capacity for R&D policies are currently surprisingly modest. So is the broad overview of the R&D complex in the scientific community as well as among politicians. The civil servants and politicians involved seem to find it increasingly difficult to come to grips with research policy. This often gives rise to simple and quick decisions on complex matters that beg for thorough and knowledgeable analysis and consideration. The complexities also imply that many important decisions with strong bearing on R&D *de facto* come as a 'windfall' from non-scientific matters.

Furthermore, the increasing importance of market considerations in the public sector leads to significant changes and normally puts pressure on the time frame in research funding. It has become more difficult to keep up a long-term perspective; quick results are often unduly expected. New powerful actors have entered the scene and their expectations and message is different.

Increased government influence and control?
The government may for various reasons take a greater though less enlightened interest in research funding by continuously stressing the social relevance of research as viewed from a political viewpoint. This may transform the traditional role of research councils in at least two ways – particularly the role of the university-oriented councils.

First, a desire to integrate and make R&D more applicable to problems of particular relevance to society may strengthen the mission approach to research funding – and also imply greater integration of R&D as part of organizations which are dealing with societal problems and innovation in a broad sense. The recent innovation agencies in Finland, Sweden and Denmark are a case in point. Scientific expertise is mobilized in such agencies too, but the scientists have usually a more marginal role than they have in the traditional university councils.

Second, increasing government control often means less bottom-up approach and self-governance by scientists in the university councils. This may be done by introducing more non-scientists on council boards or by encouraging/directing the councils to look primarily for 'relevance' through programmes that currently seem important to government or otherwise. By the same token, the government increasingly hopes to mobilize university scientists to take greater interest in problems of this kind in addition to or as an alternative to curiosity-driven research. In recent years we have

[19] I do not, though, entirely agree with their description or with their deterministic interpretation in particular.

seen that some governments pay lip service to basic research while public contract work *de facto* carry the day.[20]

Third, the many ethical problems and dilemmas with which modern science – particularly within the biomedicine sphere – confronts society may change and possibly jeopardize the whole concept of bottom-up and curiosity-driven research, the traditional stock-in-trade of university-oriented councils. The ability to assess, mobilize and articulate social responsibility in such matters at an early stage within research funding organizations may be of great importance for the actual development in these institutions. Otherwise the society at large may overreact.

Research councils – still a viable concept?

It is hard to imagine a modern nation without significant government funding of R&D. However, in most countries the actual assessment and funding of specific research projects/programmes is not seen as a natural task for 'Whitehall', the central apparatus of government. In many cases, external bodies such as research councils are seen as more suitable for the role – particularly that of assessing the 'scientific opportunities' dimension. An intermediary body of this kind is usually more able to possess or mobilize scientific expertise, which the central government apparatus finds it hard to recruit or develop. In addition, the need for an arm's-length relationship is often seen as important; political closeness and intervention in all research is not desirable.[21] At the same time councils have establish trust through channels and links to the research community as well as to government.

The research councils are also increasingly challenged from the research community they are meant to serve, and the view is heard that the dual funding system is on the verge of becoming obsolete. Resources should go directly to the institutions and not be channelled to them via a research council,[22] witness the increasingly intense discussions over overhead charges and the demand for an explicit research policy at the universities. The many large and visible research programmes initiated by the funding agencies may contribute to this development. Generally speaking, the mutual understanding between the councils and the universities seems by and large to have deteriorated in recent years; they both compete for the same government funding and neither their roles nor the established division of labour any longer seem to be quite well understood and respected.

The recent increase in external funding (grants as well as contracts) makes the council one financial source among many. A considerable blurring of the distinction between grants and contracts has a similar effect. Actually, some researchers may prefer to deal with administrators and politicians; decisions may be faster (because of a need to grasp 'scientific opportunities', or the processing of applications less rigorous), the project size bigger, etc. The difference in prestige is rapidly becoming modest. The Framework Programme in EU – essentially an applied or targeted programme – is indicative of this development.[23]

There seems to be a widespread tendency in the research community to sign a research contract of a 'utilitarian' type without much concern for the actual outcome of the research to be conducted. Obtaining resources tend to be the essential part – what is stated in the funding papers, less so.

[20] This has been the case in Norway in recent years.
[21] Cf. the Haldane principle referred to above, and Lord Rothschild's views on the need for an independent social science council.
[22] This attitude is usually more common in the institutional leadership than among the scientific rank and file. It also varies by country.
[23] Policy makers and information officers in the universities in the Nordic countries have systematically played down this fact in order to be able to 'win back' research money from Brussels.

This is actually about to become a science policy problem: researchers accept money on the basis of external criteria, but ignore this fact in the follow-up procedure. They want their work to be evaluated on the basis of criteria internal to science despite "use" has explicitly been alluded to at the research proposal. Research that seeks its raison D'être in use external to science must also accept to be judged on such grounds. Increasingly, funding authorities may not want to be fooled by the recipients of research money.[24]

Several factors could explain this. Traditionally, research is given considerable freedom and the benefit of doubt by the funder; the wording is often only meant to give an indication of the direction of the research effort. At the same time, the university community has a strong tendency to look upon research outcome essentially in terms of papers in international journals.[25] To what extent can we expect the utilitarian statements in future research proposals to be blurred over or neglected by the funder or society at large? Should we come to expect evaluations that carefully compare the research aims and the actual outcome to a much greater extent than present practice?

Picking scientific winners by committee?

The awarding of grants by committees dominated by scientific peers is occasionally called into question – also in the scientific community. Peer ability to judge and select the most promising ideas and grant applications is challenged in at least in two ways:

i) The most radical and innovative ideas may be overlooked in reviews of this kind. It is claimed that eminent scientists like Einstein or Bohr would not have succeeded in a modern research council in their early careers. A group of peers is usually better at identifying and weeding out low quality applications than at seeing the radical new ideas, according to this claim (Science, 1979).
ii) It is also claimed that peers tend to support existing disciplines and sub-disciplines. They are often hesitant to recognize emerging disciplines and sub-disciplines, they are biased toward their own areas of expertise and can hardly form a reliable opinion on cross-disciplinary and broad areas. Peers are in this respect seen as a conservative group – either because in all honesty they are not able to see the potential in an emerging field, or because they *de facto* do not want to allow more competitors access to the same funds. (Benner and Sandström, 2000) Discrimination towards women is another claim along the same lines (Wold and Werneås, 1997).
iii) Peer review and expertise in general do not always carry the same authority today as it used to. The prestige of the experts has declined; other groups claim attention to a greater extent.

The burden of the competitive grant

Others claim that the existing grant applications procedures have become too burdensome for the research community, requiring an immense amount of paper work. Greater competition for funds adds to this. Accordingly, applications are time-consuming for the applicant and involve considerable management resources – including the time and effort of peer groups.

The strong egalitarian values in the Nordic countries also tend to generate modest grants, as many applicants share the money available. This may at the same time strengthen the individualistic approach in research. Accordingly, some argue for larger grants, preferably awarded to leading scientific entrepreneurs ('block grants') and concentrated in centres of excellence and research programmes. In the 1990s we have seen considerable efforts in this direction in all the Nordic countries. To what extent these efforts have been successful is another matter.

[24] COM (1992) 682, p 44.
[25] This is apparent in many evaluations of research in recent years.

Competent council members and peers?
Science is seen as increasingly specialised and fragmented. These developments make it harder to keep a broad overview and outlook of larger fields and segments of research – including cross- and inter-disciplinary developments. This makes the work of the research councils more difficult. Assessment of applications may increasingly become a rather ritual and conventional exercise with strong emphasis on track record and on numbers rather than expert assessment of publications and projects (Seitz, 2000).

This tendency may in fact be strengthened by a parallel tendency to broaden the membership of council boards and similar bodies. Broader recruitment does not necessarily imply broader expertise and overview of the R&D complex; it may actually weaken the scientific judgement represented. Emphasis on track record and bureaucratic routes may *de facto* be the result.

A proactive council?
Assessing and funding grant applications in a bottom-up manner or through programmes often tend to become the dominant task in most research councils. They are, however, usually expected to have proactive approach as well. Initiatives of a purely scientific nature are expected – for instance, in order to initiate and strengthen a particular field/institution or an emerging field. This may also include initiating research with application in mind.

A research council is also expected to give advice to society and public authorities on scientific matters – solicited or not. A council is also supposed to see the scientific endeavour in a broader perspective, paying attention to ethical issues and dilemmas at an early stage in the science-and-society sphere – i.e., to study and discuss consequences of scientific activities and issues related to science and society. In short, they are expected to contribute to a sensible research policy that goes beyond the narrow perspective "of being able to feed more scientists".

Growth versus freedom and bottom-up initiatives
The public purse has come under strain in most countries in recent years. This means a levelling-off in the funding for research and, more important, much greater competition.[26] It is a challenge to adjust to this situation and to be able to keep some flexibility in particular. Despite the sizeable resources already committed to R&D, this is in practice no easy task.
For many reasons I think that large areas of research in the western world must accept that the formidable post-war growth is over, or at least levelling off. Many problems within research can no longer be solved through measures that assume growth. The size of the enterprise of basic research has obviously reached a level undreamed of by Vannevar Bush and most science policy advisers in his time.

The pressure on the university councils is now considerable in most countries. This also applies for the Nordic ones, as we have seen. The question is to what extent the scientific community is also prepared and able to fight for a funding channel that still gives significant room for bottom-up initiatives with or without application in mind. A more pertinent question is whether society at large is willing to accept a channel of this kind.[27] We have already noted a tendency in the research community to accept funding based on external criteria, but in practice to ignore this dimension when the research is up for evaluation. Research assessment exercises become essentially one-dimensional, with strong emphasis on publications as we already have alluded to. In the long run this practice may backfire.

[26] E.g. the cost of research ("the sophistication factor") and the increase in number of scientists.
[27] Gibbons et al. obviously has a different view on this important point. They neither defend a bottom-up channel nor see it as a successful strategy.

In my view the dichotomy in our definition between researcher-initiated research on the one hand, and user or socially influenced research on the other, should be the basis for peaceful competition rather than an either/or attitude. It is more important for the spokesmen of basic research to monitor developments in their own resources and working conditions and the general well-being of their fields than to compare with and envy developments in applied research and experimental development. The objectives are different and should be viewed and assessed as such.

The essential point should be to sustain vital basic research of high quality. In my view, further expansion of resources for basic research is less important than securing good working conditions for the research activities that already exist and are able to make a real contribution. The wealthy western countries of today should be able to maintain and finance research that does not only promise short-term usefulness. The amount of resources going into this endeavour is in the end a political question, and it will help that some research "stands up honestly" as basic research and does not sail under false colours.

'The Nixon trap'

It is not in the long run for the politicians to go it alone! Scientific judgement is important and should not be avoided. The Nixon trap ("Mr President: You can cure cancer!")[28] is to be avoided, and the fact that research results normally do not materialize immediately should be borne in mind. In addition one should not ignore the value of independent research as a source for society to draw upon for advice. To what extent are the councils and society at large able to maintain and renew this source and build necessary bridges? Obviously this is a particular challenge for the small Nordic countries.

Once could certainly argue strongly that there is still need for research councils. They increase national competition for research funding and fellowships, i.e. 'dual funding' within broad national strategies. However, the relative strength of the council channel – what researchers should expect from the university and council budgets respectively – is a difficult issue that for too long has not been properly dealt with.

A first priority is to maintain trust in the council system – including the research community. This relates to scientific decisions taken by the councils as well as their dealings with the authorities on procedural and priority issues.

We are surely not arguing that basic research is the superior kind of research, or that peer-reviewed 'bottom-up' initiatives always succeed. Our concern is that research not intended to be directly useful at the time of funding, but with a long-term advancement of knowledge perspective as its legitimate basis also should be adequately funded by government, preferably at arm's length. Up until now it has been obviously valuable, also from a user perspective, not to put 'all eggs in one basket' by abolishing bottom-up initiatives in the scientific community, which indeed represent only a modest percentage of total public funded R&D.

This defence of basic research certainly does not imply that all university research should be of this kind, or that universities should lived in splendid isolation. However, today's universities are the proper home for the greater part of basic research activities that society wants to fund. A well-designed research council system may still be the most appropriate way to maintain the well-being of such research and, at the same time, to maintain the universities as institutions of considerable independence and integrity in modern society.[29]

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[28] President Nixon's 'Cancer Crusade' in the early 1970s is usually seen to have failed due to lack of scientific opportunities at the time of the research effort.

[29] See for instance the recent debate on the danger of loosing integrity in several editorials in *Nature* devoted to this issue in August/September 2001.

A sombre note
Surprisingly enough, the academic leadership has only paid modest attention to important science policy issues in recent years – included questions related to basic research. Funding and principles for funding are among such issues, which include the rationale for research councils, the size and role of the council system, and the government practices with regard to budget specifications and top-down initiatives of various kinds.

This also begs the question to what extent the funding system in the small Nordic countries should be multiple-source or monolithic? Recent developments have indeed made Norway and Sweden contrasts in this respect. Is this contrast too large at present? Even if we do want it: how much diversity can small countries like the Nordic in the long run afford? On the other hand: It could be strongly argued that one should accept that there are major cleavages even in a small country, and that it would make sense to accommodate such cleavages institutionally. In other words: Putting all research activities – including technology and innovation, in one basket may be too much.

To defend basic research/bottom-up funding in the small egalitarian Nordic countries may be particularly tricky, as the contributions made here to the world's stock of knowledge will always remain marginal. Politicians may argue that the responsibility for the advancement of knowledge rests with the major countries. Hence the academic leadership face even greater challenges if they want to develop and sustain research of this kind.

Chapter 4: Different groups of actors in national priority-setting

To complement the insights gained from the types of case studies presented in the previous contributions, we focus in this chapter on the involvement of different groups of actors in national priority-setting processes: How do they gain access to the policymaking process of governments and/or intermediary agents, what role do they play in these processes, what is the nature and degree of their influence on them?

The Role of Science Councils as advisory bodies in national science policy priority setting

Enno Aufderheide
The German Science Council

In Germany, science policy priority setting is to a large extent influenced by a wide spectrum of advisory bodies. Some of them are ad hoc groups, called into action by the government in reaction to short term needs. Some are self-proclaimed and basically lobby groups.
The German Science Council is certainly the most influential science policy advisor.

In my talk I want to focus on my own organisation, the German Science Council. And besides giving you this case study, I want to put the findings in a larger context, first by drawing the background of the national situation, and second by comparing some of our features to other Science Councils in Europe.

Concerning the national context, I have to mention two things:

- First: Germany is a federal republic. Federalism and a high degree of autonomy of its provinces, the *Länder*, in matters of science and higher education is constitutive for our country.
- Second, we have of cause our special historical and cultural situation. Science in Germany depends heavily – for basic research almost exclusively – on government funding. It may largely be due to experiences in the Third Reich, that this importance of government funding meets a general demureness against governmental influence on other sectors of society. These reservations are further strengthened by the failure of the former GDR to build an efficient science system through governmental "planning". Hence, the science organisations in Germany are vigorously emphasising their independence and autonomy. There is almost some distrust between science and politics. Hence, for ensuring acceptance, governmental policies can only be successfully developed in dialogue between science and administration, moderated by a scientist.

This leads me to an introduction on the basic structure of the science council.

What is the German Science Council?

- **Advisory body**, not funding agency
- **members** from science (incl. arts &humanities) public life & government
- **Broad scope of recommendations**

  (**operational** – e.g. evaluation, HEI investments;
  strategic – e.g. modes of funding, "Future of the Science System";
  both as well for [tertiary] education as for research).
- **Patronage by the German president** (="Bundespräsident", little real power)

  ⇒ Independent from governments and ministries, who are members of the council;

What is important about this council is the fact that it is slightly dominated by scientists, but comprises representatives from government and public life as well. Also important is the fact, that it deals with a broad scope of topics. It does clearcut recommendations on specific investments as well as long-term strategic proposals ("Future of Higher Education and Research in Germany"). Its recommendations concern both humanities and sciences.

It turns out, that the German Science Council is in several aspects quite unique in Europe. To give you an impression of how other science councils are constructed, I briefly want to compare two features of our council with that of the councils in Denmark, Finland, the Netherlands and the United Kingdom.

First of all, if we compare the age of the councils, it becomes obvious that with an age of 43 years, the German Science Council seems to be the oldest of the councils in the European Union.

More important is the question: Who is the chairperson? Concerning the chair, the councils basically follow two schemes: In Germany and Denmark, the chair is taken by a scientist. Similarly, in the Netherlands, which is the only country with a full-time council chairperson, currently a scientist holds this post, but before also a businessman has been in this office, and in theory, also a former government representative could be elected into this position.

The other scheme is followed by Finland and the United Kingdom: In both countries, the chair is hold by the prime minister, who is represented by the responsible minister in the UK.
To me, this difference in chairmanship is quite important if you consider the MUSCIPOLI objective to find out about the structures and procedures of science policy formulation: It concerns the question: How independent is the council?

However, I would like to emphasise that according to my view *independence* must not be mixed up with *separation*: I will later comment on the fact, that inclusion of administrators or politicians in the process greatly enhances the influence of the council. This is reflected in the composition of most councils: Denmark, Finland and Germany include members from the government in the council, in the UK the minister chairs a group of experts. However, in the Netherlands and Switzerland, the council is solely composed of experts from science and business.

Background of Chairperson and members	Members Chosen by
Denmark (since 1996)	
Chair: Scientist members: from science and business sector	proposal by „everybody“, selection and appointment by ministry in consultation with chairman
Finland (since 1987)	
Chair: Prime minister members: from government, science, societal groups	proposal by represented organisations each for itself, selection and appointment by ministries
Germany (since 1957)	
Chair: Scientist members: from science, governments and societal groups.	proposal for scientists by organisations (consensual 3 person list). Appointment by president
Netherlands (since 1990)	
Chair: Scientist (or other, full-time), members from science and societal groups	informal suggestions by organisations and council, selection by ministries
United Kingdom (since 1993)	
Chair: Minister S&T members from science and societal groups	Appointment by prime minister after “wide consultation”

In Germany, we see one crucial point for independence in the way, how the members are chosen. Actually, we have two mechanisms, how the independence of members is ensured: First, the four biggest science organisations together propose a ranked list of three nominees for each seat, based on merit. Only a person from this list can be appointed and deviating from the ranking certainly needs good arguments. Second, the appointment is not made by any of the ministries, who are recipients of the advice, but rather by the independent German president. In this context it may also be important, that the council’s office is not run or hosted by a ministry.

Also important in the contact of MUSCIPOLI is the fact: Who is member of the council. I already mentioned that the councils differ from each other concerning government representatives. What is almost identical in all of them is the fact that they comprise persons from societal groups. This certainly adds an important perspective to the advice, especially if the participation is not restricted to representatives of the business-sector.

Another question of MUSCIPOLI concerns the procedure in the formulation of science policies. It is quite obvious that both the availability of the best possible information and the highest degree of objectivity must be warranted. This alone could be a topic of its own. The British Science Council has issued good practise guidelines for scientific advice.

In this talk, I want to focus on something else: In my view, the impact of a science council is heavily depending on how the advice is made available to the executive level, i.e. the administration. We have already seen that some of the science council’s directly involve the government in its work. To a certain extent, this may be an infringement of a council’s independence. However, I am convinced that there is something like a trade-off between independence and influence and that every country has to find its own balance in this respect. In Germany, it seems to me that involving the government in the discussions clearly is a strength of the council.

The German council prepares its statements in a two-step procedure. First, a working group prepares a draft, then the council itself finishes the final recommendation. In the first step, the working group, highly qualified experts from science and society are involved together with working-level administrators. This way, the administrators can contribute their detailed knowledge of the present state, and are confronted with the ideas of the other side. This is beneficial in two ways: First, it assures a realistic basis for the discussion. And second, it implements the ideas into the brains of those, who finally have to draft the government´s policy.

In the second step, the finalisation of recommendations, top level government-representatives participate in the discussion. Of course this leads to various compromises if recommendations are unpleasant for the government or difficult to realise. Still, in my experience the independent scientists mostly find a way to preserve the essential parts of recommendations. This way, the government officials are already “sworn-in” on the recommendations and the chances for realisation are certainly better, than if they are only confronted with a written report.

In saying this, I have already stated on one more of the MUSCIPOLI-objectives: How do policy actors interact and how are they coordinated: In the German Science Council, the actors find themselves in a face to face, equitable interaction. The Science Council is itself an instrument for coordination. It coordinates both the federal and the state or Länder governments and it brings together initiatives from science with political discussions.

Contributing ideas and criticism in direct discussion with both high-level and working-level government representatives is hence one of the ways, how the actors in the council exert their influence. Being able to put things on the agenda is an other important feature of their influence: Probably all European Science Councils are able to decide themselves, on which topic they want to issue recommendations.

So: What has changed in these processes of decision making and priority setting in recent years. Though there is an increasing number of private enterprises, which try to become active in the same field and of advisory bodies of “Länder” (state) authorities, the demand for advice has both been growing quantitatively and shifted in type. The quantitative growth becomes manifest e.g. in the number of evaluations done. As these evaluations can have vital consequences for the institutes, this has increased the awareness about the Wissenschaftsrat and has lead to a broader perception of the council’s recommendations.

The qualitative change can be seen in the fact that the council has more often been asked to recommend on structural issues that go far beyond a single institution. Examples are recommendations on the whole assembly of higher education institutions in some of the German States or *Länder* and the systemic evaluation of whole research organisations, namely the Leibniz-Gemeinschaft or the Helmholtz-Gemeinschaft, the association of the German Large Scale Research Centers. By doing these evaluations, the council had a unique opportunity to give statements on central issues of the organisation of the science system with implications for direct action (and we will come to the question of impact in a second).

Another example of a new type of advice by the Wissenschaftsrat are his Theses on the Future Science System. With this paper the council left its usual time frame, which is normally restricted to the next few years and tried to envisage the main lines of discussion for the next 12 to 15 years. Of cause, the paper is somewhat speculative and broad, but it has already turned out to have kind of a normative influence on the science policy discussion in Germany.

Still, there has not been any significant change in the procedures of the council. For example, the council has not been trying to become a business consultant for private universities, which are beginning to establish themselves in Germany. Also, it is difficult to see, whether the impact of the recommendations has really changed.

I have had a hard time trying to figure out, what a case study on the German Science Council could contribute to the MUSCIPOLI-objective of the impact of science policy advice. To be frank, I have to admit that we do not have a straight track record of our recommendations. But how do you really get one? It might seem quite simple for recommendations on discrete investments, that are either made or not. Here, we do not find any investments being made that have got a negative statement by the council. But on the other hand, the science budget does not allow all recommended investments to be made – so what is our impact? If an institute gets a negative evaluation, in about half of the cases it's being closed. So that's a clear impact. But in the other half, it may be restructured, some departments closed or renamed and it is very hard to tell, to which degree this obeys to the recommendation. Or in strategic recommendations: They are always followed in part. But if this is 60% – how do we know what had happened without our recommendation?

My personal statement is as follows: The Wissenschaftsrat clearly influences almost any science policy debate. Almost none of its recommendations find a 100% realisation, but none remains without effect, either. If you ask people from different actors even about the effects of one single recommendation, you will also find differing views: Even if the council would criticise that important parts have not been realised, others would argue that "almost all" postulates had been fulfilled.

"Managing with Uncertainty in Science Policy": That is the background of our workshop. And that is also the background of my council's work. I will have to leave you with this uncertainty.

Addendum: More specific aspect concerning workshop issue ("thematic priorities")
There is no tradition of (technology or science) foresight in Germany. The German Science Council has issued a recommendation to invent a transparent process of "Prospection" (to imply "finding the gold mine" instead of "predicting") in 1994. Later, it conducted a pilot study together with the other German science organisations (published 1998). Still, there is no acceptance for a general foresight/prospection especially in the scientific community. In industry and in government, foresight is mainly seen as an instrument to make allocation decisions. In governmental programs, even for such decisions this method is rarely used. This year the research ministry BMBF has initiated a foresight process ("futur"), which is planned to involve some 2000 people and which is meant to help delineate a roadmap of research policy. Whether it will have any impact remains to be seen. A similar process, started two years earlier, was finally cancelled without result. In general, there will always be a conflict between the results of a large consensual process, and the personal conviction of the actors especially in "political" funding, unless the actors are involved in and committed to such a (foresight) process.

The German Science Council has still given recommendations on thematic priorities in the context of evaluation exercises, not on the basis of an organised foresight-process, but of detailed peer-review and peer discussion. Recommendations concerned broad areas (energy research, materials research) or small entities ("Which activity within the spectrum of a single institute should be emphasised or added to the research portfolio?").

Perceived and actual roles of academics in science policy

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1. Introduction

The purpose of this paper is to investigate the role academics play in science policy. Academics are broadly defined here as researchers in HEIs and research establishments.

As empirical research in the topic is limited I try to suggest some concepts and methodological issues that can help identify diverse models of roles and influences. I start by looking at the ***level*** of involvement (individual, institutionalised or collective), the ***nature*** of the influence (direct on various funding schemes, or indirect in the regulatory framework and training) and the ***type*** of influence (formal or informal).

Based on this first investigation I try to suggest some dimensions for alternative models, conclusions and recommendations. The most important recommendation is that it is worthwhile investigating further on this topic, so some research ideas are put on paper.

2. The Level of Involvement

Academic freedom allows academics, unlike other actors, to participate in science policy at various levels:

2.1 The individual level

The *Individual Level* is probably the one most often encountered. Academics have the reputation of being knowledgeable and thus able to give advise for science policy, either in the field in which they specialize, or in methodological terms. They are thus more often than not used for peer reviewing, ex ante and ex post evaluations and methodological advice to policy makers. In practically all advisory bodies to either the political or the administrative authorities in Europe and the US one encounters academics nominated because of their individual reputation rather than appointed by their institutions.

Those academics typically differ from the archetype of an academic (talented people with own research agendas and no project funding). This archetype is still dominant in most countries for academic promotion criteria but differs substantially from the model of the Triple Helix Academic (full titles, project funded research teams, member in policy boards, member/executive sometimes in corporate boards). The latter may have some intra-departmental difficulties but he is a very popular person for both corporate and policy advice.

In the end of the day one may argue that whether an academic wants to participate to such tasks is a matter of personality. With descending order of popularity academics take part in:

- Evaluations
- Consulting
- Permanent or political jobs in the administration

To contribute to our main objective one may formulate an assumption: The closer academics are to the fulfilment of the new role, the higher their influence. But this leads to important policy questions:

- Is that legitimate or not (implicit assumption: the market selects the best)?
- Should policy makers (educational policies) speed up the transition?

2.2 The Institutional Level

Academics are often asked to advise as representatives of specific organisations (university x or research centre y) or the institution to which their organisation belongs (the HEI system or the interdisciplinary public research establishments). In the former case the *Institutionalised Level* acts more as a lobbying power and to some extent this also applies for the latter.

Institutional roles are such as ex officio:

- Influential HEIs, research centres, academies
- Assemblies and academies
- Advisory role to politicians
- Advisory role to the administration

Major universities are always represented when there is a discussion about educational or science policy reforms. There is of course a question whether less performing HEIs are also represented. But in this function, academic representatives of major establishments may be assumed to use their influence to perpetuate the system.

There may be an additional issue for discussion, though theoretic from my point of view: Independently of what academics do in their free time or for their own budget they still belong to certain institutions. It is very unlikely that an academic, in his individual role turns against his colleagues, the specific organisation he belongs to or even the institution that encompasses his organization.

The assumption here is that the higher the hierarchy of the nominating body the higher the influence of the academic representative but possibly also vice versa: the higher the rank of the representative the better he/she can defend the interests of his/her organisation/institution. This leads to the next policy question: Is that legitimate or not (implicit assumption: the boss/peer reviewers/self regeneration select the best)?

2.3 Representation of Collective Interests

The third level is different in the sense that here the representation takes officially a lobbying form. The following bodies may be officially requested to express their opinion in either current matters or potential changes:

- Professional organisations and societies
- Institutional Trade Unions
- Confederations

In this case the role of the academic is to defend salaries and careers rather than the effectiveness of S&T policy. One may of course, with neoclassical considerations, assume that the higher the rewards the higher the research productivity, but any empirical research may contradict this assumption so we do not incorporate it into this policy oriented report.

Yet another assumption is important here: the higher the number of members and the personalities in the board the higher the influence and this again lead to questioning the legitimacy of democracy selecting the best.

2.4 Suggested country models

While the following table is only based on intuition and does not have the ambition of a thoroughly thought model, one may still argue that all levels of representation appear in all countries but there are different mixes, which are about to crystallise in different EU areas:

	Individual	Institutionalised	Collective
Anglo-Saxon	XXX	XX	X
Central Europe	XX	XXX	X
Southern Europe	XXX	X	XX

X: low
XX: moderate
XXX: very important

By this it is not argued that one model may be better than the other. The assumptions and policy questions formulated above should only be used as a tool to better understand and organise the academic representation in each country. Diversity is important and all models can work well. There is no good or bad model, there are good or bad people.

3. The *nature* of the influence
The nature of the influence of academics may differ, depending on the social and political environment as well as on the circumstances.

Direct influence on the type of intervention is exercised when academics are directly asked to advise on the distribution of funding. It starts with the basic question whether public subsidies should be sectoral or neutral. The dominant position in the global competition era favouring the former automatically leads to the second question: which sectors should be funded: those that already present a competitive advantage in the country or those, medium and high tech ones, where demand and profit margins will evolve positively in the future. Or a mix of both and this case which mix? The problem then is that individual or institutional representation may take a conservative position, while exactly the opposite is needed. At the same time direct influence is exercised in the project selection or institutional evaluation level.

Indirect influence is very different in nature, and I would argue that academics have a much stronger influence in this, as they are by definition in a position to view longer term than politicians or civil servants. Their influence on IPRs, the design of the regulatory framework and training (in particular at the graduate level) are of paramount importance and often not institutionalised.

4. The *type* of influence
Finally the type of influence may be distinguished into:

Formal or informal, in which case the transparency principle of sound public management requests to lead to as formal influences as possible.

Universal or specific, distinguishing between influence within organisations (e.g. specific ministries or implementation agencies) or across organisations to broader policy aspirations.

Short or long term, depending both on the time in office of those who advise and those who are advised.

5. Tentative conclusions and recommendations

The conclusion of the above mentioned remarks is that the academic community as a whole has undoubtedly a great influence in S&T policy. Selected academic have a high influence, others not. It is argued that in all countries there is ***a leading group of new model individuals,*** who informally, universally and in the long term influence all three natures of intervention. The leading group is not necessarily composed of the same people for all types of influence. Often this leading group has institutionalised powers. But we are in a model of transition and this means that any changes need to be carefully studied.

Tentative recommendations suggest that:

- Lead groups should have high influence but institutionalise it (market and political selection coincides)
- Make the system as transparent as possible (informal can harm, e.g. replication of the current status)
- Collective interests are not supposed to be represented in science policy (science is not a democratic process)

How can policy-makers select the best remains a question for each system to answer. Alternatives are:

- The market (appoint the successful Triple Helix academics)
- The boss (political selection)
- Self-generation (advisory bodies changes a fraction of their members every time)
- Peers (random process)
- Democracy (institutionalise collective interest representation).

At any rate this paper did not have the ambition to give mathematically clear solutions. It only tried to suggest methodologies on how to proceed with the selection of academic advice in the future or how to evaluate its past contribution.

The voice of the industry

Bjarne Lundager Jensen
Director of Science & technology and higher education policy
The Confederation of Danish Industries

My title tells that I'm a lobbyist, and what I do for a living is lobbying the industries agenda in policies of science, technology and higher education in Denmark and abroad.
That means I know a little bit about science and a lot about politics, and here I will focus on the politics. In this presentation I will try to give you an impression of how we work as an organization to gain access to the decisionmaking process in councils, universities, parliaments etc.

As an example, I have chosen to concentrate on a case that we are all familiar with; namely the negotiation of the formulation of the European Framework Programme in Brussels.

First a couple of words on the voice of the Danish Confederation of industries. What do we do?

- We represent app. 6000 companies in Denmark – trying to create the best possible, most unrestricted conditions for business operating in Denmark.

As more and more Danish companies are dependent on corporation funding on developing their technology with other companies, universities and technological institutes both in Denmark, Europe and the rest of the world, we in the Danish confederation have an obligation to pay attention to what is happening in the triple-helix and work as effective and influential, as we can.

As a lobbyist trying to influence the science and technology policy there are a number of important issues that I have to take into account, when I plan my strategy:

- to identify common interests with the science community, with the civil servants and with the science policymakers
- to create and use personal relations – not by acting as a lobbyist, but as an individual to create mutual respect
- to exchange valuable knowledge
- to use the press as your best friend (that's one area where we in the industries are much more professional than the scientific community
- to make new and surprising alliances, that will give the Confederation more legitimacy (a recent example in Denmark is alliances with the student organizations)
- to have the right timing (essential).

The European Research Area
To return to my case, I want to show how we tried to gain access to the allocation of the wonderful 100 million Ecu in the European framework program.

In the European Research Area there are some good intentions of coordinating the different European research institutions closer and coordinating European and national funding, but it also represented a step towards the academic research and towards a thinking that big is beautiful. The intention was to direct the money to networks of excellence, to big public/private enterprises, and that is where we saw the Danish small and medium-sized enterprises getting lost.

We in the Danish Confederation were sitting in a political bad situation, so we had to come up with a good strategy to influence the final outcome of the European Research Area.

It was difficult to catch the attention of national politicians in this case, so we had to find another way. Instead we focused on the conflict: big versus small, and tried to create a story about the little country with the small companies and small universities getting lost in the enormous EU-system with the big countries, big universities and big enterprises taking the lions share of the 100 million Ecu. With this story we tried to get influence through the scientific community, the national politicians, the media, the commission and parliament in Brussels and the Europea Confederation of Industries, which of course have much more influence than the Danish Confederation alone. We tried to convince all these actors, that the European Research Area is a good idea, but that we should not forget the small and medium-sized companies.

We have worked on this strategy in the past year, and I think it has been one of our biggest accomplishments as lobbyists so far in influencing the political priority setting process. We have now to some extent secured the smaller and medium-sized enterprises in a number of important issues in the proposal for the sixth framework program.

Setting the Research Agenda - the industrial/commercial perspective

Maureen Gardiner
Consignia Research Group, UK

The role of UK industry and commerce as a sector in setting direction for national and European research is still, in process terms, unsophisticated and insecure. However there are developing mechanisms, and they have been in place long enough for a certain amount of process development to have taken place.

Broad based consultation by government on long-term research focus uses the Foresight Programmes. These ask questions about the big issues, which should influence future direction. In consequence they do not generally rouse companies' anxieties about sharing knowledge and insight. They also, in the publicity, which they engender, go some way to creating awareness and consensus about need and the value of long-term research. They also provoke early interest in areas of cross-disciplinary needs - as for example in the social and economic implications of health technologies.

Other points of engagement in government sponsored research agendas exist all down the chain, and will be general to many countries. Large companies have a place at the table in most of the standing bodies like the Research Councils, and in specific single issue groups set up from time to time. Small companies on the whole do not. Gaining value from this involvement, seen from the industrial and commercial community perspective, can be difficult. The development of thematic approaches is of benefit here, giving an opportunity to scope the issues in terms, which can include community impacts, and creating a vehicle in the research programmes for on-going dissemination.

Downstream in the knowledge transfer process, in creating agendas for applied research and in particular promoting the transfer of knowledge into the user community, the Department of Trade and Industry Link scheme plays an interesting. Link programmes have had success for some time in the physical and engineering sciences. They are making some, but slow, progress in the social and economic sciences, and particularly in cross disciplinary subject areas which link physical and social science research.

Companies as sponsors of research are junior but not insignificant players.. The idea of a Foundation, for those companies able to exploit research directly and wanting to own the wider agenda is attractive but expensive. Microsoft is the current archetype. Increasingly, companies are also looking to the outsourcing model - the Centre of Excellence, set up as a series of contracts with a limited set of individual institutions. British Aerospace and ICL are examples of companies recently adopting this approach, which appeals strongly to current company thinking about the nature of core and non-core competencies.

Finally, however the real point of engagement comes for whole industries when 'something goes wrong'. In practice, this generally means that the market place - the consumer - reacts adversely and fiercely to innovation by the industry. The importance of this for policy making are, to my mind, significant. They include:

- A reinforcement of mistrust by industry in formal policy forming processes - "'they' should have thought of this".
- A perception that research has only a limited contribution to business strategy **or** that the research agenda was wrong, and greater 'real world' input is therefore needed.
- A rapid re-making of policy and intervention only marginally informed by research.

On balance, since government does not like being rushed into policy, and since these issues are increasingly complex, these events generate a demand for, rather than a rejection of research.

However, as uncertainty in business strategy generates more interest in research - and particularly inter-disciplinary research - it also highlights major problems for business to engage with the research community:

- Agencies operate on timescales, which are very long compared with business planning cycles.
- Sources of knowledge and insight are elusive. Businesses need knowledgeable individuals, and are used to engaging with experts as consultants able to interpret impact in business-specific terms.
- Companies prefer on the whole to operate independently, and to own knowledge, particularly where it is of direct market value. In this sense, exploratory and generic research is easiest to co-operate with, where the outputs can be independently developed by participating industrial partners.
- The multi-national dimension of large company activity creates the need for research relationships in a number of countries.

The challenge of industrial engagement in research agenda setting is to include such diverse interests to optimise benefits for all parties. At least a part of this is to build the breadth of involvement and experience, which leads to greater mutual understanding between players.

Chapter 5: Policymaking instruments: The design and delivery of priorities

Many of the instruments used to facilitate the formulation and/or implementation of priorities would already have been referred to in the case studies included in Session Two. In this session, we aim to create an inventory of the variety of policymaking instruments currently in use and to examine some of these in more depth. Apart from learning how and by whom the choice of instrument is determined, we are also interested in considering the perceived impact on scientific activity, its outputs and outcomes.

Resource Allocation and Comparative Expenditure Trajectories

Annamária Inzelt
The Budapest University of Economics and Public Administration, Hungary

The challenges of the knowledge-driven economy are serious ones for the European Union and for the Accession Countries. Not only are Central- and East- European countries in a transition process, but also the European Union member states, and the Union itself, are entering a phase of societal and economic transformation. The role of knowledge is becoming crucial. Policy-makers have to revise science, technology and innovation policies to develop a truly relevant policy for the 21st century. Faced with these challenges, policy-makers are looking for additional and new tools by which to understand the changing world and to identify future priorities.

In the process of priority-setting, European politicians recently declared that the principal objective of the EU was “To make the EU, by 2010, the most competitive and dynamic knowledge-based economy in the world”. (The Lisbon Summit in March, 2000) They stressed many themes applicable to different factors and actors within innovation systems: from the integration of financial markets and appropriate regulatory measures to reduce gaps in IT skills, to support "frontier technologies" and to develop the European Research Area. The document initiated debate at both on European and national levels.

The relevance and quality of policy-making are influenced by many factors. In the global world countries have many similar – but also different - questions for science and technology (S&T) and for innovation policy-making. The countries have diverse characteristics, which influence their capacity to deal with the problems.

Among policy-making instruments, indicators are important tools in all policy fields, including S&T and innovation policy-making. Indicators serve policymaking as main tools and also as a support for other tools such as evaluation, foresight, and assessment.

A general definition of "*Indicator*" is: "something which gives an idea of the presence, absence, nature, quantity, or degree of something else", and, deriving from this, S&T indicators can be defined as series of data designed to answer questions about the S&T system and about its links with the economy and society.

Data are facts, that is, information. Statistical data are the material (atoms) from which indicators (molecules) are constructed. Data compilation and available indicators inform policy-makers in their deliberations. However, the indicators themselves do not solve the difficulties of shaping and deciding S&T policy but they do have a very important role to play in obtaining a better knowledge

of the situation - and of the way in which scientific and technological policy can impact on the socio-economic objectives which they wish to reach.

S&T indicators have a long tradition. The measurement of S&T indicators and their employment in policy-making are the product of the mid-20th century, and the growing importance of S&T policy has created a demand for new indicators. Before this time sporadic data collection had occurred. In the last 40 to 50 years S&T indicators have developed considerably, thanks to the efforts of the academic community, of national statistical agencies and of the international organisations such as the OECD, and EUROSTAT for the European Community. Publications of these indicators and their analysis offer excellent tools to decision-makers at both national and international level.

I. The Function of Indicators

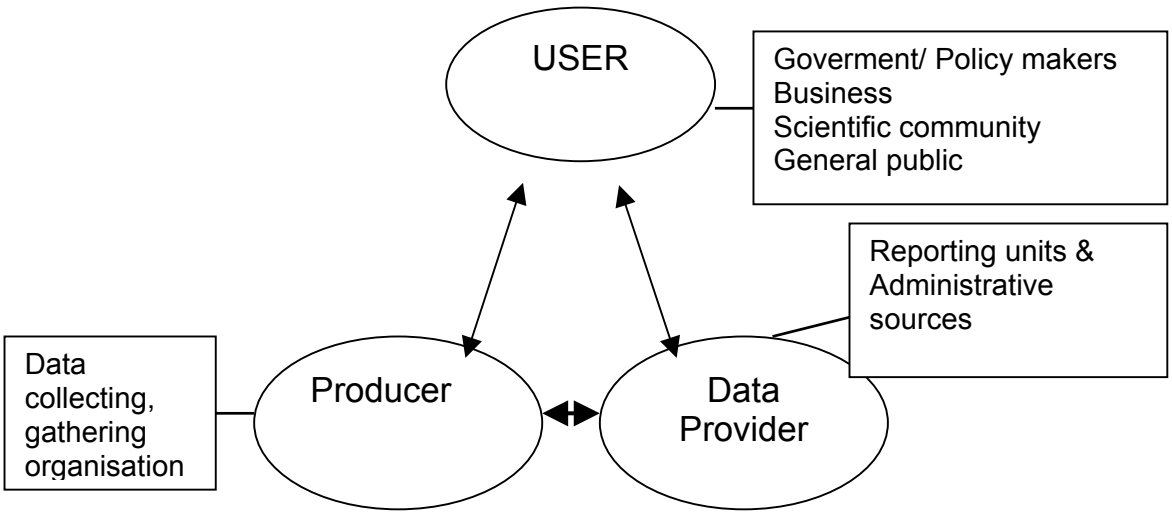
Measuring efforts in S&T in a comparable form is an important requirement for analysis. The indicators have ex-ante and ex-post roles in policy making. In policy management practices indicators may employ in evaluation and in strategic planning. The good indicators are those which, in Jankowski's words, perform the following:

- Reflect past trends and circumstances,
- Contribute to understanding the current environment, and
- Guide the development of future policies.

To perform these three, very different, tasks indicators have to develop an interactive process among user-producer and data providers.
Due to the distance between language and decision of policy-makers and the language and practical constraints of analysts and statisticians, it is no simple matter to determine what information is relevant to policy.

Tripartite participation is crucial in the context of indicator development and its preparation, and the users of indicators are equal partners in this process. Amongst users the Government (public policy administrations, Parliament, regional and international authorities) is the principal – as a stakeholder. In this same triangle the organisations which are responsible for preparing indicators are also of crucial importance. The third partners are the reporting organisations and ‘owners’ of administrative data-sources. (See Figure 1.)

Figure 1 Actors and Relationships in Indicator Development



The relationship among actors is reflected in the quality and in the timing of indicators. The availability of relevant indicators (reliable and up-date) affects, on the one hand, the ability of policy-makers, whilst, on the other hand, the policy-makers' substantive needs have a strong impact on the availability of different indicators. Data can both inform as well as reflect policy, and indicators can perform their supporting role to policy if the policy-makers pay adequate attention to data and devote sufficient resources to the collection and processing of statistical data. Policy-makers are not only users but stakeholders also, and their dependence is highly significant in terms of quantitative information.

Policy-makers need a complete overview of developments in the S&T sector for use in policy deliberations, which should itself foster efforts to overcome the lack of appropriate statistical information (Inzelt, 1997). Consequently, the supply-side can grow provided that the demand-side is ready to invest in long-term development. Indicator compilations need strong pressure in terms of demand from the user side. Similar to the situation with prototypes of new technology (analogous to the theory and conception of new indicators), profitable innovation would simply never come about if no-one were to invest in the design and development process (to continue our analogue, in data-gathering and in data- processing). The construction of new indicators - or the renewal of old ones - also need feedback loops similar to those in successful product and process innovation.

A continuously updated, standardised, internationally comparable measurement system, and time cycles in S&T, will be at society's disposal *if potential clients for indicators can create the demand, and* if ex post and ex ante impact studies are requirements for the decision-makers. *Policy-makers* have a singular role to play in the creation of a viable demand for indicators since they, as stakeholders, can provide financial resources for data-collection, -processing, -analysis - and for further development.

Likewise, statistical measurement has a critical role to play in the formulation of scientific policy. Over the last five decades many statistical agencies, S&T indicator laboratories, and research groups have been involved in developing and improving sets of Science and Technology indicators. Policy discussions on S&T themes have dominated, introducing a number of enduring themes, which have led indicator development over these decades. However, to identify a useful and enduring set of indicators is no easy task, and core indicators, which have emerged in the leading S&T policy-making countries have been harmonised internationally. Well-known products of harmonisation are the Frascati Family Manuals (OECD and OECD-Eurostat publications.) International experience proves that good policy for science; technology, innovation and industry cannot be formulated without acquiring an appropriate pool of information. Decision-makers need to know not only the cost of research and development, but also the results of these activities, as well as the environmental factors, which may come to hinder the practical application, usage and propagation of the results. Appropriate, internationally comparable, statistical indicators are needed to support the complete process of policy formulation, including financial decisions. *Indicator projects* are not undertaken for their own sake, but specifically in order that their results can be *used in a variety of processes*.

II. Snapshots of Indicators and their Employment

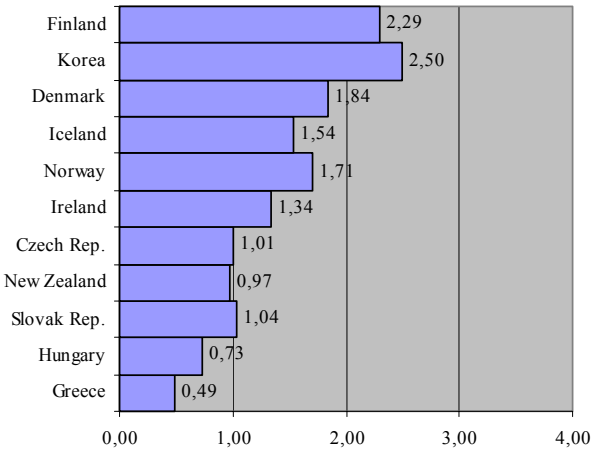
The role which indicators play in policy-making may be observed *in the way in which they are used in policy documents*. The main indicator of the national effort devoted to S&T support is that shows the fraction of GDP (Gross Domestic Product) devoted to Research and Development. (Benchmarking, theme 2) The relative importance given to R&D in the government's general spending commitments indicated budget allocated to research amongst government spending measures. The GBAORD by socio-economic objective is shown relative importance of different R&D targets.

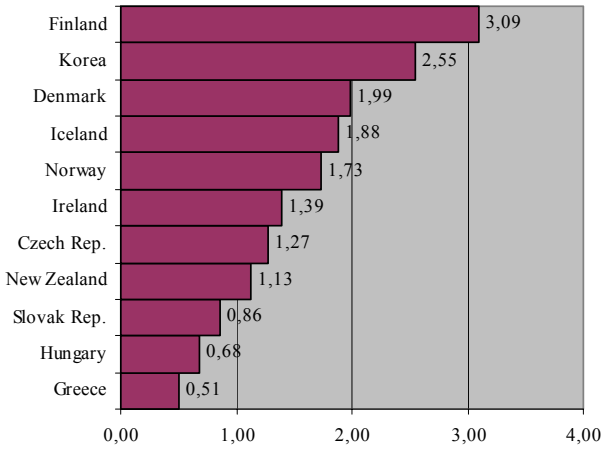
II. 1 GERD to GDP

All national documents use *the ratio of Gross Expenditure on Research and Development (GERD) to Gross Domestic Product* (GDP)

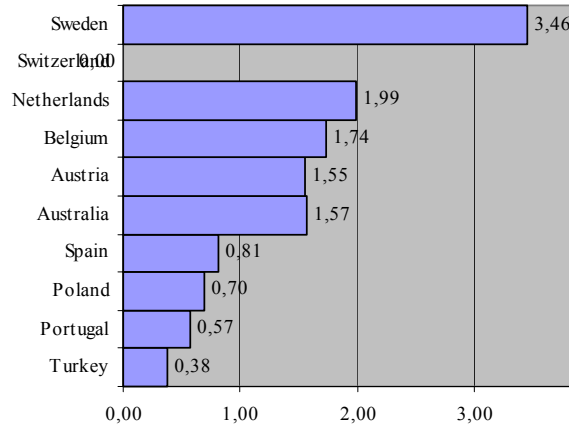
Figure 2 GERD to GDP byGroups of OECD economies 1999

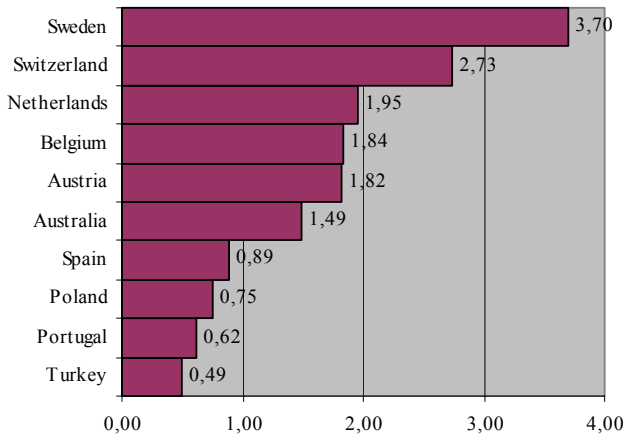
Small economies



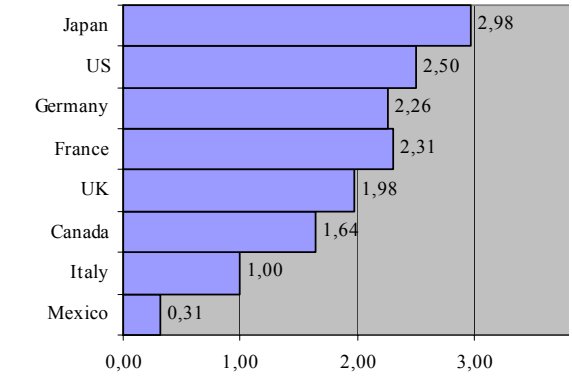


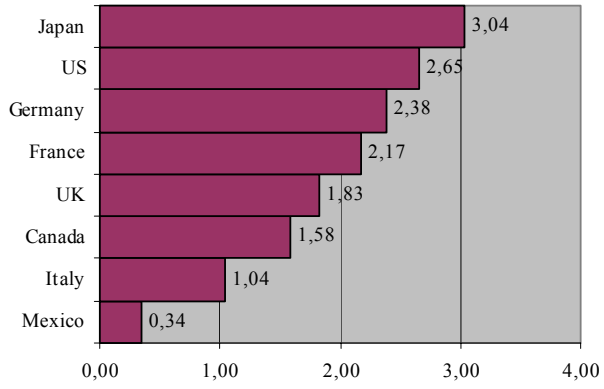
Medium economics

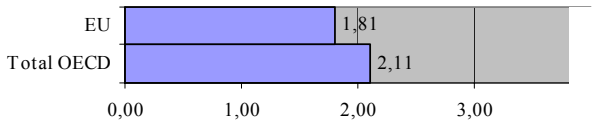


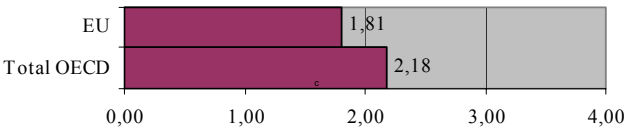


Major economies









This indicator gives information on the share of the GDP invested in R&D in a national territory and this enables a comparison of the relative importance of R&D in different countries. In addition, knowledge can be gained regarding any development in R&D expenditure during the time period in question. The indicator is a reliable measurement of the relative importance of R&D in relation to the economic power of a country, since the absolute amount of GDP is relatively stable. The importance of R&D depends on the industrial structure of a national economy and on several other factors also.

If we observe the countries of Europe, we will see a spectrum of EU-members and non-members. Some are highly developed, others much less so; few can be said to be growing rapidly. Many non-EU members are coping with the transition from a command economy to a market economy. Mature and developing market economies, both large and small, are included. If we follow the OECD grouping system we may divide the countries into three groups according to their level of economic power. (See Figure 2.)

The leading position in the international comparison of the OECD member states for the year 1999 is occupied by the medium-sized economy of Sweden with 3.7% - ahead of a small economy, Finland, with 3.1%. Among the large economies the leader is Japan with 3%, whilst in the small economy sector the leader (Finland, as above) is followed by another Asian country, Korea, with 2.6%. Besides these, Germany, the USA and Switzerland are all above the OECD average of 2.18%. The EU average is below that of the OECD at 1.8%. At the other end of the scale we find Mexico (0.3%), Turkey (0.5%), Greece (0.5%), Portugal (0.6%), Hungary (0.7%), Poland (0.8%), the Slovak Republic (0.9%) and Spain (0.9%). These are mostly Southern European and transition economies.

The figure shows two years, 1995 and 1999, and so we can observe changes in R&D expenditure over a period of 4 years. Out of 29 OECD member-countries, 20 increased their ratio of GERD to GDP. The relative ranking of countries also changed over time. The largest increases in the GERD to GDP ratio can be observed in Finland (0.8 percentage points), Iceland (0.3 percentage points), Sweden (0.2 percentage points) and Austria (0.3 percentage points). On the other hand, Canada, France, the UK, Australia, Netherlands, Hungary and the Slovak Republic all show a decrease in the R&D expenditure to GDP ratio from 1995 to 1999.

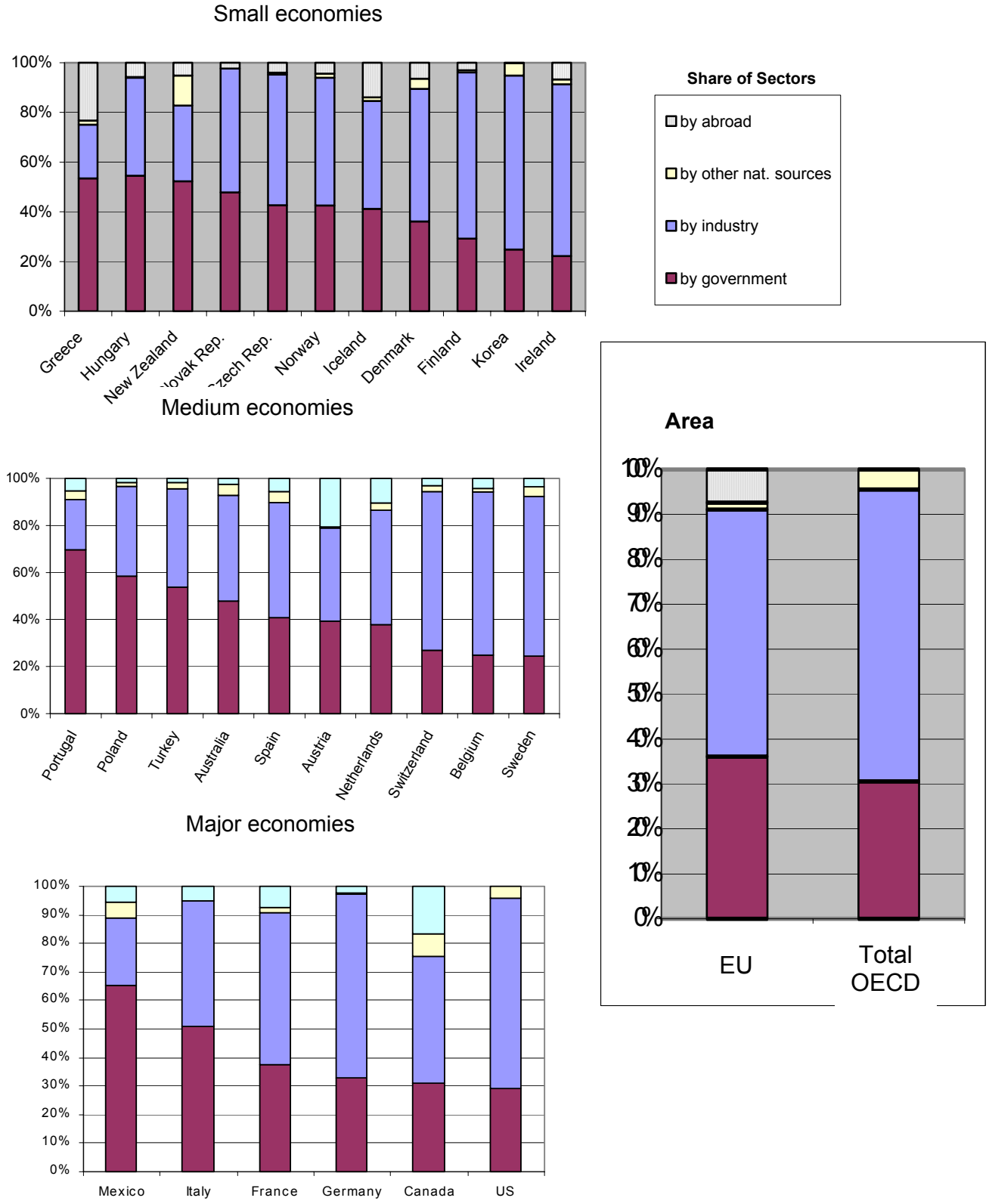
II.2. Shift among the funding sectors

At OECD level, governments financed one third (33.8%) of GERD in 1995 a proportion, which had decreased by 4 percentage points by 1999. The tendency is similar at the EU level, but the EU average is higher than that of the OECD. The difference was 5.1 percentage points in 1995 and 6.2 percentage points in 1999. Figure 3 illustrates the proportion of R&D expenditure by funding sectors in 1999.

The varying interventionist character of countries is only one of the reasons for this phenomenon. The degree of willingness of industry to invest in R&D is also one of the crucial causes of a high government ratio. France is a good example of a traditional interventionist government, whilst Japan, at the other end of the scale of the major economies, is an excellent example of strong business involvement in R&D. In the same group Mexico illustrates one form of interventionist government which tries to replace missing business involvement. The lowest ratio of R&D expenditure in the government sector may be observed in Japan (among the large economies), followed by the UK and the USA. Among medium-size economies Belgium, Sweden and Switzerland are in the same category. Of the small economies two emerging countries have the lowest government ratio, namely Ireland and Korea.

Figure 3 Ratios of GERD by Funding Sectors, 1999

The smallest fraction of industry funding characterises Greece, Portugal and Mexico. Low business involvement can complete with other sources financially. The breakdown of GERD by funding



sectors is influenced by many factors. The relatively lower proportion of business enterprise sector in GERD worth to investigate further. If the low business R&D funding is accompanied by low innovative performance of the country that pays the attention to the absence of effective economic demand for R&D and innovations. It also might be a sign of weak absorption capabilities of new knowledge.

II. 3 Analysis of GBAORD (Government Budget Appropriations or Outlays for R&D)
The acid test for a government's S&T policy-making is its mode of allocation of funds. The structure of its S&T budget, and changes in the allocation of the budget by socio-economic objective, by sector and field of science all characterise policy.

An analysis of funding for R&D is available in many countries' policy documents but the number of countries is smaller. Such indicators allow us to track the real priorities of S&T policy. Government budget appropriations or outlays for R&D describe government allocations to R&D. All the budget items involving R&D are derived from the budget. These measured or estimated data can be linked to policy issues by means of classification by 'objective' or 'goals' (OECD Frascati Manual, 1993) Without this quantitative information difficult to make distinction between wishful thinking on S&T policy goals and real 'objectives'. The non-existing indicators cannot assist in government science and technology policy formulation. The availability of data gives information on governmental commitment allocating money to R&D. The GBAORD data is not or only partially available on several OECD economies, such as Korea, Czech Republic, Hungary, Poland, Switzerland, and Turkey.

For benchmarking purposes we selected this indicator in order to shed light on government appropriations. The classification of GBAORD by socio-economic objective reflects the policy intentions. International comparable data are available by main purposes (e.g. civil and defence R&D, general university fund, economic development, space). These very broad categories allow some insights into aspirations. From one period to another governments appropriations change.[30] The re-allocation of priorities is shown as changing proportions among the various S&T policy themes. Public expenditure on R&D has a special function, and changes in the size and proportion of budgetary appropriations for R&D by socio-economic objectives highlight national priorities over a given period of time. These changes show us how policy-making reacts to the emergence of new needs, new research areas.

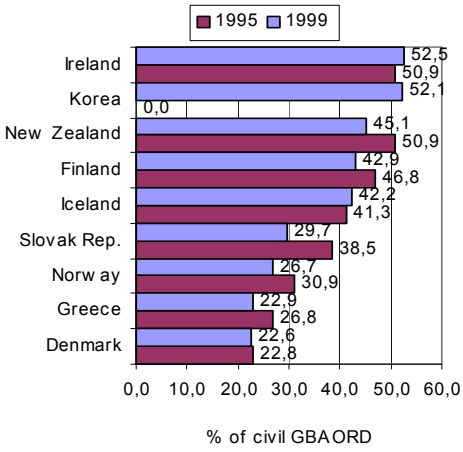
GBAORD data show very clearly that both "large" and "medium-size" economies devoted their largest proportions to general university funding in both of the years examined. Out of 8 large economies this was the first priority in 5: (Canada, Germany, Italy, Japan and Mexico) in 1995 and remained so the same countries, with the exception of Canada, in 1999. Out of 10 medium-sized countries 7 (Australia, Austria, Belgium, the Netherlands, Portugal, Spain and Sweden) devoted their largest proportions to this sector. In 1999, however, Belgium and Spain prioritised other objectives. Within this group the actual size of the apportionment devoted to this objective does vary. Among 11 small economies only 3 (Denmark, Greece and Norway) devoted their largest proportion of GERD to this objective in both years; the greater number (5) of these small economies focused on economic development. (Finland, Iceland, Ireland, New Zealand and the Slovak Republic). Korea also belongs to this group but can offer data only in respect of 1999. Figure 4 illustrates the differences among the countries by two largest proportions of socio-economic objective: economic development and General University Fund.

[30] International comparison of GBAORD data is constrained because of the imprecision in budget appropriations and of the discrepancy by countries among the amount of R&D being performed and expected in appropriations stage.

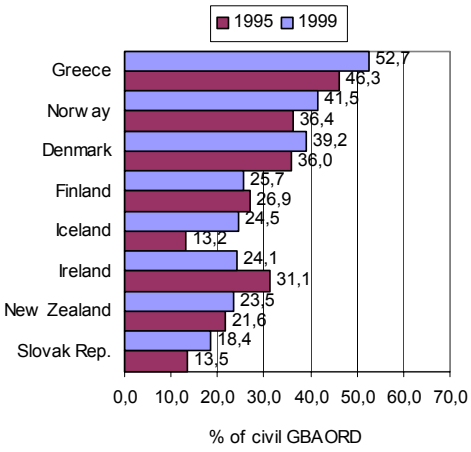
Figure 4. Proportion of economic development and GUF to total GBAORD in %

Economic development

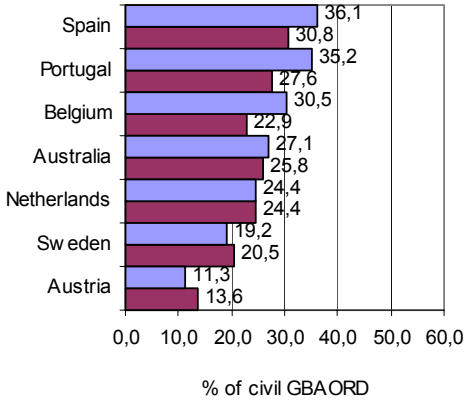
Small Economies

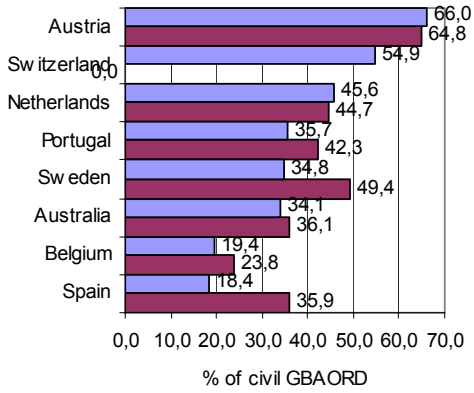


General University Fund

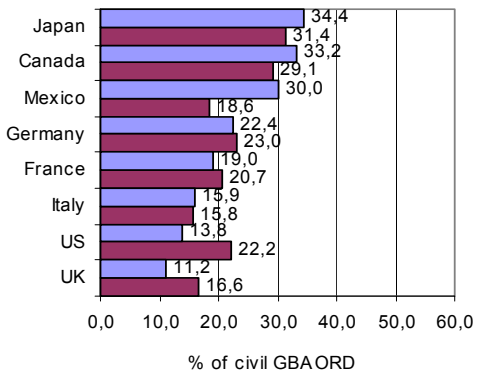


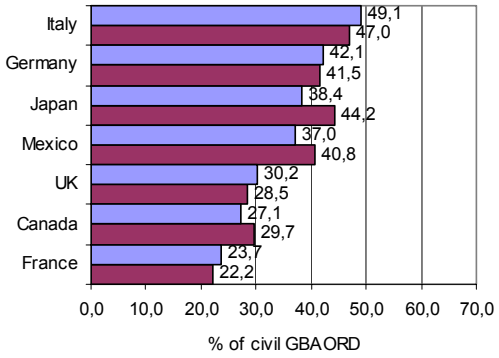
Medium Economies

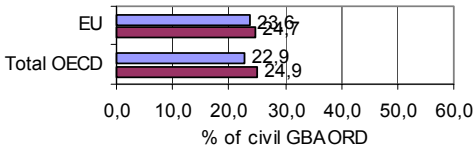


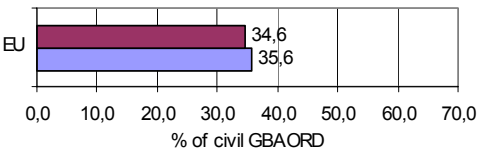


Major Economies









Several countries diverge from the general trends. The main socio-economic objective by proportion of GBAORD was health and the environment in the UK (32% / 36%) and US (44% / 51%) in the two years. All other countries devoted less than 20% to this except for New Zealand and Norway (in both years) and Mexico (in 1999).

Space programmes, as a percentage of civil GBAORD, remained below 4% in all small economies and below 10% in medium economies (except for Belgium). This proportion increased in Sweden (1.8 % $\Rightarrow$ 3.6 %) and decreased in other medium economies. Major economies also reduced their proportion of GBAORD devoted to space programmes except for Canada. The USA (25.1% and 22.6%) and France (15.0% and 14.2%) were the largest spenders in terms of their GBAORD apportionment on space programmes.

An analysis of funding R&D raises several methodological problems in respect of international comparison. It is hard to evaluate a government's budget devoted to R&D without knowing the weight of government in the economy of the country; some countries are, of course, more interventionist than others. National government budgetary practices are also different.

New policy themes may lead to new criteria for policy funding of R&D. Not only the new sources of funding are important for restructuring of research and development activities among the fields of science, economic sectors, product fields but mode of funding is also important. The shift from majority institutional funding toward programme and project funding is an important change in the R&D system. The implementation of contract system, competitive project based funding are making the R&D regime more flexible. It helps to break the monopolies of institutions and adjustment of R&D activities to focus on new challenges. A shift from institutional to target-oriented and competition-based funding is occurring in funding higher education research. Declining GUF might be a sign of this shift. However other data as GBAORD and external information need to identify the reason of declining GUF by countries.

The homogeneity of the indicators is still problematic. GBAORD, by its very nature, excludes all costs covered by governments which are not of a budgetary kind. Hospital research is treated differently, (impinging upon. the role of Social Security).

Beside the improvement of GBAORD data equally important the co-evaluation of direct and indirect government support for a country's R&D expenditures. Two kinds of policy measures are shaping together the R&D policy, activity of organisations. Joint measures and evaluations of direct and indirect instruments can give better quality information to policy deliberations, can make the international comparisons much more reliable.

II. 4 Socio-economic Objectives: University Research

Governments are responsible to their electorate, and if a budget is used to support science, this has to be proved to be productive. During the past decade governments have placed increasing emphasis on the promotion of economic growth, innovation and technology transfer, and the changing targets of S&T policy brought about changes in the location of publicly funded research.

The indicators suggest that universities might be better locations for public sector research than research institutes. The reason is that universities are capable of moving rapidly into new research areas since they can involve into the research programmes short-term contract research workers.

Figure 5. Changes in the Ratio of General University Fund in % of civil GBAORD between 1995-1999

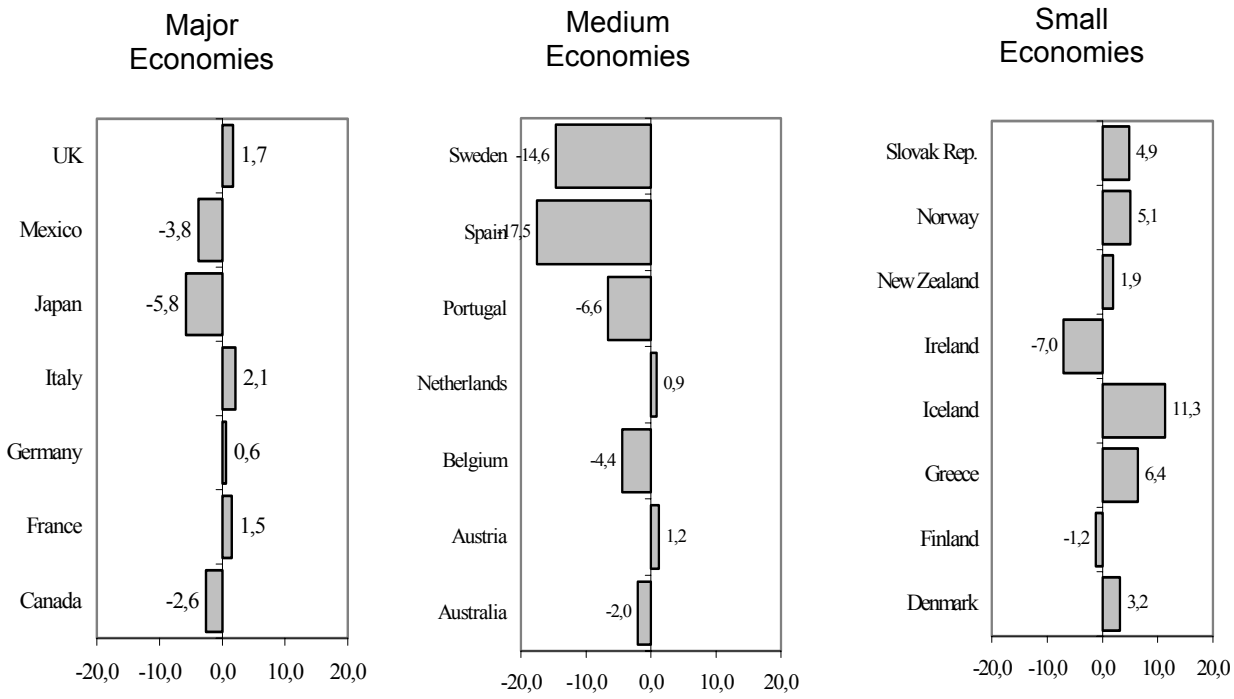


Figure 5 shows the changes in university-performed R&D expenditure over a period of 4 years.

The largest increases in the ratio of university expenditures to other R&D-performing organisations can be seen in Iceland (11.3 percentage points), ahead of Greece (6.4 percentage points), Norway (5.1), the Slovak Republic (4.9) and Denmark (3.2). All of these belong to the small economy sector. Of the medium-sized economies only Austria (1.2) and the Netherlands show positive changes, but on a much smaller scale. In the large countries a very slight increase in percentage terms may be observed in Italy (2.1), UK (1.7), France (1.5) and Germany (0.6). The sharpest decrease was in Spain (-17.5), Sweden (-14.6), Portugal (-6.6) and Japan (-5.8). The examples illustrate quite clearly that in the last few years enormous efforts have been undertaken in one or two countries to increase the role of university research in relation to other performing sectors, although its importance relative to other aims decreased.

III. Lack of Indicators in Policy-Making

When S&T circumstances are stable, the challenges for new indicators come from the policies themselves:

During the preparation of S&T policy the experts have to face new requirements, and new circumstances of science and technology policy induce the need for new indicators. However, during a period of transformation certain objective measurements and indicators will be missing.. Different priorities of a new administration which has come into government can bring in a new demand for indicators within a very short time. However, indicator development is a very long process with different stages, and a good balance amongst the various factors or players in the process is crucial.

All indicators have some externalities if time series, serial data are available and they are comparable internationally. An approach involving only the short-term observation of policy tools is a dangerous one. Politicians whose horizon is no longer than the period between elections may

abolish apparently costly indicators which are less important to them for a variety of reasons. However no uncertain, changing world can make obsolete a number of older indicators without it being reasonable to reallocate the resources to the introduction of new ones; modification to indicators is much less ion evidence than the demand for additional ones.

Among the new challenges to indicators bench-marking is an important exercise to improve national policy-making processes and to support R&D policy- making at the European level. The indicators are themselves the basis for bench-marking the performance of research policies. Similarly to the 'Endless Frontier', this document, and the debates occasioned by it, resulted in new demands for the development of indicators and for methodology for the benchmarking of national research policies:

A set of 20 S&T indicators was identified as being crucial for this purpose and for the support of EU policy-making, and a preliminary set of 15 has been prepared by EC services, in collaboration with member states and was published. (European Commission 2001)

The theme of indicators selected for benchmarking national research policies can be shown as follows:
1. Human resources in RTD, including the attractiveness of S&T professions
2. Public and private investment in RTD
3. Scientific and technological productivity
4. Impact of RTD on economic competitiveness and employment

Missing indicators to support policy-making are belonging two different groups:
The routine indicators may be missing in several countries since policy-makers are reluctant to employ (and finance) them.
New policy themes may create demand for new indicators, but their development takes time.

III. 1 Shortcomings in Well-established Indicators
Focusing on routine S&T indicators, it may be stated that the creation of a useful source of information for policy planning, decision-making and evaluation processes is methodologically sound. *The conceptual framework for, and definitions of, indicators are advanced* thanks to the international availability of knowledge. However there are still some unsolved methodological problems, or, to be more precise: theoretically unsolved ones, such as the adaptation of new methods, international standards, etc. Note that even established statistics need to be revised from time to time to determine whether they are still useful and how they can be improved in order to meet new needs. Table 1 gives a summary of missing GBOARD data in several OECD member states.

It is no accident that democratic market economies historically focus on public intervention efforts through "the purse". These indicators have been priorities.[31] As international comparison among OECD member countries shows very well, the former command economies are still lacking these indicators. Many other S&T policy-related indicators earlier had a much higher priority in CEECs.

[31] Beside budget issues there are several others (human resources development, innovation, patents) which are useful measures for S&T policy.

Table 1 Data availability on GBAORD

Country	Economic Development programs	Health and environment	Space	Non oriented researches	General university fund (GUF)	Total GBAORD	
						national currency	current PPPS
US	+	+	+	+	-	+	+
Australia	+	+	+	+	-	+	+
Poland	-	-	-	-	-	+	+
Switzer-land	+	+	-	+	+	+	+
Turkey	-	-	-	-	-	-	-
Czech Rep.	-	-	-	-	-	-	-
Hungary	-	-	-	-	-	-	-
Iceland	+	-	-	+	+	+	+
S. Korea	+	+	+	-	-	+	+
Slovak Rep.	+	+	+	+	+	+	+
Russia	+	+	+	+	+	+	-
Romania	+	+	+	+	+	+	-
Slovenia	+	+	+	-	+	+	-

Source: : New Main Science and Technology Indicators OECD Paris, May 2001, and R&D and innovation statistics in candidate countries and the Russian Federation EUROSTAT, EC 2000.

Some differences may be observed among the older member countries of the OECD, even if harmonisation of S&T indicators and other related systems is now eliminating many differences among national S&T information systems.

In some newcomer countries, including Czech Republic and Hungary, there is a more important factor hampering the availability of indicators which is a huge discrepancy between data producers and potential users. The relationship between demand and supply is very special in this field.

More data needs by detailed socio-economic objectives to learn the changing importance such aims as prevention of pollution, agricultural technology, and non-oriented research. Less aggregated data can help to respond such questions: What share of government budget for R&D is really available for new S&T policy aims? How the switching instruments can improve the efficiency of government R&D funding efforts?

III. 2 New policy theme and indicators

The set of available data may allow us to create new indicators in response to new demand. For example the level of R&D co-operation may measure with re-data-processing of patent data and data on scientific publications. However, new challenges are generating new needs for data, and the time length of indicator development differs greatly by case.

Let me mention several new policy themes which are currently creating a demand for indicators, albeit without claiming that my list is in any way complete.

- New policy themes
- S&T Policy as a growth factor in smaller economies
- Incubating European New Technology-based firms
- Co-evolution of science and economy
- Strengthening partnerships between science and other national sectors
- Integration S&T and environmental policy
- eEurope 2002
- Creation of more high-quality jobs
- More dynamic private investment in high-tech and R&D
- Biotechnology
- Internationalisation of R&D and innovation activities
- Brain circulation

Some of these emerging themes are more amenable to data collection and measurement than are others, and not all are readily amenable to policy deliberations. Two groups (those for which data can be collected and those for which policies are readily formulated) are not independent. The questions which indicators should answer concern those aspects of wider issues which can be examined using quantitative techniques. The challenge is to combine statistics in order to build indicators to answer new questions, as well as to develop entirely new categories of indicators and data - which can, in itself, be a long process. It usually takes two or more decades to achieve general acceptance and, thereby, regular collection and publication.

An evergreen problem between the needs of policy-makers and constraints upon producers is the *time gap* between the emergence of new needs and the availability of indicators. Politicians would like to have information immediately once they have recognised their own needs, and even if they realise that they need certain information before actually making a decision, they usually would like to neglect the preparatory phase simply for reasons of time. This causes political pressures on statisticians (and experts) to provide the information needed on any basis whatsoever (provided that it is immediate!). Policy needs may be satisfied in several ways, but the problem of quality, reliability, and validity of information are outside the horizon of many users. A further problem is that time-lags in the availability of regular information encourage potential users to organise their own information- gathering and indicators.

The development of an S&T information system is a *long-term process*. If recent government budgets have allocated only a limited sum to gather and publish R&D indicators, future governments will have to face the same problems.

New policy themes may create new needs for data collection and/or the preparation of new indicators. Previously, we have emphasised that the development of indicators can be optimised if there is interaction between potential participants in indicator preparation and in their employment. It also has to be emphasised that such partnerships may still not open the door to the desired results from data and indicators. Statisticians, policy administrations or decision-makers may initiate a revision of existing data and indicators. However, the revision of methods and the reorganisation of collected data are crucial professional tasks. The interest in the revision of old methods and the development of new data-sets and indicators might well be either common or

conflicting amongst those involved, although it is most certainly in the common interest of all to obtain more reliable, up-to-date indicators.

Policy-makers interests which may cause difficulties for statisticians:
- Responding quickly to current questions
- Proving results in an election period
- Producing a good return on the investment in S&T
- Obtaining indicators in emerging fields (e.g. IT, biotechnology)
- Wishful thinking

Statisticians may be reluctant to amend their data collection since:
- It may damage or interrupt the time-series factor
- Where their competence in dealing with new fields is lacking, they must invest in new knowledge acquisition, the results of which are uncertain
- If significant transformation is needed in an information system, very few governments are generous enough to cover the cost. (One outstanding exception is the StatCan redesign project.)

Concluding remarks

A sound information base is required for all countries: relevant and comparable indicators, complemented by analysis, which can help strategic research policy issues and monitor progress in its implementation. A broad quantitative overview of the S&T and innovation situation in the European Research Area, which reflects the policy, issues currently being debated. Benchmarking can help to identify the strengths and weaknesses of information systems in the EU-15 and in newly associated countries.

All candidate countries to EU have performed a significant change in the development of their R&D statistics, information system to science and technology policy making in the last decade. R&D and innovation statistics were effected by the change of economic conditions and by introduction of new methodology that compatible with OECD/EU methodology. From the Frascati Family at least the Frascati Manual was introduced in newly associated countries in 1994-1995. Data and trends for analytical purposes, international comparison are usually available since mid-1990s. As previous figures illustrated well several key data are still missing for policy deliberations. The shortage of sound information base is the weakness of policy preparation. The deliberation capabilities may upgrade if countries can overcome shortage of information, weak reliability of available indicators. Hungry policy makers (stakeholders) for proper information can speed up this process.

In policymaking process, indicator development each countries can certainly learn from others. But what it learns must be tailored to the specific conditions of its own circumstances. Countries have often imitated what appeared to be successful policy in another country. The aim of EU benchmarking exercise is the mutual learning but not the copying. It has to keep in mind in information base development process. Proper indicators have to provide responses to the country relevant short- and long-term policy questions helping policy makers to avoid traps of imitated, non-relevant priority setting. Taking into account this requirement the policy makers should evaluate how the available policy instruments can help them to respond new questions raised by knowledge economies and internationalisation? Do CEECs have to go beyond indicators employed in advanced countries to respond emerging S&T policy questions in our region?

Nowadays-common crucial policy questions for Central and Eastern Europe: Can a European Research Area be created with CEE participation before political unification? If our response is yes, the second basic question: Could science integration of candidate countries help their political integration? May the scientific integration improve the well being of these societies creating more highly skilled jobs, increasing productivity? Can such integration switch brain drain/brain waste into brain circulation? What should be done for positive sum game?

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National vs E.U. Programs – A Grassroots Approach

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With the imminent closing of the 5th F.P. and the planning and partial implementation of the European Research Area (ERA), there is a widespread worrying about the future outlook of science and technology activities in Europe and of the relevant S+T policy, as a consequence. The proclaimed aims and targets of the ERA and of the 5th and 6th F.P. have boosted expectations about the level of cohesion of E.U. RTD and the quality and quantity of research output of E.U. RTD. At the same time, the pressures on R+D teams to compete more, to secure more funds and to further integrate inside the new landscape of Europe-wide RTD efforts have strenuously increased.

The agony and the subsequent uncertainties have persisted because all E.U. policy measures are pursued through a strict bureaucratic mechanism (Commission, Council of Ministers, National Governments, European Parliament) that the majority of science and technology workers do not seem to share or even merely understand.

The philosophy and the raison d'etre of the F.P. has been consistently expressed in the preambles of the Programs and it has been convincing throughout. European Added Value in research, regional distribution of R+D activities, convergence of the Less Favoured Regions (LFR) with the rest of Europe, creation of European Silicon Valleys, intensification in the mobility of scientists and researchers, improving the level of public awareness, intensifying the involvement of young researchers, upgrading of the overall quality of R+D and other such aims have been crystal clear.

At the same time, 15 national R+D systems have been designed and are implemented parallel to this structure (Caracostas, Muldur). Altogether they constitute different national programs as well as differing thematic priorities and national mechanisms and allocation priorities. The size of funding of the national programs (according to the Science Technology and Innovation Key Figures 2000) has been quite different from the E.U. funding levels and, therefore, whatever attempt is done to compare these figures among themselves is proven futile. The E.U. F.P. budgets amount to about 1/10th of the total national R+D expenditure for all the 15 Member Countries, and to 1/20th of the total R+D expenditure for the USA for a given year. (See Table)

Parallel to this, the philosophy and practice of the Structural Funds has benefited the majority if not all of the E.U. members, with a distribution of the R+D part of the Structural Funds proportional to the size of the national budgets (and ultimately to the Member States participation in the F.P. budgets). (E. Helander, Science and Academic Systems)

What is the underlining philosophy to this dualism? Cooperation or competition? Not a few times, the F.Ps have been the connecting link of competition among R+D teams and institutions in Europe, the benefactor of the networks and the ultimate guarantor of the collaborative and cooperative schemes in E.U. RTD. Nevertheless, one of the recent analysts (P. Kneukker) when called to comment on behalf of the national governments on the new proposals for the 6th F.P. on competition vs. cooperation, he stressed the permanent value of competition, given the fact that the very nature of R+D, academic excellence and industrial technology strength are based on competition itself. (CREST Opinion on Aspects of ERA, 29.6.01)

The level of agony and/or the uncertainty of the future landscape has been heightened because of a series of new mechanisms, new tools and instruments, and new management techniques that the E.U. administration proposes for the future F.P. (collaborative research, networks, integrated projects, large scale facilities, mapping exercises, benchmarking of national policies, etc).

Are the national R+D teams and institutions ready to bend and adjust their procedures on the new proposed landscape of E.U. RTD? Are they willing to accept the principles and guidelines permeating it? Are they ready and prompt to adjust their national structures and priority mechanisms, so that the two systems can operate in parallel or even start converging? This is an outstanding question that cannot remain unanswered lightheartedly.

National Programs

To start with, the recent Benchmarking exercise of national policies in the E.U. with a purpose to explain the best practices applied in each country has revealed quite a diversified and heterogeneous landscape of national policies and priorities. National RTD systems (parallel to the NIS) have an altogether diversified, competitive and many times uncooperative structure. National Research Councils in several countries (UK, Finland, Sweden, the Netherlands), large size national R+D institutions (CNRS, Inserm, INRIA, Infremer, CNES, DFG, Max Planck, Fraunhofer Gesellschaft, CNR, CSIC, FORTH, etc), National prestigious academies (France, Austria, Finland, Sweden, etc) and powerful and penetrative national ministerial authorities (UK, France, FR Germany, Ireland, Spain, Portugal, Greece, etc) which dot the science policy landscape in the Member States indicate that the latter cannot be homogenized in an easy and pain-free way.

On the other hand, the size of national R+D programs and the flexibility of the mechanisms utilized for their ultimate application differ from country to country. In fact, recent Science Technology and Innovation Key Figures statistics distinguish two main groupings in the size of the national science policy and practice. The leaders in the field with large size institutions, large size budgets, (between 10.000 – 44.000 MEuros), large international interactions and large intereuropean influence, come together in one group (FR Germany, UK, France, Italy, Netherlands, Spain, Sweden) and the rest (the dividing line is always difficult and to skewed to draw) with medium size budgets (between 542 – 3.395 MEuros), limited or specialized international influence, proportionately limited participation in E.U. programs and medium-size specialized institutions, form another group of countries (Belgium, Finland, Denmark, Greece, Austria, Portugal , Ireland, Luxembourg) (5-Year Assessment, P. Kneukker, P. Skalicky).

As for the participation of the national research teams and the streamlining of the E.U. funds in the 4th FP, 5th FP, Tacis-Phare programs and EIB loans, P.Caracostas and Muldur argue that until now there has been a linear evolution of these Programs, through a number of periods of concept- and principle-based adjustments, and a corresponding percentage of member country activation. Overall, the rates of participation in a series of F.Ps with increasing budgets have been on the increase, the quality and quantity of this participation remaining to be determined. (See Tables, National Benchmarking Reports)

What is utterly characteristic is that the Evaluation and Assessment efforts of the thematic programs and the horizontal actions of the F.P. – although they keep a momentum of sequence and an accumulation of data – have consistently focussed on the accomplishment of the F.P. aims, the efficiency of the mechanisms proposed, the flexibility of the administrations and partly on the quality of the RTD results. They have not managed to touch upon the exploitation/valorization of the RTD results, on the specific success of the creation of a European Added Value, and the efficient, competitive and international deployment of the R+D teams and institutions of the member countries.

Quality vs. Quantity of European Research

Attempting to penetrate more deeply on the characteristics, the quantity of the effort and the quality of the results of the European (member countries) RTD outcome, we see that each one of the member countries is engaged in an endless and unrelented effort to gain parts of the technological innovation markets, the academic excellence market and the infrastructure investments market. This is of course, utterly justified but it does not always coincide with the E.U. RTD policies themselves. On the other hand, it does create a real atmosphere of competition with the internationally recognized teams of the US, Japan, Australia, Canada, China, Israel, India, etc. in an effort to safeguard niches of the wide "Knowledge Society market," that is now gradually emerging in the new globalised landscape.

In other words, technological innovation (both public and privately funded) in France, Finland, Sweden, Austria, Denmark etc. has been widely recognized many times, irrespective and outside of the E.U. RTD programs. Similarly, the academic excellence of both small and large size research teams in the UK, FR Germany, Sweden, Italy, Netherlands, Austria, Switzerland, etc, has been widely acclaimed on a number of occasions, while several other countries, are pressing hard for the reinforcement and continued preservation of large scale facilities located in their area, like JRC, CERN, Euratom, ILL, EMBL-EMBO, ESO, International Institute of Biotechnology, etc.

In brief, the question of quantity and quality of the large European R+D teams comes as the recognition of the distinct competitive character of each one of these teams on a real international level, as against US, Japanese, Swiss and other competitors and of the preservation and continuation of the market niche that they have managed to gain.

Key Figures 2000 offer a clear picture of the largest national R+D budgets, of the largest infrastructure investments in R+D, and of the largest private expenditure (BERD) on R+D in distinctive countries like Finland, Sweden, Ireland, UK, the Netherlands, etc. (See Table). It also leads to the analysis of the size of the research teams and networks actually being formulated and actively working in Europe. Such research teams –that have most of the times benefited from the E.U. research budgets as well – consist of at least 8-10 partner consortia with upwards of 20-25 researchers from throughout Europe, most of the times grouped in 1-3 research networks for each research theme or subtheme. These sizes, which involve corresponding budgets for either shared-cost or networking projects are sometimes prohibitive for smaller countries, research establishments and research teams that come into play with smaller or more limited research infrastructures. In some way, the latter are somehow rejected or pushed out of the game.

Nevertheless, it has been a common understanding that the management and flexible coordination of the large size research consortia constitutes a science by itself. Many times the research coordination, accountability and proper time management tasks impose such a heavy burden on the Project Coordinators that they become an unbearable task for a pure research or basic science researcher.

Last but not least, the auditing, evaluation and assessment exercises, as they are currently implemented in the Member Countries, are generally characterized by a diverse and heterogeneous approach. Either institutionalised on a government/parliamentary level or carried out by specialized evaluation and assessment teams, these exercises differ considerably from country to country and from scientific area to area according to the evaluation priorities, the specific characteristics of the programs and the regional or national peculiarities (financing authorities, monitoring/control authorities, research exploitation agencies etc) of each program under evaluation.

Needless to say that these national research priorities, monitoring exercises and administrative practices do not seem to change over the time. Most of the time they expand, evolve and sometimes adjust to the new demands and priorities in R+D, but they do not usually mutate easily. Such demands and priorities are nowadays the spin-off companies, the super modern technology park establishments, the broadband communication networks, the Europe-wide patenting rights, implementation of the Intellectual Property Rights and other schemes imposed by the mutation of the R+D market itself.

In conclusion, one has to deal with a variegated, self-conflicting and demanding landscape of science policies and subsequent mechanisms that touch upon a multiplicity of tools and instruments, like the ranking of the research teams, the evaluation of the research schemes, the elaboration of citation indexes and performance indicators, the mapping of excellence, even the assessment of quality on transregional, transEuropean and transnational levels.

Nevertheless, all this hyperstructure poses insurmountable difficulties in homogenizing, or simply comparing the results of the research policies, not least paralleling and jointly managing large transnational R+D programs. (5-Year Assessment, DF.Westerheijden, Keith Smith, Working Group on ITP - OECD).

If one is to tackle all these problems, he/she has to work incessantly in analysing all parameters involved on a thematic and institutional level as well as on s regional, national and paneuropean, and try to create common parameters within them. It's also necessary to measure the design, application and evaluation phases of all national RTD systems as independent entities and in relation to the E.U. RTD system.

New Perspectives of E.U. Research. New Landscape ~ New Rules.
Setting the Research Agenda

What happens in fact is that we are now facing the evolution of New Perspectives in E.U. Research. A new, thoroughly novel landscape is currently emerging accompanied by New Rules, involving the Prioritizing, Supporting and Building of the European research capacity. How well can we cope with this? We can in fact propose the mapping of uncertainties and even foresee the eventual defects emerging in the new European R+D landscape. But we should better approach this perspective more systematically.

Trying to set up the Agenda for European Research in the 21st Century, we have to proceed through a maze of policy problem areas, not least including the definition, the prioritisation, the elaboration of options and the utmost effort of advancing the level of knowledge and the park of solutions.

To start with, one basic policy approach is to examine whether we still wish to have a consensus-forming procedure. Alternatively, we should leave the decision making responsibility to the majority rule or the central core of decision makers. In case of the consensus forming, we then have to rationalize the communication and the deliberation processes, while been open to a true and democratic decision making. In view of a larger number of participating countries in the E.U. this, however, promises to be even more difficult.

Another area of future investigation is whether public funding can actually open up new prospects in S+T. As we all agree that in many domains of public life, public funding is continuously decreasing in favour of more and more private initiative and spending, we have to determine if the GERD can actually lead to new paths of joint private/public initiatives, to new forms of incentives, to maintaining new kinds of international mobility of the researchers (export-import of human resources), to international standardization of S+T quality and other such forms of activities.

This brings us to the shifts in the institutional landscape of S+T policy which will be definitely required by the new planners. Most if not all of the stakeholders have to think about the following:

- if they will accept a certain loss of national sovereignty,
- if they will design and adopt joint management of large R+D programs,
- if the new actors will really be large R+D teams, and
- if the R+D policy making bodies will accept new forms of parallel planning and action towards common goals

All these institutional shifts would need a lot of courage, pioneering quality in planning, and plenty of confidence in the implementation phase. Both legislative and executive authorities in the member countries will probably have to abandon the traditional ways of institutional function and give way to a lot of institution- building imagination and innovative schemes.

On a merely practical level, a compelling need arises for synthesizing across Europe all available science policy data and practicing joint management of information. Practically the collection of R+D data, including policy schemes, will have to be carried out jointly by all stakeholders, the data banks will have to become more openly accessible, parallel processing and analysis will have to take place jointly by more than one authorities, EUROSTAT – Olis and United Nations databases for Europe will have to turn into nurseries for the development of new management tools, the drafting of policy scenarios and evaluation processes for Europe-wide achievements in science and technology.

This way we may ultimately talk about a new S+T policy system. The big question is do we really need such a new system? If the old or traditional ways are going away who will be the new stakeholders, which policy platforms will be designed and applied for the new ERA, which control and monitoring mechanisms will prove more efficient and decidedly more effective than before. And who may ultimately play the leadership role(s) in such a new era.

If fact, just as the drafting of the 6th FP proposal smartly indicates, the new era of S+T policy will definitely involve managing interdisciplinarity. The new budgets for avant-garde research in Europe will require a lot of novel planning and adjustment efforts, like widening and mixing the thematic interests of the research programs, applying a rigorous selection process, locating and testing new and novel fields of science with a promise to contribute to the social and economic advancement. In brief, we should be able to identify and select the new fields of science and technology that will elevate Europe to the role of an undisputable world competitor and eventually leader.

Parallel to this, the new era of joint public/private funding and national/EU program interaction will have to do with a certain form of managing the uncertainty and the risks involved with the R+D policy making process. It is almost sure that the new emerging landscape will lead to new choices, will impose new and differentiated tools of implementation, it will include new and distinct stakeholders. Therefore, a considerable amount of risk and uncertainty will be present in it, which will require an increased capacity of relevant management skills.

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Research Management as an instrument

(Summary based on the taped version and the slides of the workshop presentation)

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Introduction

Strategy is becoming an increasingly important element in contemporary modern research management. It is important to make priorities, to plan ahead, make visions, choose goals etc. But strategic research management is ordinary seen as in conflict with research itself. Organisational control and planning destroys individual researchers autonomy and freedom. I will argue, that this dilemma or conflict is not a necessary result of more strategic management. On the contrary, strategic management – both as a process and as a result – can support and help establish trust between management and the researchers, and between the researchers themselves. A trust building that is of paramount importance in the research system as it functions today.
Research management can be seen as one of the solutions to the problems facing modern science policy formulation. To understand how research management can be a solution, we have to take a few steps backwards.

Two different kinds of logic

Today in the formulation of contemporary science policy we have two competing kinds of logic. At the political/administrative level we have an aim to create societal value in the form of utility and relevance, but the problem is, that on this level the decision-makers do not have the necessary insights to set goals that are meaningful for the individual researcher

A different kind of logic is found at the science producing level, where the single most important aim is to produce knowledge for its own sake. The problem here is, that the individual researcher or research group has a very fragmented understanding of the surrounding world. Therefore this logic creates a system with no coordination of action and no social responsibility. These two very different logics are coexisting in science policy, but to make the system work some kind of mediation and coordination between the different types of actors and logics is needed.

To interpret and implement societal goals in the science context mediation is required between the political demands and the values and relevance of proper knowledge production. There has to be a coordination of activities to end up with a distributed coherence, and this is where distributed research management can help to mediate and coordinate.

Research management as mediation

The function of research management is to mediate the two opposing logics of the external societal view on the one side and the internal scientific view on the other. This can be done at different levels by researchers, research managers, university rectors, research agencies, research councils etc. A central task for the research managers is to monitor the environment and make forecasts of future developments. By doing that, research management can protect the individual researcher from outside demands, so that he or she can concentrate on the actual research without worrying to much about changes of direction in the formulation of science policy. Research management can then structure and present changes in the political environment to the researchers and help them navigate in the sometimes seemingly chaotic system.

On the other hand research management also has to catch both the potentiality and the necessary demands of research and present it to the political or administrative system.

Three orders of research management
If you look at the individual researcher, you have to divide research management in to three orders.

- At the first order of research management we have the individual researchers self-management. The individual researcher is influenced by the scientific system in the form of the prestige-hierarchy etc.
- At the second order of research management we have management of the self managed researcher. Here the aim is to create shared values and cognitive frames to make coordination possible. Another aim is to make a coherent interpretation of the outside world and present it to the individual researchers as a form of mediation between the policy goals and the implementation in the scientific system.
- At the third order of research management, the single most important aim is to produce trust in the system. Complete monitoring and control is not possible in science, so the creation of trust becomes essential.

Making strategies as an example of research management
As a part of the development-contracts between the ministry and the universities in Denmark the creation of strategies has been required. This strategy process can be seen as a kind of second order management, where a mediation of the two opposing logics in the system is needed. In a top down view you can see the strategies as an implementation of science policy decided at the political/administrative level. In a bottom up view you can see them as a formulation of the wishes of the scientific system to the funding of research plans.
At the second order research management the role of the research manager is to find a common strategy by incremental alignment of the two kinds of priority-setting logics. Only that way a solution that will satisfy all actors can be found in a process where communication is the main instrument.

Conclusion
The research system can't be controlled - partly because of a growing complexity as a result of larger research groups, interdisciplinarity, new instruments etc. - so it is important to find other ways of managing research. More management at the institutional level is needed to make the policies work. Instead of trying to control the research system, it should be tried to influence it – for example through models of research management. We need more management to make the scientific system and the science policy system work together. Instead of more control- and monitor mechanisms we need more communication in the system – campaigns from the political system etc. That leads to the bottom-line, that trust is a precondition for the functioning of research management.

RTD evaluation in Portugal

(Summary based on the taped version and the slides of the workshop presentation)

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General Context of S&T in Portugal

Portugal has been in a phase of very high sustained growth: Here three important indicators have been selected to illustrate this growth. The first one has to do with the input, the second with the output and the third with the impact.

- Growth of citizens with PhDs at a rate of 10% per year in the last decade (9000 by the end of 2001). This trend is to be maintained for the next decade
- High growth of scientific production in publications in the *Science Citation Index*
- Growth of the Ministry of S&T budget, where the yearly average has been 18% in the 1995-99 period

If Portugal can maintain the present trends, the EU average of PhDs *per capita* can be reached within 6 years. Also on the other areas the goal is to reach the EU-average.
Portugal has a competitive advantage with a young and dynamic work force in the science and technology sector with strong international connections, in special in UK, USA, France, but also in other European countries as well.

In a period of such a growth and change it is essential with:

- systematic and rigorous evaluation (credibility is a key issue)
- evident international references
- clear and transparent procedures
- emphasis on scientific results
- opportunity for new leaderships
- reinforcement of scientific institutions

Evaluations at different levels of the scientific system

In Portugal the scientific system has four levels from the individual level to the level of the associated laboratories. Evaluations have to be conducted systematically on all four levels.

- A number of Fellowships are given each year. We have 2 open calls every year, and receive about 1500 applications to each call. The approval rate is normally around 40%, and here we are mainly talking PhD and Post Doc fellowships.
- Similarly a large number of research projects are introduced each year. We have one open call for proposals in all scientific domains every year. We receive about 2000 applications, and the approval rate is normally around 25%. Beyond this we have particular calls for special priority areas. We have a different approach and separate procedures for these “applied technologies projects”, and similarly we have separate calls for projects of special interest to society.
- At a different level of aggregation we have the research units (primarily centres associated with the Universities – they have to consist of at least three PhD’s). We have open calls for proposals for the centres or institutes associated with universities. Presently we have342 research units, and they are evaluated every 3 years. The amount of money they receive from these proposals depend on the evaluation.
- Finally we have the National Laboratories. They are associations of several research units devoted to the same domain or the solution of the same problem. At the moment we have 12 national laboratories in different ministries. These labs normally have a 10-year contract.

Main Characteristics of Projects Evaluation in Portugal
The project proposals are judged by international evaluation panels of high standing scientists, and are based strictly on peer review (ranking, selection, proposed funding, recommendations). We have close to 40 Panels with an average between 5 and 6 scientists of the highest international standing in each Panel. Participants in the panels are from all EU countries, but also from USA, Canada, Switzerland, Norway. Usually only one or no-one are Portuguese. The proposals are submitted electronically and also the evaluation feedback is submitted on the internet (97% of proposals submitted electronically).

Public presentation of proposals
All proposals are presented in public sessions advertised on the Internet. Here we have a direct interaction between the evaluators and the proponents, where the proponents have the opportunity to defend their proposal. Evaluation panels are publicly known.

Three qualitative evaluation criteria
1) Scientific merit and originality of the proposed activity
2) Scientific merit of the research team, its qualifications to conduct the project and its configuration regarding research opportunities provided to young scientists
3) Feasibility, work program and budget appropriateness

It is attempted to keep the process simple and transparent. The rank on these criteria is excellent, very good, good, fair and poor. We only fund proposals with the result excellent or very good. There are no political or geographical constraints influencing the evaluation.

- Separate procedures for “applied technologies projects”
- Emphasis on scientific results

Main Characteristics of Research Units Evaluation in Portugal
We never fund without evaluation. All units are evaluated every 3 years, and the mechanisms are the same as in the project evaluation. If the evaluation comes up with the result “poor”, it will result in cuts in the funding of the research unit. This sends a clear sign to the scientific society, and so far it has worked. There has been improvement in all scientific domains since the system was introduced.

Judgement is conducted by international evaluation panels of high standing scientists. The evaluation is strictly based on peer review (ranking, selection, proposed funding, recommendations). We have close to 20 Panels with an average between 6 and 7 scientists of the highest international standing in each Panel. Also here the participants are from all EU countries but also from USA, Canada, UK, France, Switzerland, Norway and Denmark. Usually only one or no-one are Portuguese.

The evaluation process includes site visits to all research units. In the process there is direct interaction between the evaluators and the proponents. In the end detailed evaluation reports and recommendations are prepared by the evaluation panels.

As a part of this process we keep data bases of approved proposals available on the Internet including title, abstract, research team, funding and other information. For the research units there is also access to the full evaluation report and rating.

Acceptance of claims against the evaluation results and subsequent review by committee of scientists Emphasis on scientific results.

Lessons: Assuring Credibility of RTD Evaluation
In our opinion, the following points are crucial in assuring the credibility of RTD evaluation:

- Consideration of previous scientific results in the evaluation of proposals. Yearly publication of list of publications in the science citation index, cross referenced to researchers and research units
- Judgement by evaluation panels of high standing scientists. They make the ranking, the selection, the proposed funding and the final recommendations.
- Detailed evaluation reports and recommendations communicated to the proponents.
- Acceptance of claims against the evaluation results, and subsequent review by committee of scientists.

Finally a few words about three important factors in assuring the credibility of RTD evaluations have to be mentioned.

Factor 1: Social construction
- Open participation of the research community in setting up procedures through acknowledged representatives
- Shared decisions by evaluation panels
- Direct relationship evaluators and proponents
- Periodic reviews of evaluation procedures and results by committees of high standing scientists.

Factor 2: Transparency
- Clear and simple criteria, and procedures known in advance to proponents.
- Comprehensible evaluation reports communicated to proponents
- Public disclosure of evaluation panel members and evaluation results

Factor 3: Accountability
- Regular review by credible independent entities
- Public disclosure of review reports
- Evident effects of review on procedures

Methods for Evaluation of Societal Quality: Theoretical reflection on Dutch experiences

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In the eighties, because of budget cuts, new accountability pressures, and new funding schemes, new evaluation processes of research were introduced in the Netherlands, like in many other countries. These new evaluation schemes are often considered as an expression of a new contract relation between science and society, or more specific, between scientific organizations and the state. Within this new contract, research and research organizations are funded and assessed because of their role for society and economy. Nevertheless, within most of the evaluation processes the emphasis was on the scientific performances, and methods to evaluate contributions to social and economic progress remained underdeveloped.

Based on a series of interviews with researchers and analysis of evaluation processes, the notion of societal quality is developed. Societal quality is, like scientific quality, a multi-dimensional concept, which within different contexts has different meanings. Explication of the different dimensions enables to distinguish between the experiences of evaluation of societal quality in various contexts and assessment of the possibilities to translate these experiences. [32]

The paper reflects on these findings from a theoretical perspective. It takes the changing contract serious. Using principal-agent theory, different contracts between the state as principal and the scientific organizations as agent can be distinguished: the post-War contract expressed in: "Science: The Endless Frontier", a contract based on the ability to create consensus on research objectives between state and society and a contract based on competition between the scientific organizations. In each of these "contracts", evaluation of societal quality will have a different function. However, if evaluation of societal quality is taken up seriously the very contract may change and society enters as a third contract partner - with consequences for the position of the principal. As a consequence, evaluation of societal quality is not just a methodological problem, but also a political one related to public research policy making by the state.

Notions of societal quality
The idea of "societal quality" was coined at the end of the eighties by the Dutch advisory councils for research. These councils operated at that time in the sectors of Agriculture, Health, Environmental & Nature, Development, and Infrastructure. (The infrastructure one is now merged with the Environment and Nature council) Their advisory role to the state implies that they develop research policies in the joint interests of scientists, society and government - often through foresight studies or programming. Members of the councils come from research organizations and "research users", and ministerial staff usually has a strong and participative advisory role. In their advisory work, the councils noticed that because of the emphasis on scientific quality in the new evaluation regime, the possibilities for scientists to focus on societal agendas were restricted. To counteract these tendencies, the joint councils plead for societal quality as an evaluation dimensions and in a series of activities, developed this idea.

[32] See: Barend van der Meulen, Arie Rip, 2000, Evaluation of societal quality of public sector research in the Netherlands, *Research Evaluation*, 8 (1) 11-25.

Over time, the notion of societal quality became a catch-all concept for research performances which were seen as important for society. Within evaluations, environmental research was easily labelled as societal relevant because of the environmental problem, but without any indication of the real contributions and attention to the urgency of the specific environmental problem and the value of the actual contribution made to the understanding or solution of the problem. Mutatis mutandis the same happened in other fields of research.

However, through discussion with researchers from environmental research and health research, and analysis what researchers, funding bodies and evaluators considered as indications of societal quality, different dimensions of societal quality can be considered. For each of these dimensions, indications and, sometimes, quantitative indicators can be constructed, based on the practices within the sector. Figure 1 shows possibilities for evaluating societal quality of environmental research in the Netherlands.

The first dimension of societal quality is the expectation of relevance. Actors involved in evaluation processes tend to speak of *the* relevance of the research, but when asked about it, it appears that the relevance is an expectation of results and the role these results can play in understanding environmental problems or in the development of environmental solutions and policies. In the Dutch context, evidence that such expectations are not just an idea of the researcher, but supported by analysis and other actors can be found in foresight reports. If such reports are implemented through nationally funded research programmes - and in environmental research policy one can find that pattern in other countries as well - the involvement in national research programmes can be used as an (partial) indicator for relevance. Another indication of expected relevance is that users are interested in the research and willing to pay for it. Through user surveys or interviews one might find indications of such interest and thus of expected relevance, or use number and size of user contracts as a (partial) indicator.

The second dimension that can be found in discourses on societal quality in the environmental research field, is interaction and communication with research users, policy makers and the wider public. Researchers refer to non-scientific products like consultant studies, advisory reports, publications in professional journals and in newspapers to indicate the societal quality. Although they admit that some of these publications can be translated into an indicator of interaction and communication with "research users", they also warn for such use. Unlike scientific publications these publications do not have review system to guarantee minimum quality, nor do they recognize any systematic relation between these kinds of publications and their research. Some of these publications, and especially newspaper coverage, are seen as coincidences, rather then indications of quality. More robust and valuable indications for (structural) interaction and communication are the positions researchers have in professional, political and advisory networks. Holding advisory positions and memberships of professional boards etc. itself are indications of the interaction and communication dimension of societal quality. One can imagine to analyse such positions more systematically through network analysis and compare researchers' positions with those of others in the network to assess how influential the positions are.

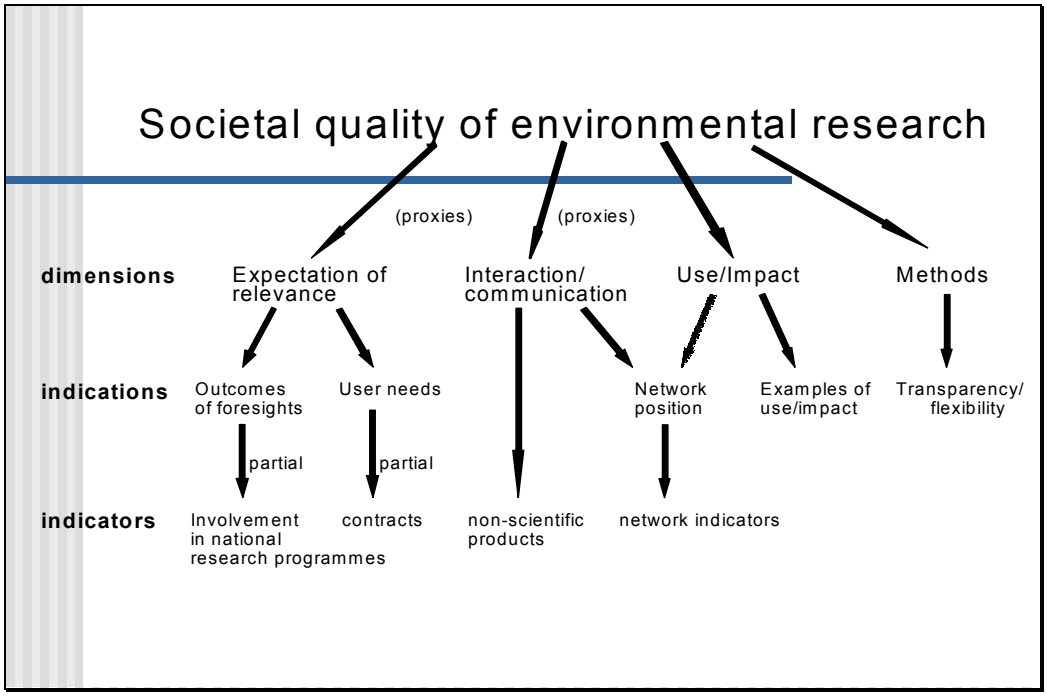
Such positions indicate a structural interaction with a user community, but also a way by which results of research can be transferred and have real impact. Use and impact of research results is a dimension of societal quality, which is especially emphasized in research policy documents, but less by researchers themselves. Direct use and impact is often unexpected and dependent on many other factors - like the dynamics of policy making. Although examples of use and impact can serve as indications of societal quality, they are not very systematic. A main problem is the attribution of the impact to a study or a research policy. Often, environmental understanding, solutions and policies are based on a *reservoir of knowledge* rather than single studies. Instead of looking for examples of direct impact and use, it is more useful to trace the routes by which results

move from researchers to users, e.g. through the professional networks, through mobility of students and staff, and e.g. through government research institutes and environmental consultants.

The fourth dimension, methods, was one raised by researchers, especially in relation to environmental modelling. Environmental modelling has a strong impact on policy making and the evaluation of policy making. Assumptions within these models may create artificial outcomes and function as hidden policy preferences. Transparency and flexibility of the models are in such a case an indication of societal quality.

The four dimension have a more general value than just for the environmental research. But within other fields, some dimensions may be more important than others and the possibility to develop indications and indicators might be different. Also new dimensions may be found. In a similar study on neuromuscular research, we found that for most of the researchers the severity of the illness of a disease is an important indication for the societal quality. The more severe the illness the research addressed, the higher the societal quality.

Figure 1



Why evaluating societal quality

The discussion of evaluation of societal quality is closely related to the contract between science and the state, or science and society. Part of the implicit contract are quality assurance processes which assures the state that it gets "value for money". The relation between science and the state can be considered as a principal-agent relation, which without any institutionalisation of the relationships that mediates the different interests of the two, would be a very unstable relationship. Basically, any principal agent relationships implies that a principal (in this case the state) contracts an agent (in this case "science") to perform certain task for which the principal lacks sufficient competences. Moreover the principal has not sufficient information to assess whether the agent provides value for money, and there is some space for the agent to use principals resources to go for his own interests. The principal then has to develop a set of incentives still makes it attractive for the agent to enter the contract but prevents the agent from shirking. Monitoring costs will be

involved, but the higher the monitoring costs, the higher the total costs for the principal. A game-theoretical reconstruction of the relation shows that the relation is basically unstable and has not stable (Pareto-) optimum, that is a combination of strategies such that none of the actors can improve its utilities by changing strategies.

The relation can be stabilized by institutionalise ideas and practices which change the interests of principal and agent, the costs of monitoring or the perceived utilities of different strategic choices, and thus the perceived game in a way that the relation can move into a (Pareto-) optimum. For the state- science relation at least three ways to stabilize the relation can be conceptualised and are empirical traceable in actual science systems.[33]

- The first stable state can be labelled the Endless Frontier system, and is characterized by a government who accepts the scientific interests as being similar to the national interests, and a well functioning peer review system, that guarantees that money is spend on the most promising research projects. The stabilization depends on a research council able to organize good peer review processes.
- The second possible stable state is build upon consensus between government and researchers and their organizations on the agenda to pursue and agencies able to develop such agendas, implement them and monitor the agenda. Without good implementation and monitoring researchers can easily shirk from the compromised agenda, and move actual efforts towards own interests.
- The third stable state is one in which the principal build a strong position by developing a competition for its resources. The stability of this state depends on the ability of the principal to articulate its objectives and to develop related ex ante assessment and performance evaluation procedures on which allocation of resources can be based.

Evaluation of societal quality can in general be seen as an instrument to improve the role of science and society. However within each of the stable states, the instrument will be develop differently. In order to keep the system in the received stable state, societal quality will at least have to function well for the basic practices on which the stabilization is based.

In a Consensus-oriented system this implies methods for evaluating societal quality needs at least be well developed for monitoring and evaluating the implementation of the agenda. In the Netherlands, shared agendas used to be implement in the eighties and nineties through national research programmes, and one might expect that methods for societal quality would be developed especially for this purpose. In a competition-based system, methods for societal quality should at least be developed for the measurement of research performance or for the ex ante assessment of research projects and programs, depending on the conditions by which the resources are competitively allocated. In an Endless Frontier stable system there is no need for evaluation of societal quality, as it is unlikely that there will be much pressure to include societal needs in science policy. Science policy in that system follows the interests of scientists.

We can develop the theoretical one step further, if we take into account that with the introduction of societal needs or interests in the contract, the contract may principly change through the entrance of a third contractant: society and its representatives. In current society it is far from evident that government can act as a legitimate representative of society and thus there is no reason to assume a priori that governments interests coincide with those of society.

The theory of "Triple Helix" argues that three actor relation systems will display chaotic behaviour. Triple Helix system will therefore display a variety of dynamic relations between government, science and - in there theory - industry and complex interference patterns in the development of

[33] Barend van der Meulen, 1998, Science policies as principal-agent games: Institutionalisation and path-dependency in the relation between government and science, *Research Policy,* 27: 397-414.

knowledge, innovation and policy. The possibility of institutionalisation is acknowledged within Triple Helix - as points of retention of accomplished performances - but it is unclear what stable possibilities for institutionalisation are. With reference to Triple Helix a lot of experiences and experiments with government -university - industry interactions are reported and analyzed, but it is unclear to what extent these experiences reflect stable institutes or temporary combinations of strategies. [34]

Based on the stabilizations already established in research systems we can assume three possible stable institutionalised research policies when society is taken into account as a third partner:

- The first one is a system in which the "self organization processes of the Endless Frontier regime are broadened and societal actors are included in the traditional governance processes. Peer review may use of experts and use a broader set of indicators and outcomes may reflect societal quality in addition to scientific quality.
- The second one is a consensus-based system, in which processes of agenda building include societal actors and policy aims at joint implementation of the agendas. Of course, again, principals will be in need of proper monitor and evaluation instruments in this case as well.
- The competition regime can be extended as well by broadening the competition. Multiple principals can be thought of and evaluation is concentrated on the evaluation of contracts. "Societal quality" in this regime will be focused on meeting the terms of reference of the contracts and direct user of client satisfaction

It is clear that traditional science policy actors like Ministries of Science and Research Council get a different position in these stable states. This is especially clear in the competition regime, were the government as traditional principal has to share its position and in a way compete for agents interests, with other principals. Such multiple-principal regimes are much more comfortable for agents, as scientists usually assume when reflecting on the economisation of research systems.

The importance of these new possible stable science policy regimes for our discussion is however is that societal actors are active in the evaluation and the notion of societal quality can be shaped.

Experiences of evaluation of societal quality

The cornerstones of the quality assurance system in many national research-systems are:

- professional control at institutional level that pressures researchers to do research according to good research practice,
- the peer review of publications that guarantees a minimum quality of the (public) results of research, and
- the assessment of proposals by peers in research councils, which rewards good research quality with extra funding.

In the Netherlands in the eighties, - in other countries somewhat earlier or later - the trust that these cornerstones were sufficient strong to guarantee "value for money" eroded. In additions, budget cuts and the introduction of new funding schemes implied that new evaluation schemes had to be developed. Evaluation of research became - at least for some period - at the heart of the relations between state, intermediary organizations like the research council, the Academy and the Association of Universities and the research performing organizations.

[34] On Triple Helix see: L. Leydesdorf, H. Etzkowitz, 1996, Emergence of a triple helix of university-industry-government relations. *Science and Public Policy,* 23: 279-286; L. Leydesdorff, H. Etzkowitx, 1998, The triple helix as a model for innovation studies, *Science and Public Policy,* 25: 195-203.

New evaluation practices that emerged at that time were:
1. the ex-ante assessment of projects in the framework of national research programmes;
2. the evaluation of university research programmes, first ex ante and later ex-post;
3. the evaluation of national research programmes, aimed at economic, societal and political objectives like the environment, biotechnology and health;
4. disciplinary evaluations;
5. evaluation of university research and institutes.

Some of these new evaluation ventures were related to policy changes with a short lifetime, others developed and became routinised. Ex ante assessment of projects remained, but national research programmes as a policy instrument became less prominent. Evaluation of university research programmes, disciplinary evaluations developed into a routinised evaluation of university research, managed by the Association of Universities. Evaluation of research programmes were done ad hoc, and, in the Netherlands, never developed sufficiently to consider it as an evaluation practice with its repertoire of criteria, approaches, methods and acknowledged competences.

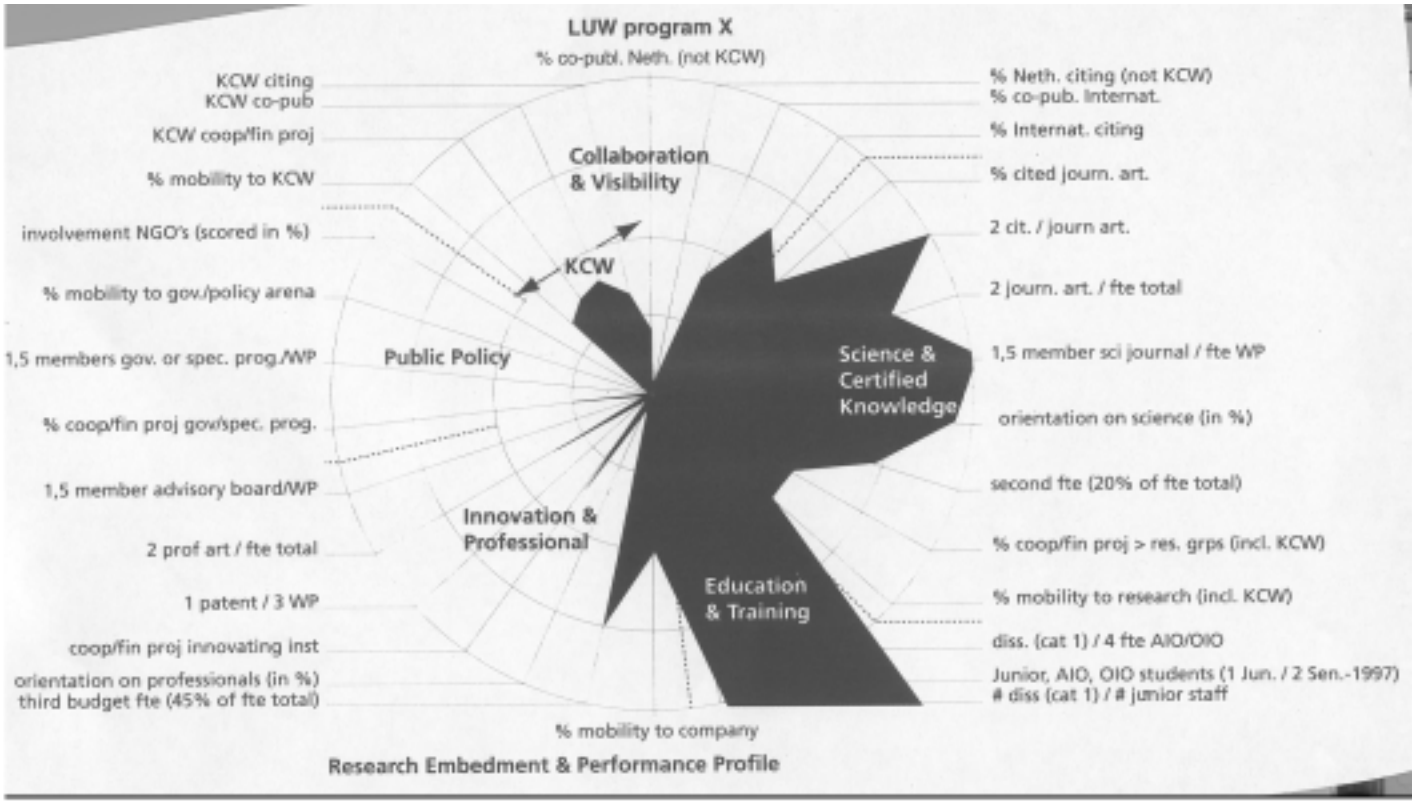
In a survey of the evaluation practices and how dimensions of societal quality were assessed, we found that good practices had developed in the ex ante assessment of projects in the technology programs and in ex ante assessment of projects submitted to the Technology Foundation. Technology programs, financed by the Ministry of Economic Affairs to stimulate university research in industrial strategic areas, introduced criteria like user interest and involvement in projects, economic utility and possibilities for product development are used. Of interest is also the ex ante evaluation practice of the Technology Foundation, which assesses and selects projects in two rounds. For each application, five experts are asked to review the projects. Applications, review reports and comments from applicants of twenty projects are sent to a lay jury of 10-12 members, of which member can come from all societal spheres. Each jury member ranks the projects on scientific quality and on utility and the eight projects with highest combined quality and utility score are selected for finances. Interestingly, the correlation between individual scores of jury members and the high regard of the procedure among engineer scientists in the Netherlands, indicate that lay jury members are much more capable to make such judgements than often assumed.

Although national research programs were for long time the main instrument by which the government tried to improve the societal relevance of university research, evaluation of the programs is done ad hoc, and ex post evaluation of the societal quality of these programmes has never developed.

The evaluation of university research programmes and of research institutes is rather well developed as an evaluation practice. In the Netherlands, these evaluations are done according to a strict protocol, which emphasizes self-evaluations of the research group to be evaluated and judgements of an international peer committee. University research is judged every five years on research quality, research productivity, viability and scientific and societal relevance, according to a rolling scheme of disciplines. Although societal relevance is within the protocol, in most of the evaluations it is unclear which indications have to be used for that, and both evaluees and evaluators have no systematic approach to it. Some of the committees even have refused to take it into account. Recently, a pilot study for agricultural research has shown that if protocols would be more specific on what are the relevant indications and indicators, evaluating societal relevance could be done much more systematically. In the pilot study, several indicators were constructed to map the way research programs are embedded in five different contexts: (1) the own university, (2) development of scientific knowledge, (3) public policy, (4) innovation and professional sector and (5) education and training. (Figure 2)[35]

[35] See: SciQuest, 1999, *Evaluatie van Universitair Onderzoek: Methodiek voor het incorporeren van de maatschappelijke waarde van onderzoek*, Den Haag: NRLO, rapport 99/12.

Figure 2 (Source: SciQuest)



Theoretical reflections on Dutch experiences and conclusions
In our review of the experiences, the Dutch experiences have been described in terms of good practices.[36] Using the theoretical framework we can draw several conclusions from the Dutch experiences with the evaluation of "societal quality", which goes beyond a mapping of the experiences in terms of best practices.

The evaluation practices that emerged are by and large related to different types of relationships between government-science and, in some cases, society. The national research programmes are based on joint agenda building. In a review of the Dutch research system, it has been shown that the intermediary layer between government and science is strongly oriented to such agenda building. However, actors have not been able to develop the appropriate methods for monitoring and evaluating the implementation of such agendas. Only for the ex-ante assessment of technology projects we see that related methods have been developed.

The periodic evaluation of university research and institutes suggests that government as a principal has moved at a far distance and has little control over the performance of these organizations. The emphasis on scientific quality suggests that the regime of the Endless Frontier is alive and kicking in the Netherlands, although the experiences with agricultural research shows that there is a need for some institutes and disciplines to move to a "Self organization regime" which includes innovation, policy and educational actors and that evaluation met such stable state can be developed.

[36] see note 33.

Science policy instruments in the priority setting processes – An overview

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This text concerning science-policymaking instruments and their role in the priority-setting processes is meant as a supplement to the contributions in this chapter. In the workshop, and thus in this report, the limitations in time and space made it impossible to cover the variety of different contemporary science policy instruments in detail, so instead it was chosen to focus on a few important instruments separately, and then present the rest briefly in this text. The overview of the multitude of policymaking instruments will be supplemented by a few theoretical reflections and some illustrative examples (mainly taken from the workshop) of the use of science policy instruments as means to affect the priority-setting processes at different levels. The approach is solely descriptive with a very tentative character, and consequently it is not normatively discussed, at what level of organization, and by what input from politicians and scientists, the goals of the public investment in research should be formulated and articulated. In relation to the MUSCIPOLI theme this text is, on the one hand exploring aspects of how priorities are selected and formulated, and on the other hand how it is attempted to implement these priorities.

The design of science policy can be seen as a question of how the dichotomy between the political system and the research system should be mediated. It can be mediated by social norms, by contracts and rules, policies and procedures; and by the mechanisms created to articulate goals, monitor agents and apply the incentives needed (Guston, 1996,231). A key question for the political system in this task is how to ensure, that the funds allocated to the research system are used in the best possible way. From the point of view of the politicians, there are two elements in this; not only should the science policy assure that the research is conducted with a high degree of productivity and integrity, it should at the same time make sure that the funds are allocated to the areas, where the greatest societal outcome is yielded. Aspects of both elements are explored in this contribution, where an overview of the instruments used in the priority-setting processes will be presented. As an introduction to this presentation a few comments, on how this central science policy question traditionally has been handled, might be necessary.

The traditional system

Contrary to most other policy-areas, science policy has traditionally been characterized with a very limited degree of direct political steering and almost an absence in the use of external policy instruments. Under what has been called “the social contract” between science and society, the politicians have relied on the scientists themselves as the most efficient way of creating a responsible, productive science (Guston, 2000, 139). It has until recently been widely accepted, that the internal scientific control system provided the best way of assuring a steady flow of research-results to the benefit of the society as a whole. As Van der Meulen has put it in his contribution to this report, this meant implicitly, that the government accepted the scientific interests as being similar to the national interests. The basis for the trust of the governments in science was a well-functioning internal scientific control system in the form of the so-called “peer review system”. The peer review system works at the same time as a reward-system, a resource-allocation system and a quality-control system, and is based on the principle, that experts in the same or closely related disciplines conduct the evaluation of research. The criteria for scientific choice are here internal (originality, stringency, plausibility etc.), while external criteria like societal relevance normally haven’t been taken into consideration. This elite-structure is regarded as the foundation for the production of reliable knowledge.

Similarly, external incentives for the researchers were not regarded as necessary under this social contract, since it was assumed, that the individual scientists primarily were driven by a desire for recognition inside the scientific system in the form of awards, citations, positions etc. Among others, Warren Hagstrom has drawn attention to this logic in the functioning of the scientific system, where it is believed that the trade between information and recognition creates motivation for the individual scientist and at the same time assures the government, that the research is done with a high degree of productivity and integrity.

As a consequence of these beliefs the use of science policy instruments has until recently been limited. This has also been the case in relation to the priority-setting processes. Apart from the most overall priority-setting, the majority of priority-decisions have until the beginning of the 1980's been left to the scientific system. Under the traditional social contract most of these processes in the western countries took place in the research council system, where the internal scientific criteria dominated the priority-setting. This system worked as long as the political system kept the faith in the internal scientific allocation mechanisms and the concomitant idea, that the progress of science - and therefore in the long run the progress of mankind - was best served by the autonomy of science (Van der Meulen, 1998, 5).

But this traditionally autonomous system started to become seriously challenged in most western countries from the end of the 1970's and onwards. The pressure on the role, functioning and organization of science increased from both public, administrative and political actors, who started to doubt if the funds distributed to science were allocated in the best possible way and with the greatest societal outcome. Demands of accountability, effective administration and proper use of resources rose accordingly, and focus shifted from the acceptance of the internal scientific steering to the question of how to increase the economic consequences – the productivity – of publicly funded research. Therefore the notion, that a more coherent and institutionalised science-policy with increased focus on prioritisation was necessary, became more and more widespread. With the disappearing political trust in the traditional system and the increasing demands to the research system, the politicians found it necessary to introduce a number of policy instruments to achieve a more direct effect on the priority-setting to ensure that the R&D resources provided the maximum return to society and the economy.

With this new task the central question for the policymakers was how to create a science policy that was able to solve the existing problems and affect the actual priority-setting process without creating new and bigger problems, than the ones attributed to the traditional system. A new social contract with other terms and conditions had to be made for the relationship between science and society, and a number of science policy instruments had to be introduced to structure and enforce this contract.

The political system had a number of different opportunities in the institutionalisation of a new science policy with a more active societal perspective in the priority-setting processes with instruments ranging from manipulation of incentives and direct orders, to reporting and monitoring. So far in most countries there have been at least three main elements in the consequent changes:

- there has been an attempt to restructure the incentives for the decision-makers and performers of research in the scientific system,
- at the same time it has been tried to promote and maintain an identity of goals,
- and finally these two strategies have been combined with elements of monitoring and reporting.

Accordingly a number of these solutions in different disguises and mixes have been chosen by the political system in the form of a variety of science policy instruments, and consequently the political/administrative level is today pursuing these goals in an increasingly specific and formal fashion.

Contemporary science policy instruments
In the following these instruments are presented briefly. In the textbox we have tried to list a number of science policy instruments, which have been introduced to directly or indirectly affect the priority-setting processes at all levels of the science policy system: from the international level to the individual level. Below a few comments will be tied to each of the instruments.

This report has primarily targeted the priority-setting process at the national level, whereas the other levels only have been mentioned briefly. This contribution also has its starting point and main focus at the national level, but instruments affecting other levels are presented briefly here as well. The instruments are presented in three groupings depending on their function in the priority-setting processes. This grouping could be made different, and some of the instruments could be placed in more than one group (for example evaluations), but still we believe the distinction is useful to obtain an overview of the variety of different types of instruments.

Fig. 1: Instruments in the priority-setting processes

TYPE OF INSTRUMENT	INSTRUMENTS IN THE FORMULATION OF PRIORITIES	INSTRUMENTS IN THE IMPLEMENTATION OF PRIORITIES	FRAME-CONDITION INSTRUMENTS
	Budgets Statistical indicators Policy advice Expert reviews Foresight-processes Strategy-planning (at institutional, sectorial and national level) Evaluations ex post & ex ante (including) - Benchmarking processes - Publication-measures - Accounts of patents - Other quantitative and qualitative measures Situational instruments influenced by the media agenda or similar	Contracts (including specifications of) - Goals - Results - Publications - Patents - Collaborations etc. Ministerial orders Calls for proposals (Evaluations) <u>Funding instruments:</u> Public funding (free funding or programmatic funding) Special funding-foundations Program-funding (includes) - Frame programs - Centers with or without bricks - Collaboration across boundaries, institutions, sectors and borders - Networks of excellence - Integrated projects Short-term programs, projects and initiatives	Management principles at different levels Wage-systems Position-structures Taxation-models Ownership-models of institutions Short-term management at national level and institutional level

Instruments in the formulation of priorities
In the first column of the figure a number of instruments used in the formulation of priorities are presented. It is a common trait for these instruments that they provide input to the decisionmakers in the priority-setting process.

The budgets and the statistical indicators are important instruments in the priority-setting process as Annamaria Inzelt emphasize in her contribution to this report. They work at the same time as instruments themselves and as support for other instruments such as evaluations, foresight, strategic planning and assessment. As Inzelt writes, the indicators themselves do not solve the difficulties of shaping and deciding S&T policy, but they do have a very important role to play in obtaining a better knowledge of a given situation – and of the way in which policies can impact on the socio-economic objectives, that they wish to reach.

Other important types of instruments in this category are forms of policy advice and expert reviews. The science policy area is characterized with a high degree of information-asymmetry and uncertainty, and statistical indicators alone are not sufficient basis for a proper decisionmaking process, so different forms of policy advice and expert reviews are also regarded as necessary. In the western countries these needs have primarily been covered by a number of permanent organs as well as a number of more temporary and ad hoc based committees. Of the permanent institutions the national advisory bodies and the research councils have in most countries played the leading role. But as Enno Aufderheide showed in his contributions, there are great differences in the role and function of national advisory bodies across countries, and differences in the selection of members and their influence and independence as well. Similarly the advisory role of the research councils also appears to be differing in different national settings. Finally advice in the form of reports or recommendations from international actors like the EU or the OECD can also be important input to the priority setting processes.

A different form of policy advice has been introduced in the foresight processes, where it is attempted to induce interaction between government, science and industry on priority-setting. The aim of the processes is development of collective strategies, based on exchanges of individual perspectives of the future of science, technology, economy, environment and society (Van der Meulen, 1998). There are several different foresight techniques available to structure the interaction process, and in the workshop the more or less systematic foresight processes in the Netherlands, the UK and Germany have briefly been discussed.

Contrary to the above mentioned instruments, strategy planning is not only used as a tool at the national political level, but is also used actively in the priority setting processes at the institutional level. In the majority of western countries the political systems seems to a higher and higher degree to have encouraged all levels of the scientific system to engage in processes of strategic planning in an attempt to create a more coherent research effort directed towards areas where the greatest societal outcome, can be expected. These efforts have often been directly inspired by the OECD, and have often (especially previously) been accused of primarily having a symbolic effect.

Another important type of instrument is evaluation. Different forms of evaluations have always been a central element in the functioning of the internal scientific control system, but since the beginning of the 1980's governments have introduced more evaluations and other evaluative criteria, like user-judgements, productivity and network relations (Van der Meulen, 5, 1998). Evaluations are used at all levels both ex ante and ex post. This instrument plays an important role both in the formulation of priorities and in the implementation of these priorities.

In some countries (such as Denmark) the evaluation-efforts seem to be very ad hoc based, and characterized by a lack of coherence, with no established criteria and no fixed repetition in the evaluations, even though the number of evaluations has increased dramatically and even though

the debate on this instrument has been very intense. In other countries much more systematized efforts seem to be the norm. What is common for most countries, though, is that in spite of the fact that the wish for a greater societal outcome from the research allocations has been one of the main reasons for the increase in the use of evaluations, the vast majority of evaluations have been based on internal scientific criteria, while methods to evaluate contributions to social and economic progress have remained underdeveloped, as also Van der Meulen points out in his contribution. Another consequence of the increased focus on evaluations is that the cost of monitoring has increased.

Finally there are a number of more situational and informal influences in the process of selecting and formulating priorities. The media is a notable example. Another example could be imitation of popular priorities from other countries, or influence from international buzzwords and general hype of non-documented solutions.

Implementation of priorities
In the second phase of the priority-setting process, where the chosen priorities are attempted implemented in the actual performance of research, a different set of instruments have been introduced. These instruments directed towards the implementation of priorities are the ones presented in the second column of the textbox. For the decision-makers they serve the aim of assuring that the chosen priorities are implemented according to the political goals and aims. In other words they are supposed to assure that the priorities are followed, and that the research is conducted with productivity and integrity.

The first type of instrument in this group is the contracts between the political level and the scientific institutions, where demands of the fulfilment of certain priorities can be specified. The content of these contracts can range from relatively vague goals to very specific demands in relation to certain themes or requirements on the number of publications, patents etc.

Another type of instrument in this group is the direct ministerial orders. Where the contracts often are a result of a negotiation process between institutions and ministries, the direct orders have the character of a one-way communication. Accordingly this instrument is in direct conflict with the ideals of freedom of research, and it is consequently not a widely used instrument. But nevertheless it can be used at all levels of the scientific system, and it is probably most important as an instrument in the relation between the sector-ministries and the public research institutes.

The most important and most widely used group of instruments in the process of implementing priorities is the diverse group of funding instruments. They vary from the basic funding where the only prioritisation is taking place in the allocation of funds between different research fields, to the most detailed programmatic funding where research topics and sometimes even methods are given on beforehand. These funding instruments are directed towards all levels of the scientific system. Especially the programmatic funding has been popular way of implementing priorities, and often a number of strings have been attached to the program-funds. These strings have not only been thematic, but there have typically also been demands of the way the research should be institutionalised both in terms of location, physical form and in terms of partners: centres with or without bricks, centres of excellence, demands of collaboration across boundaries, institutions, sectors, borders etc. In most countries, the program funding has increased its share of the total R&D funding drastically since the beginning of the 1980’s.

Frame condition instruments
The final group of instruments in this presentation is not directly influencing the priority-setting processes, but they still have an indirect influence, because they seek to change the incentives for the performers of research. They are primarily directed towards the lower levels of the scientific system – the institutional and the individual level.

One intensely debated instrument in this group is research management. Research management can be seen as a supporting instrument in the priority-setting processes at the institutional and individual level. As Wenneberg argues in his contribution to this report, strategy is becoming an increasingly important aspect of modern research management. It is important to make priorities, to plan ahead, make visions, choose goals etc. Even though strategic research management is ordinary seen as in conflict with research itself, it is argued, that this dilemma or conflict is not a necessary result of more strategic management. On the contrary, strategic management – both as a process and as a result – can support and help establish trust between management and the researchers, and between the researchers themselves.

Another type of instruments can be observed in the changes in wage-systems and position-structures in the scientific system. These efforts are elements in the general new public management wave that rolls over all parts of the public sector, and these principles are now increasingly being transferred to the scientific system as well. With these instruments it is attempted to change the incentives at the individual level by applying rewards for certain decisions and priorities. By creating attractive wage systems and desirable positions in certain fields, it can be attempted to support prioritised themes or areas by attracting talented researchers.

Other attempts with the same logic, where it is attempted to change the incentives for the performers of research, can be observed in experiments both with different ownership-models of institutions, and with special taxation models, where tax advantages are given to investments in certain areas.

Final remarks

This contribution has given a short tentative presentation of a number of science policy instruments in the priority-setting processes. Increasingly this variety of instruments appears to have spread to almost all western countries, where they are used more or less intensely. In reality a lot of the instruments are intertwined in the practical use, and almost every country seem to have found it's own unique mix of instruments – both in design and use. In that relation it is important to stress, that even within the different types of instruments, there can be great differences across countries, fields, sectors etc., so the variety in design and use of these instruments are in reality even more complex than this presentation might indicate. On the other hand it is also important to note, that almost all these instruments, in one form or another, increasingly are used in all western countries.

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Chapter 6: Researchers reactions to science policy

This chapter is concerned with the reactions of the individual researchers to the changes in the design and delivery of science policy.

The effect of Research Council policies on researchers' choices

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Abstract
This presentation draws on an empirical study, funded by the UK Economic and Social Research Council, which aimed to find out, through interviews with a cross-section of members of university departments, what UK university researchers knew about Government and other policies for research, and how, if at all, these policies affect their research. In MUSCIPOLI terms, it focuses on 'downstream outcomes'. Researchers and their associates showed a keen awareness of policies of their main funding bodies (ie research councils, higher education funding councils and major charities) and regulatory authorities, though their understanding or interpretation of these was skewed in the direction of their own preoccupations. Thus policies relating to setting the research agenda or concentration of resources were their major concern and were acknowledged to influence their conduct – though within limits that they felt were controllable. In other areas, researchers were more likely to attribute changes in their research behaviour (eg towards interdisciplinarity or collaboration) to changes in the nature of the science rather than to any outside influence. Policies relating to research management were the most criticized, mainly on the dual grounds of bureaucracy and mismatches between funding structures and the needs of research and researchers.

The presentation discusses these findings and what inferences might be drawn from them for science policy making and its implementation. This includes discussion of the factors appearing to influence the take-up of policies, the extent to which scientists (as agents) are able to divert or subvert the intentions of the policy-makers (and how far there is collusion in this process), and what mechanisms or processes might, on this evidence, smooth the transmission of policy aims or desiderata to and from the workplace.

Introduction
The paper (which draws on work already published or in press elsewhere – Morris, 2000, 2001) starts with some background information on the aims and methods of the larger study of which it forms a part; it briefly outlines the contemporary policy agenda and then goes on to categorize researchers' reactions to the policies being pursued. The paper concludes with discussion of what features of the structures or processes of policy-making might influence uptake of policy and the difficulties of assessing how far researchers' responses may approximate to the policy outcomes desired by the funding bodies. For convenience, I shall normally refer to 'research council' policies, though in many instances the policies are common among a range of funding and regulatory bodies, who may also have a share in modulating researchers' responses.

Aims and methods
The study aimed to address the following basic questions:
- What do researchers know about external policies?
- What influence are the policies perceived to have?
- How do they square with researchers' needs?

A case study methodology was used in order to gain a fuller understanding of how much researchers knew about policies, and how they interpreted them, as well as their perception of the effects of these policies on their working lives. Any generalization from the study must therefore be approached with caution because of the limitations in scope that the case study method requires. In particular, some features are likely to be peculiar to the biological sciences, which were the particular focus of this study.

In brief, the study involves in-depth interviews with a cross-section of university scientists and relevant administrators and support staff. It was limited to four biological/ biomedical sciences departments in UK universities. A total of 74 people were interviewed, including 6 representatives of research councils and other funding bodies. The field work was complemented by study of published and unpublished documents made available by departments and sponsors, statistical sources relating to higher education, and the relevant academic literature.

The policy agenda
A first task was to identify what were the operative policies: (a) as perceived by the funding bodies (comprising mainly, though not exclusively, the research councils), and (b) as perceived by the members of university departments. A reasonable, though not perfect, correlation was found between these, as shown in Figure 1.

Figure 1 The main policies

Research Council, etc	Researchers
Steering research into strategic areas	Setting the research agenda Concentrating research resources
Efficient use of resources/accountability	Requiring stricter accountability
Interdisciplinary research and collaborations	
Effective interactions with users	
Production of skilled manpower/post-graduate training	Policies on research manpower

Researchers' reactions
On the basis of the interview data, researchers' reactions can be categorized into three kinds, as follows:
- Awareness and compliance, but keeping control
- Change in practice or behaviour acknowledged but perceived as internally driven
- Misprision and frustration.

The reaction was determined by the type of policy, not the type of researcher. There were of course differences between individuals, depending on age or status, with a few diehards still resisting any policy impinging on their work, but these were marginal.

The 3 types of policies correlating with these reactions may be loosely characterized as relating to, respectively:

1) the themes and subject priorities for research
2) the way research is done
3) the management of research

In the next section each type of reaction is discussed in turn.

Awareness/compliance

The researchers interviewed were most responsive to policies concerned with setting the research agenda and the concentration of resources. It surprised me that researchers should be most willing to accept what seemed to be 'scientific direction' but that was the case. This is contrary to popular beliefs about what scientists care about, but the people I met were for the most part pragmatic and adaptable. They made comments such as:

> *'I **am** influenced by funding....I try to influence people round here...to target - to be aware'*
> *'I'm not sure whether, if I'd had a free hand, I would have done that'*
> *'quite an interesting piece of work but it's not something I would have done had MAFF [the ministry]not put out that call'*

Awareness of the concentration of resources policy was indicated by scientists attributing funding failures to their being relatively isolated and highlighting this as a consideration about changing place of work

It should also be noted that both these policies have a big influence on departments drawing up their scientific strategy. All departments in the study acknowledged a need for specialization, building on strengths, and identifying fundable areas. The latter tended to reinforce the scientists' propensity to concentrate on research councils' priority areas.

It is worth noting that there are hierarchies of compliance with scientific priorities**.** These are of two kinds: a stratification by career stage and by talent. To illustrate:

> *'younger people, before they have established their own personal reputation - they can afford to have that broad portfolio, that might involve getting some funds out of certain areas that are in an initiative or whatever'*
> *'now, I am less lured by those sort of things'* ***or***
> *'there is a subset...who..can work on what they want...And then there's your average scientist who's got to at least recognize where the funding's coming from'.*

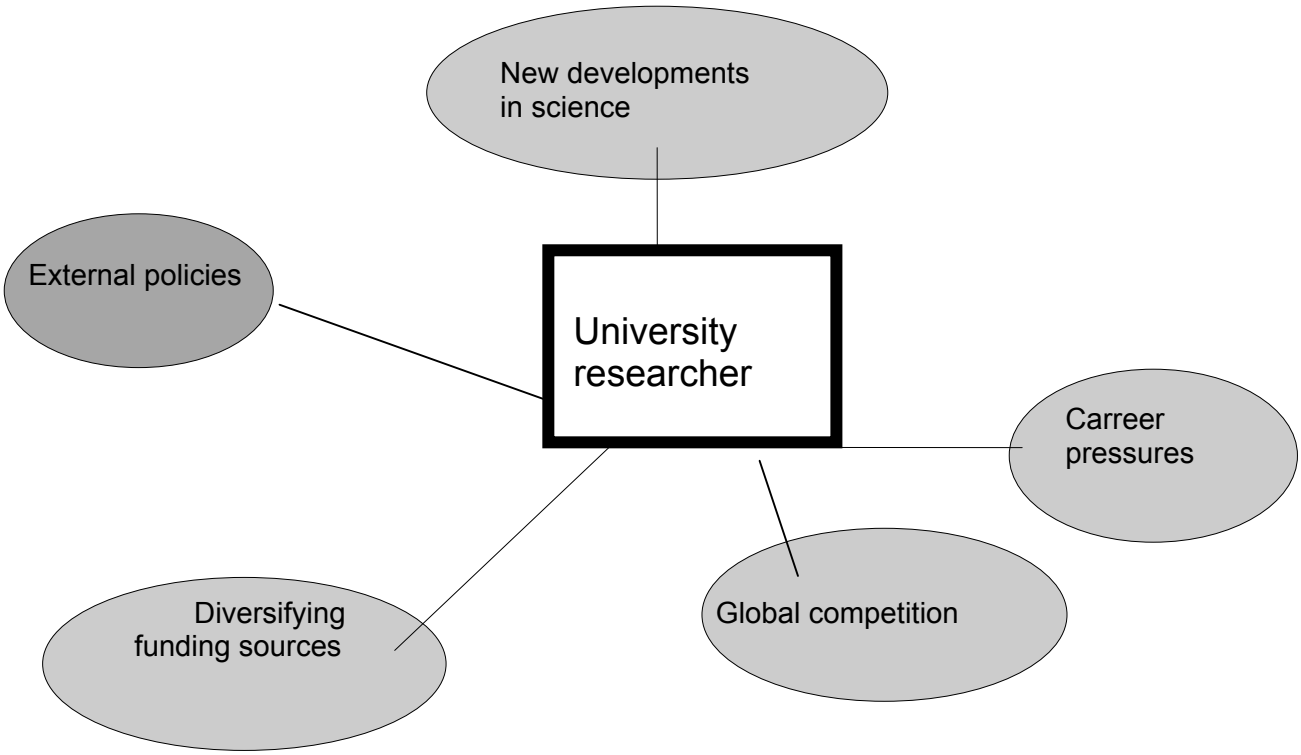
Reactions to the policy of accountability also came in the category of high awareness. Furthermore, accountability was acknowledged to be right in principle (no '*god-given right to do research').* But scientists were minimalist in their compliance.

Competing influences on researchers' choices

The second of my categories of researcher reactions is where change is seen as internally driven

Coming, as I did, from a research council I had to learn that life looks different from the laboratory bench than it does from the Council chambers and offices of the policy-makers. The researcher's job is Science, not Policy. Policy is just one tool (or obstacle) for doing his job. Figure 2 attempts to capture how external policies appear from the researcher's viewpoint. They are but one among many pressures bearing on his life as a researcher.

Figure 2



The external policies must compete for attention. Equally pressing for the researcher is:

- Whether he (or she) is keeping up with the science, his competitors, the latest techniques, and the end of the era of the 'man and dog' team in biological sciences.
- The stage that his career is at:- does he need quick results to bolster his next job application? Is he senior enough to get a 5-yr rather than a 3-yr grant?
- How vulnerable is the group's funding - how might he 'hedge' the risk? . One way is to do work for industry or other users (Govt Depts) to provide a small pot of funds that might be useful for 'tiding over' or getting new work started.

So the need to diversify funding, the awareness of competition, and the wider range of applicable techniques encourage or necessitate working with users, collaboration and interdisciplinarity (for speed and in-depth knowledge). All these are named research council policies (and some of the other 'internal' pressures are also closely related to research council and other government policies, though not always perceived as such). But the researchers don't regard themselves as responding to a research council policy in engaging with these pressures, and modifying their behaviour to suit. They consider they are simply doing what the job of being a scientist requires.

This increases the chances that their interpretation of eg 'collaboration; 'working with industry' may be different from what the research councils had in mind. It raises questions (which we'll come back to) of whether the outcome of placing their policies in this cultural washing machine will be a policy garment the research councils can still wear - or crumpled, stretched or shrunk beyond recognition?

Misprision and frustration
This reaction characteristically relates to management issues, which ramify beyond the scope of the research group, viz.

- policies on staffing structures and careers
- mismatch of traditional funding schemes with current operational needs
- perceived lack of longer-term strategy.

There was widespread discontent over policies relating to staffing structures and careers, ranging from the poor career prospects for contract staff, the scarcity of senior research fellowships, and the continuing failure of academic and technical staff structures to find a place for the highly skilled technical expert who could provide both continuity and ideas to an increasingly technology-dependent science. Insofar as these criticisms were directed at research councils, they were, in some cases at least, unjust. The research councils' policy on contract staff, for example, is not well understood and its failure to make any significant improvements so far may be as much a matter of uncertain application by the universities as intrinsic weaknesses of the policy. It is also questionable whether research councils should take responsibility for reform of the staffing structure in universities to make it better suited to research needs. But as with their complaint about a *lack* of policies for the longer term, it is understandable that researchers should feel that somewhere in the policy arena a wider, more holistic approach to science policy-making – particularly as it relates to universities – should be taken.

It may be significant that all these are matters which are out with the control of the individual research group leader, or – for the most part – of the individual department. The same is true of the complaints about the mismatch of funding schemes with operational needs. This is made the more frustrating since many of the policies or practices in question appear to be 'taken-for-granted' by the research councils, and outside the scope of their policy deliberations. Typical of the concerns are the following comments about lack of provision for exploratory or pilot work (where although a few schemes exist they are either little known or inadequate in scale):

> *there's no seed-corn money...to develop new ideas. I feel very strongly about that....The only way I can do that is by having spare[cash] left over at the end of grants*
> *'The NERC grant will fund my next application.'*

This is specially tough on the new researcher, who has a smaller resource base than his/her more established colleagues: as one of the latter remarked:

> *I don't feel the restrictions that I think would have existed when I had a smaller group and less resource*.

A further concern was grant application obsolescence (because of the slow assessment system)

> *you write a grant, and by the time it is processed the project is almost done…*

Since in these circumstances researchers still take the money, it raises questions of accountability of which researchers were aware, but where the position of the research councils remains veiled. It ties in with the larger questions of policy implementation which are discussed later.

Finally the concerns about the effects of current policies in the longer term and the perceived absence of or secrecy surrounding policies for the longer term – relating to matters such as managing the outcome of continuing concentration of resources; safeguarding the future of long-term research; long-term effects on the teaching/research balance. This brings up a general question of uncertainties about intentions and outcomes of policies, which is again a matter we shall return to later.

Questions arising
The foregoing description has elicited some of the features that seem to characterize researchers' reactions: eg flexibility where they feel in control; personal and professional priorities; and hostility or unease about 'management' policies – possibly relating to relative lack of control. But in order to provide feedback into the policy-making system, a more systematic approach is needed, looking particularly at whether any of the varying reactions can be linked to structural or process features, and how they may affect policy outcomes – the achievement of policy objectives. Given the limitations of the data, and the many intangibles, my analysis can only be speculative, perhaps identifying some avenues for further study.

Factors that may make for compliance
I shall discuss four structural or process factors that may have significance:

- Constitutional similarity
- The policy process
- Immediate and tangible rewards
- Mediation

Social and economic factors have not been included here because – although clearly an important influence - they would apply to all and any policies.

Constitutional similarities between research councils and scientists include the analogy (Rip, 1988) between the 'credibility cycle' of councils and of research scientists, and their common experience of the role of Agent in a Principal-Agent game (Braun 1998, van der Meulen, 1998). There is also the matter of the dominance of scientists on research council executive and advisory Boards and Committees. This kind of overlap must make for a degree of convergence and consensus about scientific priorities, making it less surprising that scientists feel able so readily to comply with 'scientific direction'.

The weakness of this as an explanation is that the similarities should be expected to have the same emollient effect on manpower policies. A possible reason for the discrepancy may lie in the behaviour of those academics who are active in research council affairs. I could speculate that closer study would show that resource allocation to science programmes is what's 'sexy' for Board and committee members, and they are not sufficiently interested in or attuned to other strategies of a more managerial slant.

Turning now to process, it might also be posited that a transparent and consultative process for scientific priority setting might bring scientists on board at an early stage. The representatives of research councils at interview put great emphasis on how their strategy was science-community led, and the product of consultation. Written statements of policy echo this theme. But both researchers and administrative staff in universities still thought it was 'Them and Us'. This attitude may be reinforced by the perception of accountability as over-zealous and the upsurge in monitoring, assessments etc. So they feel themselves in the role of Agents**,** working to the Principal's agenda, and kept on a short rein.

The type of reward that comes from uptake of a policy is an important consideration. Where scientific priorities are concerned, rewards come in the form of successful bids for funds - instant gratification. Similar effects are more difficult to achieve with structural manpower policies, and the beneficiaries of 'young researcher' or fellowship awards are still a minority. As a living experiment it will be interesting to se if the profile of collaboration (now barely recognized as a policy) should change if specific collaborative grant schemes proliferate. (The UK Medical Research Council, for example, has largely replaced its traditional responsive project scheme, by a new scheme which requires joint applications from small consortia of research groups.)

The final structural or process factor on my list is mediation. This is a complex issue in science policy, which I do not propose to go into here. I have however developed elsewhere (Morris, forthcoming) the suggestion that certain university departments are developing a mediating role that facilitates compliance with the priorities. At this stage this applies particularly to policies relating to scientific subject priorities. Departments have a lower profile in research management: and research councils normally address their management policies to the central university administration (rather than directly to the scientists). By this route, they apparently make only a faltering passage to 'the coalface'.

How real is the compliance?
A preliminary consideration is whether the interviewees were giving an honest account of their actions and perceptions. Internal checks suggested that they did, and in the interview situation they had no motive for misrepresentation. They were as ready to talk about their failures as their successes, and about the limits they set to their compliance (with policies or with 'rules') as about the instances where they had taken pains to comply. Where they may at times have been a little less than frank was in being sometimes a little defensive about small team size, and perhaps over-emphasizing how they valued the esteem of their peers or inner satisfaction above more material rewards.

As remarked above, in following scientific priorities, researchers set well-understood limits to how far they would depart from their personal conception of what work they could best and most satisfyingly do. The boundaries varied according to the status and skills of the individual. But all, in their different ways, had strategies for reconciling God ('good science') and Mammon (the science that would win funding). I was given many examples of how this could be done. Most strategies involved pursuing a personal, long-term agenda while keeping up a flow of fundable proposals. Techniques included tailoring projects to include 'deliverables'; keeping work 'on the back burner' while doing something more profitable; 'sculpting' proposal to fit known priorities, and so on. At the level of inputs this seems to be skillfully, and on the whole, fairly achieved. The question for policy-makers is whether the outputs from such a compromise give them the outcomes that they want? Does it fulfill their aims? Or do the scientists' actions constitute what is known as 'shirking' (ie not fulfilling one's contract) in Principal-Agent terms?

While my personal reaction to what is happening is that both sides come out of it well, it may be salutary to take a sideways look at what happens with regard to the policy of accountability. This is an area where things are much more black and white, and failures to comply can be the more easily defined. Here it is clear that scientists are in some cases, from a formal point of view, misappropriating funds. The examples given earlier (of how funds from one project are used to do the initial work on another, or how project plans are changed from those for which funds were awarded) show that scientists do not feel obliged to observe the written conditions of grant: this must at least raise a doubt as to whether they observe the less tangible requirements on scientific direction.

A slightly different case arises in connection with collaboration and working with industry. Here the researchers are, according to their own account, voluntarily doing these things, for their own good reasons. But, as mentioned earlier, it does raise a question as to interpretation: do they have the same understanding of what these terms mean as do the research councils? In view of all the talk about innovation and entrepreneurialism, it seems likely that government had something more in mind that encouraging researchers to do a little contract work to generate income – but perhaps that is thought an acceptable beginning?

It is my view that all these questions about the reality of compliance are unanswerable in present conditions: but that unanswerability yields some possible insights into the policy process as currently practised in the UK.

Research councils do not normally define in any explicit way what outcomes they want from their policies. They concentrate on the inputs to named policies, and have processes of evaluation that do not provide any 'audit trail' back into the policy-making process itself.

The point of interest is how far the ambiguity about outcomes is deliberate. One interpretation is that research councils, in their relationship to Government, find it expedient to frame programme proposals in very broad terms. This enables them to negotiate a position of greatest autonomy for themselves (as Agents to the Government's Principal) in the execution of programmes and limits the government's opportunities to monitor progress. Much of this breadth then gets passed on to the academic community when they act as Agents to the councils. There is perhaps also an intrinsic reluctance to predict (by attempting to define) outcomes when allocating resources to research. Policy decisions are made, at best, on the basis of probabilities: councils may expect a percentage pay-off, but in a climate of uncertainty about where such a pay-off will occur. Their tactic may therefore be to preserve their freedom to make the best of what they get.

This might also offer an explanation of the blind eye they turn to accountability in the circumstances where a researcher knowingly departs from the programme of work for which he has been awarded funds. Research council spokesmen were anxious to tell me that they would be sympathetic to such deviation if good work was done, and a substantial proportion of researchers were confident that this would be the case. Is this a practical solution to deal with the unpredictability of science? Or is it collusion between research council and academic community to subvert the system for allocation of resource, and allow the research councils to support science through something like the old system of unpredicted funding while ostensibly steering research into priority areas. And will this give them the best of both worlds?

However it arises, the ambiguity of research councils about outcomes has practical implications for evaluation of policies. It is significant for the kind of discourse the councils are likely to adopt for justification, encouraging qualitative, *ad hoc* (or perhaps more accurately, *post-hoc*) criteria. And it limits the possibilities for constructive feedback into the system from surveys of researcher responses, such as this one.

Conclusions

The indications from this limited study are that university researchers are selective in their response to policies, and their uptake is modulated by competing pressures to which they try to make a balanced response and self-set boundaries. Further studies of researchers in a range of disciplines, research environments and national policy systems would help to establish how locally-specific these findings are.

Further exploration of what causes the differences in researcher response – whether intrinsic to the policy or related to structures or processes – might yield some practical lessons for policy-making. It might also help in our attempts to model they system, as would a better understanding of how far research councils regard the outcomes of their policies as negotiable, and how this affects the nature of feedback into the policy-making cycle.

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Researchers' reactions to and perceptions of policymaking instruments

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The Danish Institute for Studies in Research and Research Policy

The research systems and the research management in Denmark have changed during the last ten years.

Among the major changes are changes in the management rules at the university and changes in the employment structure both at the universities and at the government research institutes. In the same period contracts have been introduced in the research system.

The researchers are core employees at the research institutions and therefore their reactions to the changes have a large impact on the effect of the changes. In this paper the focus will be at the researchers reactions to some of the changes and their attitudes on the issues.

The main issues in this paper are:

- Research policy in general - from the researchers viewpoints
- The policymaking instruments:
- The Employment structure at the Danish research institutions
- The changes in the management structure at the Danish universities
- Contracts and milestones at the Danish research institutions

These issues are also focused in the project 'Research management under Change'[37] a project empirically based on case studies and surveys conducted at The Danish Institute for Studies in Research and Research Policy.

The two larger survey studies used in the project and in this paper are:

- A survey study conducted in 1998 at 20 Danish Government Research Institutes (GRIs) with 999 valid respondents[38]
- A web based survey study in 2000/2001 at all Danish Universities with 2897 valid respondents[39]

Research policy in general - from the researchers viewpoints

One main issue in the discussion of research policy in general in Denmark is the relevance of this policy: Some researchers claim that only researchers have the sufficient knowledge on research to manage research and thereby to make decisions about research and that politicians (and others) should stay away; as well as they claim that the autonomy of the universities and freedom of research is the only guarantee of growth of knowledge in society. But very little were known about the general attitudes among researchers.

[37] These project is a part of REMAP (WWW.REMAP.DK).
[38] Kallehauge og Langberg: Forskere på sektorforskningsinstitutioner AFSK 1999/6.
[39] Langberg og Lauridsen: Universitetsforskernes arbejdsvilkår og holdninger til forskningens og forskeres vilkår AFSK 2001/5.

In the survey to the university researchers there where four questions connected to research policy:

- I fear that research policy will interfere on the future situation at the institute.
- There is a need for initiatives within research policy on collaboration between the universities and the private sector.
- Research themes may come as initiatives from outside: the important issue for me is that I decide what methods to use.
- University researchers ought to be free to do their research without any restrictions or initiatives from the outside.

Figure 1

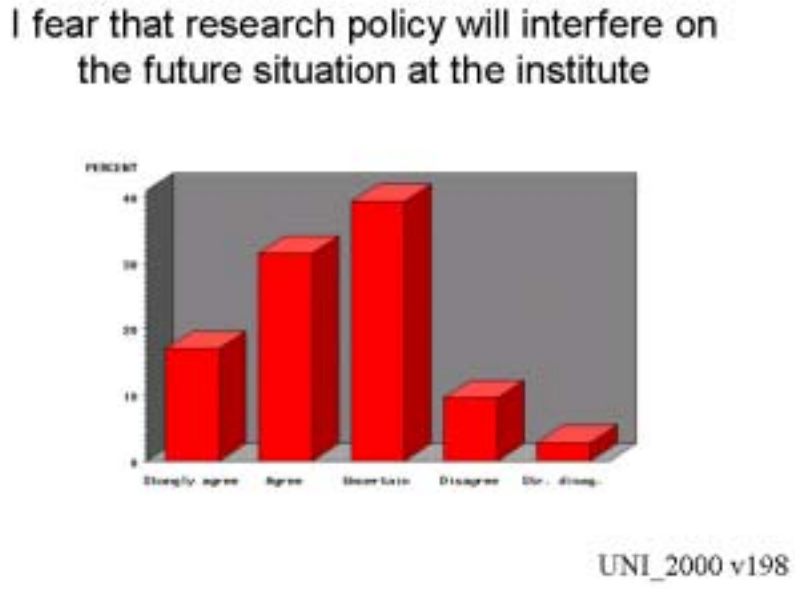

Figure 2

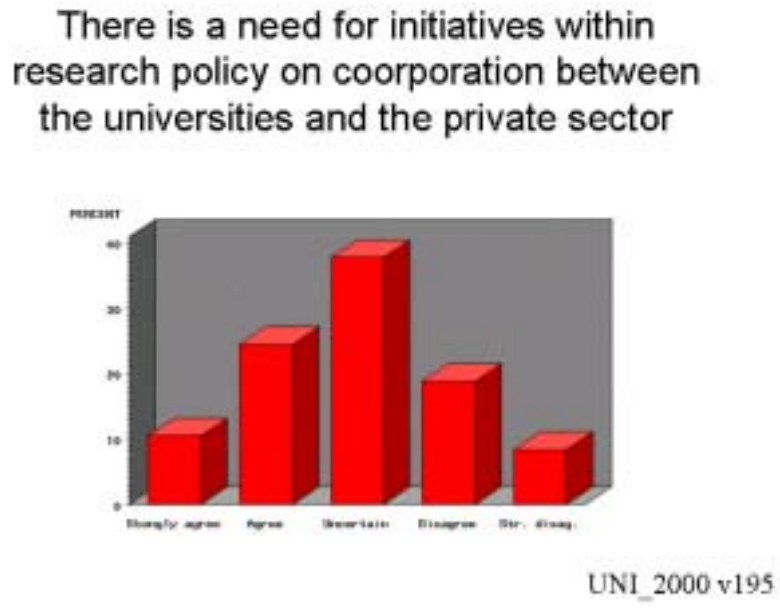

Figure 3

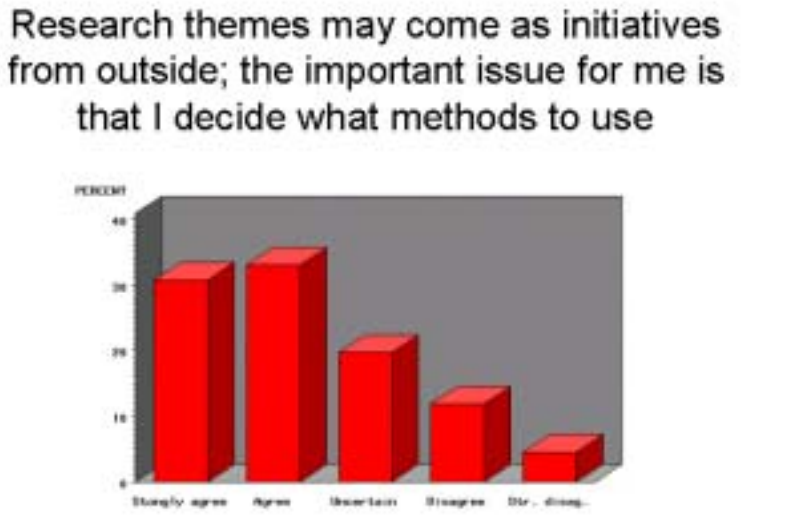

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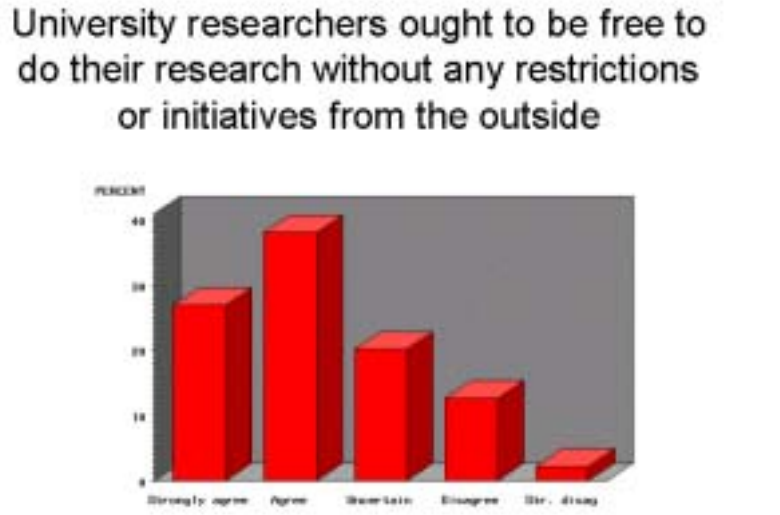
Figure 4



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As seen in figure 1 nearly one out of two university researchers 'fear' that research policy will interfere in the future situation at their institute (= department). This fear can partly be regarded as an indicator of uncertainty and a lack of knowledge: the question is negatively correlated with questions on changes in research management (figure 5) and positively correlated with the question on the debate on the contract (figure 8) - but still the largest number of the researchers that 'agree' on the statement has an unfocused fear.

A number of researchers are, as seen in figure 2 and 3, positive to the ideas of collaboration between university researchers and the private sector as well as they are positive toward the idea that research themes may come from the outside. These positive attitudes are negatively

correlated with the question on 'freedom of research' where the response is seen in figure 4. But put all together: a large number of the researchers at the university do not recognize a conflict between 'freedom of research' and collaboration with the private sector or that research themes may arise from the outside.

So at one hand a large number of researchers have a 'fear' of the research policy, on the other they are positive to specific instruments.

The policymaking instruments used during the last ten years
Out of the policymaking instruments used in the last ten years in Denmark three has been heavily discussed:

- Changes in the employment structure.
- Changes in the management structure at the universities.
- Contracts and milestones.

Changes in the employment structure
There has been two major changes in the employment structure at the university, the latest in 2001; and one major change at the Government Research Institutes (GRIs) in 1997: from a structure similar to the general structure in the public sector to a structure similar to the university sector. In the same period the salary structure in the public sector in general was changed from a rather stiff system with 16 steps to a system with 8 steps and greater use of special bonuses.

There is an ordinary and a supplementary system as seen in scheme 1 and 2 at both kinds of institutions.

Sometimes the ordinary employment structure is described as a system similar to the tenure-track system - but it is not quite the same: first of all after the assistant professor/researcher level (in Denmark normally a temporary appointment lasting 3 years), a position as associate professor/senior researcher will not automatically be advertised and secondly if advertised, it will be advertised openly.

In the supplementary system all the positions are temporary.

Before the 1990'ties a PhD degree (or a Danish Lic. degree) was not a formal requirement when appointed to a researcher position in the Danish universities, and it was not a tradition to have one, nevertheless there was formal requirement to proof of the scientific level (a number of articles, books, etc.) when appointed to different positions. When the PhD was introduced (the former Lic. degree was changed) in the system as a formal requirement it was therefore accompanied by 'or equivalent' in the rules, so that persons at the proper scientific level regardless of their degrees could receive positions.

There is two doctoral degrees in the Danish system: the PhD (Lic.) and the Doctoral degree similar to the 'German Doctor Habile' (Doktor) the later is not a formal requirement to achieve a professorship, but the scientific level equivalent to this is.

Scheme 1: The ordinary employment structure at Danish universities and Government Research Institutions 2001

Requirements	Danish Universities	Government Research Institutes (from 1997)
	Research Assistant	Research Assistant
	PhD-student	PhD-student
PhD or equivalent	Assistant professor	Researcher
PhD or equivalent + a number of publications/patents	Associate professor	Senior researcher
Doctor (like the German Habile) or equivalent	Full professor	

Scheme 2: The supplementary employment structure at Danish UNI (1993 - 2000) and GRIs (1997 -)

Requirements	Danish Universities (employment after 1993 and before the 1st Sept. 2000)	Government Research Institutes (after 1997)
PhD or equivalent	Research assistant professor	Project researcher
PhD or equivalent + a number of publications/patents	Research assistant professor	Project senior researcher
Doctor (like the German Habile) or equivalent	Research professor	Research professor

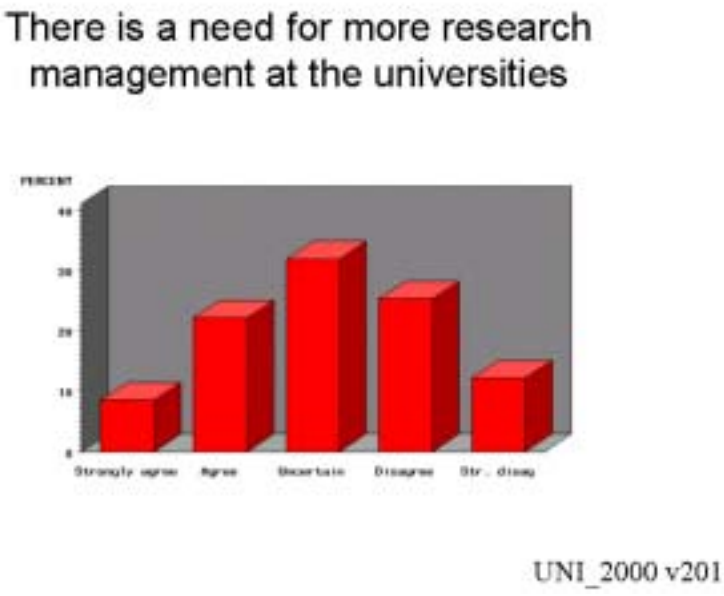
The supplementary employment structure was changed at the universities in 2001 it is not quite clear at the writing moment how the changes will effect the employment system.

Changes in the management structure at the Danish universities
The managers at the universities at all levels are elected by and among the researchers (associate and full professors can be elected as managers)[40]. All levels have a manager (e.g. a dean or head of department) and a council. Before 1990 the management power was mainly placed in the councils, during the next ten years most of the management power was transferred to managers. In the same period there has been a focus on management in the public sector in general in Denmark, and new instruments as contracts and milestones have been introduced.

It has been said, that management and 'freedom' of research cannot work together, that management would restrict the free and creative process of research and therefore there should be no research management at universities, on the other hand both people in and outside the university has claimed that there was a need a management. As seen en figure 5, the researchers at the universities fall into tree groups at nearly the same size:

- One group supporting the idea of more research management.
- One uncertain group.
- One group, that do not support the idea of more research management.

Figure 5

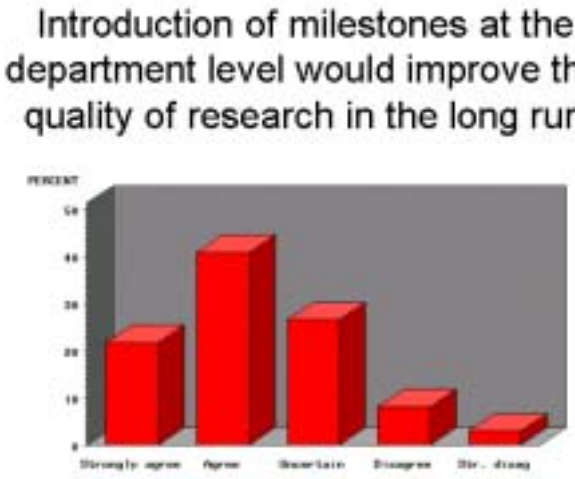


This might reflect that the management system is changing and that the researchers attitudes are changing along with the changes, e.g., that the researchers regard a need for change.

[40] The Danish university of Education (DPU), that was founded in 2000, was build on a former university institution and a GRI, this university has it owns managerial rules.
Technical University of Denmark (DTU) has since 2001 experimented with the rules.

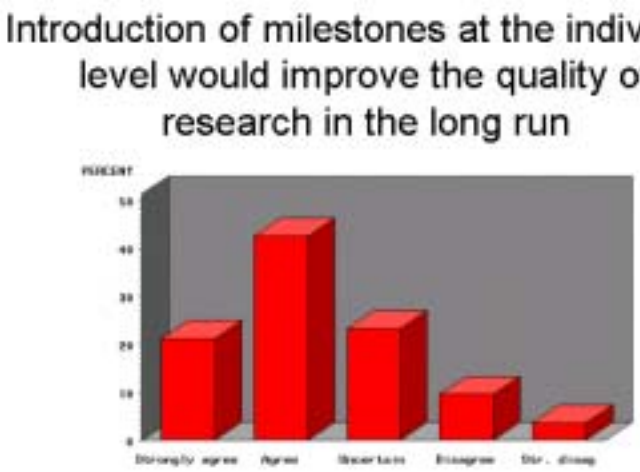
Contracts and milestones at the Danish Universities and Government Research Institutes
Contracts and milestones have been widely introduced in the public sector in Denmark. In 1998, where the survey was conducted some of the GRIs has worked with milestones and contracts for a longer period and some not at all, so the questions could not address the issue directly. The answers to the questions are seen in figure 6 and 7.

Figure 6



GRI_1998 H20

Figure 7



GRI_1998 H21

As seen the researchers are basically positive to introduction of milestones. A closer look at the answers delivered showed that the answers were connected to the knowledge of milestones, e.g., that researchers on institutions with contracts and/or milestones did agree more often than others.

Contracts were introduced at the universities in 2000. From an ideal point of view the contracts should be a top-down process combined with a bottom-up process. These processes should be based on strategies for the future development and the expected results on department level, on faculty (school) level as well as on the overall level. With a decentralized management structure it should be expected that a large number of the researchers had been involved in the discussions of the contracts, but rumours said that this was not the case.

As seen in figure 8 and 10 most of the researchers were uncertain on whether there had been an intense debate or not and on the eventually inference on the daily work. As seen in figure 9, more than 40 percent agreed on that the debate didn't give them much information - and other 40 percent were uncertain on the issue.

Figure 8

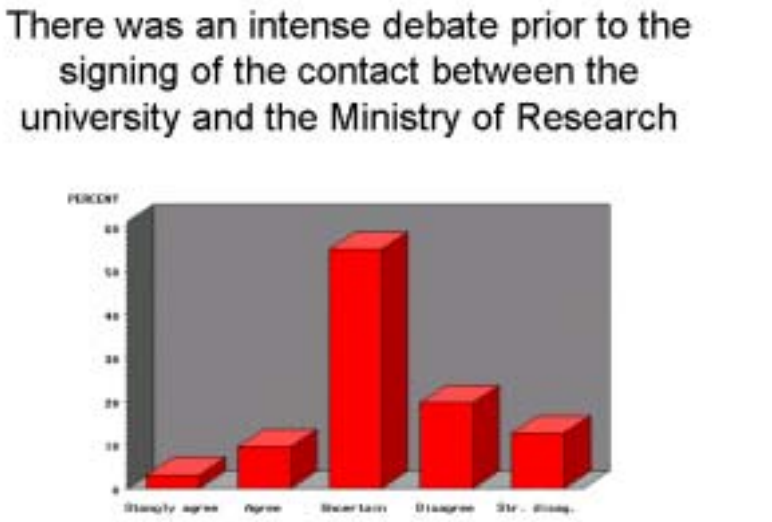


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Figure 9

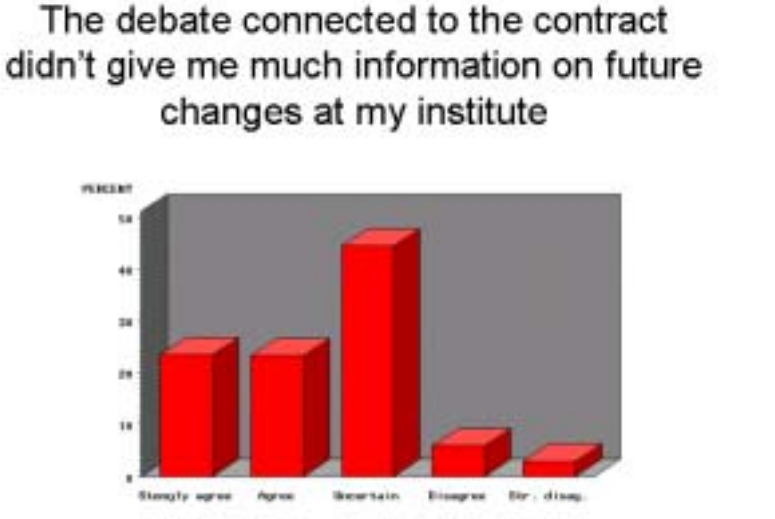

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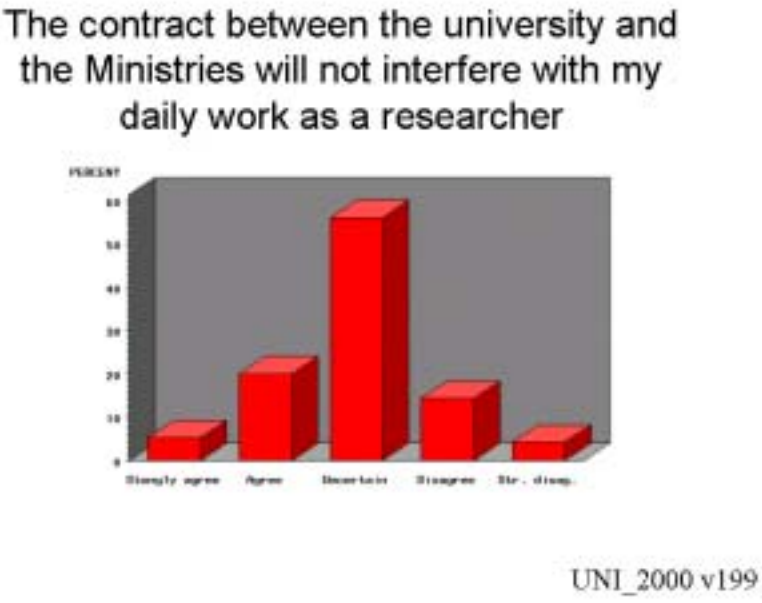
Figure 10



The large numbers of answers in the category 'Uncertain' point to the possibility that the contracts as an instrument were pretty unknown to the individual researcher[41].

Perspectives
The main results on policy-making instruments were an uncertain fear of them in general among the university researchers but positive attitudes toward a number of specific instruments and issues.

The attitudes among the researchers at the GRIs where milestones were known as managerial instruments were mainly positive, where the attitudes among the university researchers on contracts (that in fact include milestones) where uncertain, an attitude that can be explained by lack on knowledge, because the idea of contracts were new to them. This combined with the fact that a large number agrees on that there is a need for more research management at the universities supports changes at the university system toward new rules, where contracts could play an important role.

The overall impression is that a large number of the university researchers are very open to collaboration with society and that their main interests is research - not management rules.

[41] An interpretation supported by the fact that the question showed in figure 8 did not fit into the overall model (see section 6 in AFSK Report 2001/5).

Chapter 7: International trends

In this chapter we move beyond individual case studies to examine wider international trends in agendas and agenda-building processes. These presentations attempt to highlight and explain changes and stability, as well as similarities and differences across national borders.

The Changing Rationale for European University Research Funding: Are there Negative Unintended Consequences?

(Published in *Journal of Economic Issues*, Vol. 35, No. 3. pp.607-632)

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Abstract: This paper analyses how changes in the rationale for and composition of university funding could influence the behaviour of these institutions. In particular, the unintended consequences of the re-examination and modification of resource allocation to universities is examined. It is shown that problems arise due to 1) increased concentration of resources, 2) disproportionate incentives for short-term foreseeable research endeavour, 3) conflicting incentive structures, and 4) exacerbation of the impact of cumulative and self-reinforcement phenomena. These problems result in negative unintended consequences that may prevail over the predicted advantages of the new rationale in the long run.

Keywords: rationale for science funding, economics of science, science policy, unintended consequences, resource allocation, quasi-markets

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1. Introduction

In recent years there has been wide-ranging debate on the advantages and drawbacks of the rationale for resource allocation to university research. The post World War II rationale for public support of science has been challenged by a more contractual-oriented vision of how to support research. The academic debate has provided a diverse set of descriptions and explanations with some views strongly supporting the 'contractual-oriented rationale' and others critical of it.[43] The debate transcends the academic circle, as illustrated by the large number of national government reports; for example, Commission Jacques Attali (1998) for France, House Committee on Science (1998) for the US and National Committee of Inquiry into Higher Education (1997) for the UK.[44]

This article examines how changes in the rationale for science funding might influence the behaviour of universities in European Union (EU) countries and the US.[45] The article begins by describing the changes in university research funding for a selected group of EU countries during the period 1981-1996 and goes on to analyse the contractual-oriented vision of university research funding and its consequences. The primary focus is on the negative unintended consequences of the new rationale. It is shown that the short-term efficiency gains resulting from the quasi-market incentive structure introduced by the new rationale could be counterbalanced by long-term disadvantages arising from unintended outcomes. This paper does not provide a quantitative comparison between long run negative effects and expected short-term benefits because it is arduous, if not impossible, to exactly quantify these effects. Instead, the paper provides a critical analysis of the relevance of the negative unintended effects of the new 'contractual-oriented rationale' for university research funding. Finally, national specificities in connection with university researchers that relevant for national policy are subsumed here; the purpose here being to create a comparative analysis.

In his original work on American universities, Veblen (1918) proposed economic explanations for the institutional behaviour of universities, focusing particularly on the introduction of business principles into university policy. Since this seminal work, it is mainly historians, political economists and sociologists who have been concerned with understanding the behaviour of universities. From the 1960s onwards, with the development of human capital theories, economists focused some of their research on the university (e.g., Becker [1975] and Schultz [1960]). However, despite this new interest, it was mainly the educational aspects --the contribution of universities to the production of the human capital of graduates or others that leave the university to enter other sectors of the economy-- that were taken into account, leaving aside the analysis of the overall behaviour of the institution or its specific contribution to society's stock of scientific and technological knowledge. While this research endeavour led to the development of the economics of education, it did not equally promote the development of the economics of university-based research.[46]

[43] For examples, for the diverse approaches to the analysis of the changes in the rationale for public support of science, see, among others, David (1997), Dill (1997), Gibbons *et al*. (1994), Guston and Keniston (1994), Kealey (1996), Pavitt (1996), Slaughter and Rhoades (1996), Sommer (1995), Vavakova (1998) and Ziman (1994).

[44] See also the survey by *The Economist* (1997).

[45] In particular, the analysis developed in the last section of this paper is of relevance for both European and US universities.

[46] See Blaug (1970) for an introduction to the economics of education and a review of the literature.

At the beginning of the 1960s, the articles by Nelson (1959) and Arrow (1962) laid some of the foundations for the current economics of science.[47] These two papers underscore the fact that the properties of non-excludability and non-rivalry in consumption prevent the creator of scientific knowledge from fully appropriating the returns from investments in knowledge creation. Moreover, as the marginal costs of duplicating scientific knowledge are very low, scientific knowledge can be characterized as a 'public good,' which prevents the producer from capturing the benefits stemming from the production of new knowledge. Therefore, market forces are inadequate to deliver the socially optimal level of scientific research. As a result of this market failure, private investment is socially insufficient and the state has a legitimate role in taking responsibility for the support of a sizeable fraction of scientific research.

Scholars in the economics of science have been mainly concerned with analysis of the behaviour of the individual researcher.[48] With the exception of the works of Dasgupta and David (Dasgupta and David, 1987; 1994), the scholarly work in this area only marginally considers the issues related to the institution where the research is carried out and does not analyse the interactions among the various organisations forming the system of innovation.

Throughout the 1980s and 1990s, attention increasingly has been devoted to the institutional analysis. On the one hand a large literature mainly within the framework of political economy, institutional economics and national systems of innovation, has developed theoretical concepts in the broad area of the national systems of innovation useful for the understanding of university behaviour.[49] On the other hand, a number of studies have focused on how different micro-decisions and micro-incentives generate perceptible differences in institutional behaviour.[50] Most of them originated from, and referred to, the Anglo-American context. Recently, especially in countries such as the United States, the United Kingdom and Australia, market forces and government simulated market actions (via performance-based funding systems) have significantly influenced the behaviour of universities (Geuna, 1999; Massy, 1996). These changes towards a stronger market orientation for higher education systems have stimulated further research on the economics of university-based research.

The remainder of this article extends the literature on the economics of the research conduct of universities by analysing the behaviour of European universities over the past 15 years and proposing an interpretation of the possible unintended consequences of a more contractual-oriented rationale for the funding of university research. Section 2 analyses the evolution of university research income in ten EU countries during the period 1981-1996. Section 3 briefly

[47] Prior to these works a large number of economists, sociologists and philosophers have developed concepts and interpretations of relevance to the economics of science. Due to the confines of space and focus of this article on the economics of university-based research these works are not discussed in detail here. However, the work of Charles Saunders Peirce deserves particular mention. At the end of the nineteenth century Pierce put forward the idea of using an 'economics of research' to analyse and affect the conduct and organisation of scientific activity (Peirce, 1876). His original and subsequent developments of the economics of research can be considered the first contribution to the economics of science, see, for example, Wible (1994). (I am indebted to Professor Paul David and an anonymous referee for useful bibliographical suggestions.)

[48] For a critical presentation of the main themes of the economics of science, see the survey articles by Stephan (1996) and Diamond (1996) and the survey on the new economics of science by David, Foray and Steinmueller (1999). For examples of current research, see the special issue of the Revue d'Economie Industrielle edited by Callon and Foray (1997).

[49] See, among others, Edquist (1997), Geiger (1993), Lundvall (1992), Nelson (1993) and Sommer (1995).

[50] For examples of recent studies see Adams and Griliches (1996), Baldwin (1996), Cave, Dodsworth and Thompson (1992), Garvin (1980), Geuna (1997, 1998a, 1999), Hare and Wyatt (1988, 1992), Hoenack and Collins (1990), James (1986, 1990), Johnes (1988, 1992, 1997), Mansfield and Lee (1996), and Massy (1996).

reviews the confrontation between the post World War II rationale and the developing new rationale for scientific funding and further pursues the analysis of the characteristics of the 'contractual-oriented rationale'. Section 4 focuses on the long-term unintended consequences of the new rationale. The last section offers concluding comments.

2. Changes in University Research Funding

After the Second World War, the higher education systems of EU countries witnessed an impressive growth in the numbers of students and staff, and spending. For example, the number of students in the EU countries increased from about one million in 1960 to approximately nine million in 1990. In the same period, the gross enrolment ratio – *i.e.* total enrolment, regardless of age, divided by the population of the age group 20-24 — grew from less than 10% to around 30%, depending on the EU country. This rapid growth was also connected with a rise in society's expectations of economic returns (Geuna, 1998b).

These two phenomena have led to conflicting pressures on the institutional organisation and role of the university. Examples of the tensions characterising contemporary universities are: (1) incompatibility between the demands of elite and mass higher education; (2) friction between curiosity-driven research aimed at the researcher-directed advancement of the knowledge frontier and targeted research driven by the needs of society; and (3) the different impacts of private and public financing. From the early 1980s onwards, the policies and priorities of universities have been increasingly influenced both by the quest for nationally relevant university research and by the pressure for accountability and cost reduction. Although these changes vary from country to country, they are driven by the same forces and have similar overall aims.

University Research Income

One of the most pertinent pieces of evidence highlighting these changes can be found in the changing structure of university income. University income stems from four main sources: general government grants or general university funds, direct government funds, internal funds, and the sale of academic services. By far the most important source of university funds in Europe is government funding. Depending on the country, the responsibility for the public funding of universities is attributable to different levels of government. It can be the responsibility mainly of central government (Austria, Finland, Denmark, France, Italy, Ireland, The Netherlands, UK), mainly of the regional government (Belgium, Germany), or be shared between the central and regional governments (Spain) (OECD, 1995).

Government funds to universities are funnelled through three different channels: 1) incremental funding, 2) formula funding, and 3) contractual funding. In the first, funds are allocated on the basis of past expenditure levels with incremental resources made available for the development of new activities. This funding mechanism was the most prevalent in the expanding university systems until the early 1980s (OECD, 1990b). Under formula funding, the budget of the institution is determined by some form of assessment of the actual institutional expenditure *per* student enrolled or expected to be enrolled. These funds are combined with general research funds according to a ratio of government funding for teaching compared to research, *e.g.* a 60:40 split. Research funds can also be determined by a formula system that allows the distribution of the funds in a selective way on the basis of research record. Contractual funding is applied via tender schemes. Public funding agencies issue targets in terms of student numbers or research and the various institutions apply for the funds to carry out specified tasks. There are different forms of contracting depending on the existence of fixed limits for the availability of funds, and on the degree of specificity of the activity. In the case of limited funds and tightly specified targets, universities have to compete with one another for the resources. Although there is a high level of diversity in the mix of the different funding systems in the EU, recent years have seen an increasing reliance upon formula and contract funding (OECD, 1990b).

In the case of university research funding the OECD provides data for Higher Education Expenditures on Research and Development (HERD) that are approximately comparable across countries.[51] Table 1 shows the evolution of HERD intensity (HERD as a share of GDP) for the four main EU countries and for the EU countries together in the period 1981-1996. During the 1980s HERD intensity on the whole increased only slowly with some countries witnessing reducing intensity. The 1990s were characterised by contrasting tendencies; in the first half of the decade HERD intensity increased significantly, while in the second half decreasing or constant HERD intensities characterised all European countries. Over the last decade, HERD growth rate has continuously declined in almost all the countries producing, especially in the second part of the 1990s, relative stagnation in constant prices of overall efforts (OECD, 1998).

Table 1: HERD Intensity

		1981	1985	1989	1993	1996
HERD/GDP	*Germany*	0.38%	0.37%	0.41%	0.44%	0.41%
	France	0.32%	0.34%	0.35%	0.39%	0.39%
	UK	0.32%	0.33%	0.33%	0.37%	0.38%
	Italy	0.16%	0.22%	0.24%	0.28%	0.25%
	EU	0.30%	0.31%	0.34%	0.39%	0.38%

Source: OECD, 1998.

The R&D performed in the higher education system can be analysed in relation to the different financial sources. The OECD classifies the funding sources for HERD into five main classes:

- *Government*, subdivided into *Direct Government Funds (DGF)* –e.g. contracts and earmarked funds— and *General University Funds* (GUF);
- *Business Enterprises* –e.g. R&D contracts;
- *Abroad* (including foreign companies research contracting and EU research funds);
- *Private Non-profit Organisations (NPO)*;
- *Higher Education (HE)*, own funds –e.g. income from endowments.

Table 2 presents the evolution of the relative share of the HERD funding sources for an aggregate of seven EU countries between 1983 and 1995 (see Table 3 in the Appendix for a ten country breakdown). These seven countries account for about 80% of total HERD performed in the EU countries throughout the period. [52]

[51] In the Frascati manual, the basis for measuring R&D in OECD countries, the Higher Education sector is defined as: "All universities, colleges of technology and other institutions of post-secondary education, whatever their source of finance or legal status. It also includes all research institutes, experimental stations and clinics operating under the direct control of, or administered by, or associated with, higher education establishments." This definition has been interpreted in different ways by the OECD Member countries. Important differences are present in the way government-funded research institutions are classified. For example, while the Centre National de la Recherche Scientifique (CNRS) in France is classified in the Higher Education sector, the Consiglio Nazionale delle Ricerche (CNR) in Italy, which has broadly the same functions of the CNRS, is accounted for in the Government sector. See the Frascati manual (OECD, 1981) for a discussion of the shortcomings inherent in the measurement of HERD.

[52] See Kyvik (1997) for an analysis of university research funding in the four Nordic countries in the period 1981-1993.

Table 2: HERD Source of Funds for and Aggregate of 7 EU Countries (%).

	Total Gov.	GUF	DGF	Business	Abroad	NPO	HE
1983	94.0	68.3	25.7	2.9	0.6	1.5	1.1
1985	92.7	65.2	27.5	3.7	0.7	1.7	1.3
1989	89.9	60.2	29.7	5.4	1.4	2.1	1.2
1991	89.4	61.7	27.7	5.5	1.6	2.3	1.2
1993	87.7	60.1	27.6	5.8	2.5	2.7	1.4
1995	85.6	57.2	28.4	5.7	3.2	3.7	1.8

Source: Elaboration OECD data. The breakdown in GUF and DGF has been estimated for Italy.
The 7 countries are: Denmark, France, Germany, Italy, Ireland, The Netherlands and the UK. Belgium, Greece and Spain have been excluded due to missing or not comparable data.
GUF= General University Funds, HE= Higher Education (own funds), NPO= Private Non-Profit Organisation

In six of the ten countries considered government funds account for more than four-fifths of total expenditures. Only Greece, Ireland, and the UK have lower shares of about 70% in 1995.[53] All countries, without exception, have witnessed a decrease in government funds. For example, in France the share of government funding decreased from 98% to 91% while in the UK it fell from 82% to 68%. These changes mask differences in the types of government funding. While General University Funds tend to be allocated on the basis of incremental funding or some form of formula funding, Direct Government Funds are principally funnelled through contractual funding – e.g. research funds from the Research Councils or Ministries. In all the countries, the share of General University Funds has substantially declined, while the share of Direct Government Funds has increased, although not sufficiently to offset the decrease in the other components of government funding.

The declining share of government funding has been compensated for by a rise in the share of the other sources of funds. Where figures are available, Abroad, Private Non-profit Organisations, Business, and Higher Education sources of funds show positive trends.

The growth in finance from abroad is particularly important. In the period under consideration funding from a country other than that of the institution experienced a compound annual growth rate of 23% for the aggregate of the seven countries. Funding from abroad has become extremely important for the higher education systems of small less-advantaged countries, such as Greece, Ireland and Portugal, accounting for over a quarter of total HERD in a few of the years under consideration. Particularly for these countries, but also for the other EU countries, a significant proportion of the funds received from abroad can be ascribed to the European Commission (Commission of the European Communities, 1994 and 1997), for example, through the Structural Funds and the Framework Programmes. Generally, the growth in foreign funding for R&D performed in the higher education sector is an indication of the increased internationalisation (Europeanisation) of university research (OECD, 1998).

Funds from private non-profit organisations (usually private foundations such as charities) have continuously increased throughout the period under consideration.[54] In the European context, in contrast to the US, private foundations did not play a significant role in the funding of university research until the end of the 1980s. Although at the aggregate level NPO funds account for only

[53] Also Belgium and Spain had a low share of government funds in 1995, however the figures for the last year are a break in the series and, therefore, are not discussed here.
[54] For example, in the bio-medical area from cancer charities such as the Imperial Cancer Research Fund in the UK and the Dutch Cancer Society (Queen Wilhelmina Fund/KWF) in The Netherlands or the Association Française contre les Myopathies (AFM) in France.

3.7% of total higher education expenditures on R&D, in countries such as the UK, The Netherlands and Denmark private non-profit organisations had become the second most important source of funding by the end of the period.

The share of HERD financed by business showed positive growth rates in all EU countries during the 1980s. This increase has been particularly important for the nations that started from a low share, while countries such as Germany and Ireland, which already had relatively high values, witnessed only a moderate rise. The case of Belgium is peculiar. Although Belgium had the highest share of HERD financed by business enterprises in 1983, significant growth continued throughout the period under consideration so that industrial funding was responsible for about 10% of HERD performed in Belgian institutions by 1995. From 1989 onwards, at the aggregate level (seven countries combined), the share of business enterprise funding remained almost constant. However, at country level different tendencies can be highlighted. The countries with high levels of industrial funding for university research witnessed constant or decreasing shares of business funds (for certain countries there was a reduction in real amounts of funding), while most of the nations that had started from a low share showed positive growth rates.

In the thirteen years under consideration, the share of HERD financed by government decreased by about eight percentage points. Two periods can be identified. In the first, up to circa 1989, increased industrial funding accounted for most of the difference. In the second period, during the 1990s, other sources of funds, such as private foundations and the European Commission, contributed significantly to the funding of higher education expenditures on R&D, while business funding stagnated or, in certain cases, even decreased.

Although industrial funding of university research showed indications of stabilisation during the 1990s its share of total HERD was about 6% at the end of the period under study, representing the second most important source of funds (in some countries such as Germany, Ireland, Spain and the UK, it reached about 7%).[55] Most of these funds are channelled to universities via contract research or co-operative R&D projects with industry. Although these links may be of various types, they are all characterised by an exchange of knowledge among participants, with the university usually being the most important supplier of knowledge.[56] These collaborations are also the result of policies aimed at raising the apparent economic returns from publicly-financed research by stimulating interactions between universities and industry. The goal is to increase the transfer of knowledge from the university. An example is the LINK programme to promote collaboration between university and industry in the UK.

3. The Changing Rationale for University Research Funding.

This section, after briefly reviewing the confrontation between the post World War II rationale and the developing new rationale for scientific funding, analyses the objectives, resource allocation mechanisms, and implicit assumptions of the new rationale.[57] On the basis of this analysis, the following section shows that the potential advantages of the contractual-oriented approach could be counterbalanced by long-term disadvantages arising from unintended outcomes of the new rationale.

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[55] Recently released OECD figures on the share of HERD financed by industry in 1997 are almost identical to the 1995 figures with an average EU share at 5.7%.

[56] A large body of literature has been devoted to the analysis of university-industry co-operations. For an analysis of the different types of linkages see, among others, Blume (1987), Malerba *et al.* (1991) and OECD (1984, 1990a). For an analysis focused on the US context see, among others, Etzkowitz (1997), Geiger (1993), Mansfield and Lee (1996) and Nelson and Rosenberg (1994).

[57] The situation in the EU countries is used as a reference in this analysis. For a discussion of the changes going on in the US see, among others, Barrow (1996) and Slaughter and Rhoades (1996).

The Rationale for University Funding

The move towards indirect control of university behaviour via financial incentives and government push for increased co-operation between universities and industry are just two of the outcomes of a re-examination of the rationale for resource allocation to university research that are taking place not only in the UK but, to varying degrees, throughout Continental Europe as well.

The 'canonical' model of university research funding, arising from the dual considerations of expanding student enrolment and the building of greater university research activity, developed after the Second World War. It related academic quality to the level of funding. The increase in public funding was grounded on the premise that the proportional rise in academic quality (for both teaching and research) would foster the welfare of society. Crucial to this view are the following two assumptions. First, the transfer of knowledge from basic research to commercialisation is seen as a linear process. In this linear model, basic research (mainly carried out at the university) leads to applied research and development and then to commercialisation.[58] Second, knowledge is a public good with important positive externalities and hence there is a need for public funding to reach a socially more appropriate level of investment. As education is characterised by positive externalities, this reasoning is also applicable. On the basis of this model, governments, first in the US and then in the European countries, regarded scientific research as a source of future welfare, and directed a large amount of financial resources towards university research.

In the post World War II rationale, resource allocation to universities, as compared to other publicly-funded sectors such as health care, was mainly based on an *ex-ante* judgement of research promises and therefore was influenced by the priorities of the academic community. Two main reasons justified the self-determination of priorities by the university community. First, as the research output (and the value of education) is difficult to measure, the people in the best position to evaluate it are the practitioners, that is, the academic staff. Second, the strong conviction that the internal social organisation of the university was the most appropriate means for managing university activities supported the claim of autonomy in the definition and control of university behaviour.

Based on these premises, a predominant post World War II rationale for university research funding was to fund research considered by the academic community to be most worthy. Grant allocation via the peer review system, and allocation of block funds to the university on an incremental or formula basis, the most common practice in the European countries, were the mechanisms used. In return, scientists were producing new knowledge that, due to its ‘public goods’ nature, would enter into other knowledge production processes within and outside the university. This system was paralleled by public procurement which, although less comprehensive than that developed in the US, supported university research to support the state, such as in the case of the French grandes écoles or the reliance on universities for defence research in the UK.

The economic crises in the late 1970s and the rise in inflation put national budgets under strain. Although the scale of university activity continued to increase, lobbying from other publicly-funded sectors, such as health and social security, for reduced public budgets put increasing pressures on university research funding. In the same period in most European countries universities were going through a phase of increasing bureaucratisation and massification and consequent loss of prestige in the eyes of the public. These phenomena opened the way to a more direct intervention of government in the guiding of the research enterprise. From the early 1980s onwards there has been a transition from the post World War II rationale for scientific funding to what can be referred to as the contractual-oriented approach to university research funding. During the 1990s, also due

[58] For a clear analysis of government expectations from scientific research generated by the successful use of scientific discoveries made during the World War II, see Brooks (1996) and Geiger (1993). For an early formulation of the rationale used to justify the public support of science, see Bush (1945).

to government budget constraints resulting from the enforcement of the Maastricht criteria for joining the common European currency (the EURO), science funding shifted from a period of continuous budgetary expansion to one of constant or shrinking budgets as shown in the previous section.

Two main features characterise a contractual-oriented approach to university research funding. First, the university is required to support aims that are intended to enhance national economic development and the strengthening of competitiveness. Second, to obtain this result, and to increase the short-term efficiency of the institution, the government makes increasing use of competitive mechanisms for resource allocation. These two points are discussed below.

The Role of the University in the New Rationale for Resource Allocation

A new government vision of the role of the university characterises the contractual-oriented approach to university research funding. Although there are some differences in the views of various European nations, the following can be considered to be the principal social goals for the university system as defined by governments:[59]

1. To reproduce existing levels of knowledge.
2. To improve the critical reasoning capabilities and specific skills of individuals:
   - 2.1 as an input into their public and private work activity;
   - 2.2 as an input into the development of a democratic, civilised, inclusive society.
3. To increase the knowledge base:
   - 3.1 by pursuing knowledge for its own sake;
   - 3.2 by pursuing knowledge and its application for the creation of wealth.
4. To serve the specific training and more general research support needs of the knowledge-based economy at local, regional and national levels.

The first two aims correspond to the traditional role of the university as an institution for the preservation and the transmission, through education, of knowledge, culture and social values. The third social goal, although referring to the traditional role of the university as a site where knowledge is produced through scholarship and research, defines the action of the university in a broader sense and changes the 'control' of the research agenda. Scholarship and research should be pursued at the university for the production of knowledge for its own sake and for the production of a stock of useful knowledge that might be applied at other sites resulting in benefits to society. Moreover, university research should also aim at the direct production of applied knowledge for the creation of wealth. Finally, the fourth social goal assigns a new role to the university. Universities are seen as direct actors in the process of economic development. In this new role, the university has to satisfy the knowledge needs, in terms of teaching and research, for economic development at local, regional and national levels.[60]

Two streams of thought are at the basis of the new government vision of the role of the university. Although both have been highly criticized, analysis of the debate is beyond the scope of this article. On the one hand, on the basis of the *laissez-faire* philosophy, and due to the process of globalisation and resulting increased international competition, a number of politicians and industrialists have begun to perceive the contribution of universities to wealth creation and national competitiveness as being insufficient. From this point of view, public funding of university research

[59] See, among others, Commission Jacques Attali (1998), Ministero dell'Universita' e della Ricerca Scientifico Technologica (1997) and National Committee of Inquiry into Higher Education (1997).

[60] For example, the report of the Commission Attali puts particular emphasis on the fact that the university has to act directly as a producer of innovation: “les universités devront contribuer à la création d’entreprises et à leur développement. Pour cela, elles devront valoriser leur recherche, prendre des brevets, organiser des entreprises en leur sein” (p.23).

is expected to result in more concrete and direct returns. Hence, university research should reflect more closely the scientific and technological needs of society, and universities should co-operate with firms, becoming the suppliers of applied knowledge that can be readily transformed into innovations that increase the competitiveness of national industries.[61]

On the other hand, the increased complexity of scientific research and the development of cross-field research, for example information technologies and molecular biology, underscores the relevance of knowledge production based on cross-disciplinary and cross-institutional collaborations. On the basis of this observation, it has been claimed that the nature of the scientific investigation process is changing from the search for new knowledge in a single discipline to a search process that cuts across disciplines, institutions and methods. In this highly controversial view of a changing process of scientific discovery[62] the university ceases to be the leading player in the process of knowledge creation and becomes only one of the possible sites where knowledge is produced (Gibbons *et al.*, 1994). From this perspective, the structure of the university is not suited to the new process of scientific discovery and, therefore, without radical structural changes, it cannot claim the current level of public resources.

Competitive Mechanisms for Resource Allocation

The contractual-oriented approach to university research funding is based on the use of financial incentives to control university research behaviour indirectly. Quasi-market incentive schemes are applied to steer university research behaviour towards the accomplishment of new objectives and to increase the short-term efficiency of the institution. Policies are implemented to increase the concentration and selectivity of research funds and, more generally, to improve accountability and reduce costs. Although direct competition is not permitted, government attempts to simulate market actions by adjusting its demand for university services in response to absolute or relative institutional performance (Massy, 1996). To implement a system that enables the evaluation of performance a series of administrative measures would need to be to be created.

The clearest example of the contractual-oriented approach in Europe is the market-steering model developed in the UK. This has two main thrusts. First, as a result of budget constraints and competition for funds from other publicly funded sectors, the overall government contribution to the total research incomes of universities is reduced or maintained unchanged in nominal terms. This strategy is pursued not only to stimulate cost-minimizing behaviour in the universities, but also to create incentives for the development of research activities that might receive funding support from non-government sources such as firms and foundations. Second, a reallocation in government funds is implemented with a decrease in general university funds and an increase in direct government funds. A larger allocation of resources through specific grants allows government to develop policies aimed at a more purpose-directed allocation of research effort, and at the creation of quasi-market incentive structures that permit indirect control of university research behaviour.

Other European countries, such as The Netherlands, Finland, Hungary, Poland and Portugal, have started to implement similar approaches to university funding (Geuna, Hidayat and Martin, 1999). van Vught (1997), for instance, suggests that the new government strategy towards higher education in The Netherlands is the outcome of both government planning and market-coordination. In other countries, such as France and Italy, government proposals for changing the organisation of the higher education system are currently under discussion.

National policies aimed at concentration and selectivity of research funds may be further reinforced by the research actions of the EU. The four Framework Programmes of the Commission of the

[61] For a criticism of this view on the contribution of university to the welfare of society see Vavakova (1998).
[62] For an analysis supporting this view see, among others, Gibbons *et al.* (1994); for a criticism of the approach see, for example, David, Foray and Steinmueller (1999) and Pestre (1997).

European Communities in support of R&D co-operative projects have been characterized by a highly competitive approach to research funding. Universities have increasingly taken part in these co-operative R&D projects, and have become the largest single type of institution in the Fourth Framework Programme both in terms of the number of times they have participated in an EU-funded R&D co-operative project and in terms of funds received (Geuna, 1998a, 1999).

Given national differences, the core of the new resource allocation system resides in an *ex-post* evaluation of university research performance via market forces or simulated market actions. First, most non-government sources of university research funding, especially industry funding, are characterized by a high level of competition and by a continuous short-term evaluation of research outputs. Second, direct government funds are allocated through competitive mechanisms, such as tenders with specific targets and limited budgets, on the basis of the past performance of the applicants and the 'excellence' of the proposal, and involve repeated evaluation of the outputs. Finally, an increasing share of general university funds is granted through simulated market actions such as the case of research funding being allocated to universities in proportion with their previous research performance.

The contractual-oriented approach to university research funding is based upon the following main assumptions. First, that it is possible to evaluate the quality of the research output accurately. Second, that it is possible to identify the most promising research avenues. Third, that cost reductions can be achieved without any decrease in the quality of the output. Fourth, that due to the existence of scale and scope economies, the concentration of scientific capabilities increases the research output of the system. And fifth, that the administrative costs of assessment and evaluation, for both government and universities, linked to the implementation of a competitive system, are small compared to the cost savings.

4. The Unintended Consequences of the New Rationale for Resource Allocation

This section assumes that the new rationale stimulates cost-efficient behaviour from universities insofar as it creates incentives for productivity increases and cost minimization, and explores whether or not the negative unintended consequences of the new rationale might prevail in the long run over its assumed advantages. More specifically, the analysis focuses on the long-term implications of a strong reliance on quasi-market mechanisms for public funding and of increased industry funding for university research. In this connection, the following four issues are examined: 1) increased concentration of resources; 2) disproportionate incentives for a short-term foreseeable research endeavour; 3) changing incentive structures; and 4) exacerbation of the impact of cumulative and self reinforcement phenomena and, in particular, of the Matthew effect.[63]

Increased Concentration of Resources

One of the aims of the allocation of government funds via the simulation of market conditions is to obtain a higher concentration and selectivity of research funds, which will permit the exploitation of economies of scale and scope present in the research production process, and to orient the research towards the needs of society.

First of all, it is important to notice that the existence of scale and scope economies in university production is an assumption for which there is no strong empirical evidence. Indeed, the literature

[63] For the original definition of the Matthew effect in the sociology of science see Merton (1968). Merton (1968, 1973) and some of his students, see for example Cole and Cole (1973) and Zuckerman (1977), suggested that the organisation and resource allocation structure of science tend to reward successful individuals and groups with access to means that increase their probability of being successful in the future. For an early analysis of the relationships between scientific productivity and cumulative effect see De Solla Price (1963, 1976). For an economic analysis of the Matthew effect and its implications for resource allocation see Arora and Gambardella (1997), Dasgupta and David (1987, 1994) and David (1994).

concerned with scale and scope economies in university production offers a blurred picture. There are two main approaches. The first evaluates economies of scale and scope for the joint production of teaching and research using econometric cost function estimates (Cohn, Rhine and Santos, 1989; Johnes, 1997).[64] The second studies the relationship between size and research performance applying statistical-descriptive tools (Martin *et al*., 1993; Johnston, 1994). Neither approach provides unequivocal answers. While there is some general consensus on the existence of scale economies in teaching and administration, when research production is included the empirical evidence in favour of scale and scope economies is more mixed, with cases in which department size and scientific research productivity have no or only weak negative correlation.

Furthermore, uncoordinated multiple sources of research funding might result in negative unintended consequences that could offset the potential positive effects of the contractual-oriented approach. This could occur both at the national level, as a result of the existence of diversified competitive national sources of funds, and at the European level, as a result of the existence of national and EU funding sources. For example, due to its competitive character, industrial funding will tend to be mainly funneled towards the top universities, which, via simulated market actions, also receive the largest share of public funding.[65] In the UK, 33% of the total university research income from industry was accounted for by only 6% of the institutions (seven institutions) in 1996-97 (HEFCE, 1998). On the other hand, multiple sources of funding may help to offset the danger of scientific sclerosis in established ideas that can occur when only one agency in a monopsony position allocates funds relying on an established group of peer reviewers.

An overlap of industrial funding with increasingly selective public funding may create an increased concentration of resources. The following are the unintended consequences of this situation. First, given the fiscal limits of the public sector, the trends towards increasingly selective funding will reduce the availability of non-competitive public funds –*i.e.* funds allocated in a proportional way. The allocation of resources on a basis other than merit enables human resources and research organizations to develop and express their potential in ways of their own choosing, and hence allows the public agency to collect information about research potentials. The distributive allocation of funds also offers the possibility for researchers and research organizations of unknown 'quality' to perform research outside the programmatic agenda. Their success or otherwise in producing relevant results from the research funded in this way is a source of information about their capabilities that can be used in future allocations of finance by the funding agency. The scientific capabilities of a researcher (or research organization) tend to be uncertain in the early phases of her/his career. In acknowledging this situation, the Social Science and Humanities Research Council of Canada (SSHRCC) weights the proposals from young scientists more heavily than their CVs in the evaluation of research applications (the reverse of the normal evaluation procedure). Competitive allocation mechanisms that concentrate funds in a few highly productive institutions generate less observable experience with research performance by other institutions and individuals. Thus, the selective funding approach, although efficient in the short term (the most productive universities/research organizations are those that receive the largest share of the funds), could have negative long-run consequences for society in preventing new scientists who have bright ideas, but work in less esteemed institutions, from developing their potential. Indeed, only a fraction of human resources and research institutions are able to express their quality, leaving research potentials unexploited.

[64] For a criticism of this approach see Getz, Siegfried and Zhang (1991).
[65] Arora and Gambardella (1997) show that due to an information externality problem, firms have lower incentives than public agencies to fund scientists and institutions of unproven scientific capabilities. However, especially for small firms, the fact that universities are located nearby can become a factor as important as their scientific capabilities.

Second, the local positive externalities and the scale and scope economies produced by the geographical concentration of scientific capabilities and the concentration of a large part of research resources in a few universities, could be offset by the negative externalities imposed on the universities that are marginalized by this process. For example, the knowledge of researchers at institutions with few or no resources to conduct fundamental research will tend to become stale or obsolete, preventing them from teaching and carrying out targeted research in a way that is effective in terms of social needs (Dresch, 1995).

Third, quasi-market allocation mechanisms for public funding and increased industry funding of university research push universities to reduce the 'price' of their services. It is economically rational to set these prices at levels below the amount required to maintain the portion of the university that is not 'fully employed.' The costs of the institutional and research infrastructure, such as the library, may be only partially covered depending on whether the competitive conditions support the attribution of these to research contracts. Moreover, universities are ill-prepared to account for the real opportunity costs of the involvement of their scarce resources in contract research for industry. Professors or other researchers are likely to set prices based upon the incremental costs of an activity rather than at levels that will permit reproduction of their intellectual assets. In effect, individual researchers are unlikely to have a realistic idea of the depreciation of their own intellectual capital or will take the view that in the long run (when they retire) the university will have had to make investments in younger researchers to retain the competencies of the institution. Industrial contracts enlarge the dimension of the laboratory with an increase in the number of junior staff, but they rarely cover the costs of the involvement of senior faculty, or the increasing organizational costs and the use of the infrastructure, which is only marginally covered by overheads. The adaptation to the new funding system requires a process of learning that may take several years.[66] Hence, contract research for industry may result in a form of public subsidy for particular industries for the type of research that firms would otherwise have had to finance on a full-cost basis. This situation is particularly important for universities with very low research receipts from government, that are thus pushed to rely more heavily on industrial funding. Being in a weak financial situation, they find themselves in an asymmetric bargaining relationship with industry. This in turn can result in a large amount of these universities' research resources being tied up in routine contract work for industry. Researchers, technicians and the scientific instrumentation of these universities are thus employed to develop a type of research that translates public support of universities into subsidies for specific firms in the private sector.

Disproportionate Incentives for Short-term Research

The push towards tighter interaction between university and industry, with the aim of possibly fostering national competitiveness and economic development, and the use of *ex-post* evaluations of university research performance via market forces or simulated market actions, could create disproportionate incentives for short-term research. In such circumstances, university research will tend to respond to the short-term concerns of industry and, in addition, the *ex-post* evaluation approach emphasizes the recent quantifiable outputs of the institution, without taking into account work in progress or the long-term development of projects or capabilities. As a result, projects with a long-term horizon will be less likely to be performed. The contractual-oriented approach creates disincentives for researchers to become engaged in this type of project as they do not produce quantifiable outputs at the time of evaluation. This is the case with the Research Assessment Exercise in the UK which evaluates the four best publications produced in a window of 4/5 years. Hence, with this incentive structure, application-oriented short-term research will substitute for long-term research in the university research activity portfolio, dismantling what was the core activity and the source of comparative advantage for the university. Furthermore, the lack of

[66] An interview with the manager of the transfer office of the Université Louis Pasteur of Strasbourg confirmed that, although the university has a long history of university-industry relationships, a large number of professors still have problems in correctly accounting for their opportunity costs.

incentives for path breaking, and consequently more risky, research decreases the probability of scientific novelty, potentially reducing the new knowledge base from which new technological innovations can emerge.[67]

Conflicting incentive structures

Different competitive research-funding sources create diverse incentive structures. Researchers and, in general, research organizations face different incentives and constraints depending on the source of the funds upon which they rely. In a very schematic way, a researcher is paid on the basis of the teaching she/he does, the non-contractual research she/he carries out (general or fundamental research), the contract research she/he is involved in, and the administrative and other duties she/he performs. However, in practice, research and teaching activities overlap at least partially, so the research activities carried out at the university cannot easily be allocated to the sources of funds. Hence, the behaviour of the research organization (sum of researchers' behaviours) is the result of the interaction among various incentives and constraints originated by different research-funding sources. In the case in which the incentive structures lead to conflicting behaviour, tensions would characterize the organization of university research. For example, secrecy and applicability of research results are cases in which incentives and constraints created by industrial funding conflict with the more traditional university research behaviour (David, Foray and Steinmueller, 1999). To the extent that the practice of secrecy or delay in publication is typical of contract research carried out for industry, this conflicts with the incentives to publish that originate in the scientific reward system based on priority claims and reputation building typical of traditional university research (Dasgupta and David, 1994). A striking example is the case of scientific research in chemistry where, increasingly, papers cite patents not because the technological innovation patented was produced before the paper, but because the researcher, being financed by industry, had to wait for approval of the patent application before being allowed to publish her/his research.[68]

Furthermore, in certain cases, the impact of the various incentive structures is proportional to the support provided, while in others it can be more or less important. In the former instance, where there are multiple sources of funds equally weighted, university behaviour is driven towards accomplishing diverse aims depending on the weight of the various incomes in the total research budget of the university. In the latter instance, the incentives associated with one subsidiary source of funds may dominate university research behaviour, distorting the role played by the university and thus reducing the social benefits of the allocation of public resources to university research. This is more likely to occur when general government research funds are fully utilized. In these circumstances, new research activities should be supported by other funds, hence the incentive structure stimulated by these funds may have an impact on university research behaviour disproportionate to the level of resources supplied (OECD, 1990b).

Cumulative and self reinforcement phenomena

The increased reliance on quasi-market incentive schemes in university research funding, and the existence of diversified non coordinated competitive funding sources, may exacerbate the importance of the cumulative and self-reinforcement phenomena present in the process of scientific production. Since the seminal work of Merton on the Matthew effect (1968), it has been

[67] The following two examples, among many others, are of relevance here. "When James Lovelock sought funds to study the distribution of CFCs in the atmosphere he was turned down, for making 'one of the most frivolous applications' the committee had heard. Years later his work proved a key to understanding the causes of ozone hole…Crystallography experts told Max Perutz and John Kendrew they were crazy to attempt to solve the structure of protein molecules using X-rays. For more than ten years 'they had no success at all' (Kendrew). It took over twenty years to achieve success" (cited from SBS).

[68] The sources of information for this example are personal communications with directors of chemical and pharmaceutical laboratories at the Université Louis Pasteur of Strasbourg.

recognized that the organization and resource allocation structure of science tends to reward successful individuals and groups with access to means that increase their probability of being successful in the future. The new economics of science has elaborated this concept in terms of path-dependence and self-reinforcing mechanisms.[69] The reputation of a researcher (group) derives in some measure from prior success, but this may be due to good luck and not to 'real' innate abilities. On the one hand, a lucky researcher may have an early success that feeds subsequent performances putting her/him on a high productivity path. On the other hand, an unlucky, but possibly talented researcher, may have problems in getting work published, leading to decreased means to fund further research and reduced self-motivation that will drive her/him onto a low productivity path. An extreme case of government trying to maximize the return on R&D investment can be modelled as a multi-armed bandit situation with each researcher being an arm. Eventually one researcher gets all the money (Cowan, 1991). The same mechanisms can be applied to groups, with the additional problem that groups, especially disciplinary departments, may be more long-lived than individuals.

In this situation, quasi-market allocation mechanisms based on *ex-post* accountability not only produce a biased evaluation of real scientific capabilities, but also, due to their mechanistic accounting, tend to reinforce the virtuous and vicious circles described above. Moreover, the existence of diversified non coordinated sources may further reinforce the cumulative process.[70] In fact, on the one hand, the concentration of public funding in a few institutions because of competitive resource allocation, augments the probability of attracting other competitive research funds for these universities and, on the other hand, decreases the attractiveness of the less supported institutions to external providers of funds. As pointed out above, this latter type of university will be pushed to carry out routine contract research to attract money from industry. This in turn may lead to a reduction in the quality of scientific output, which will further reduce the probability of attracting research funds targeted to high-quality research.

5. Conclusions

EU countries implement different approaches to public university research funding, forming a continuum of possible funding configurations. On the one hand, countries such as the UK tend to rely most heavily on mission-oriented and selective policies, while in countries such as Italy proportional allocation policies (distributive policies) are still dominant. Nonetheless, recently there has been a move from the traditional model of university research funding towards the contractual-oriented approach in all the EU countries as indicated by funding patterns. Policy justification or rationalisation exists for both canonical models. However, there has been too little analysis of the potential adverse consequences of the new contractual-oriented model.

As a result of these changes, university research has been increasingly supported by sources of finance other than traditional government funding. Nonetheless, government funding is still crucial and industrial funding has not substituted for public funding. For university departments the importance of business funding, non-profit organisations and funding sources from abroad has increased. The rapid rise in the share of university R&D financed by business during the 1980s has been followed by a period in which other sources of funds, such as private foundations and the European Commission, have contributed significantly to the funding of university research, while industrial funding has stagnated or even decreased. Foundations are increasingly playing an

[69] For the building blocks of this new theoretical approach to the organisation of scientific production, see Dasgupta and David (1987, 1994) and David (1994). For the original definition of path-dependence, see Arthur (1988) and David (1985).

[70] Although it is possible to imagine some form of co-ordination that would reduce the negative unintended consequences of a diversified funding sources structure, co-ordination failures are likely to occur at both national and European levels.

important role in the funding of university research. Thus, focusing only on university-industry relationships can paint a misleading picture of the changes in public research.

This article has analysed how changes in the rationale for, and composition of, university funding could influence the behaviour of these institutions. In particular, the 'unintended' consequences of the re-examination and modification of resource allocation to universities have been examined. It has been shown that problems arise due to 1) increased concentration of resources; 2) disproportionate incentives for short-term foreseeable research endeavour; 3) conflicting incentive structures; and 4) exacerbation of the impact of cumulative and self-reinforcement phenomena present in the process of scientific production. These problems result in the negative unintended consequences that may prevail over the predicted advantages of the new rationale in the long run.

To test the behavioural hypotheses set out here would require time-series data on funding and research outputs at the institutional level, which are not available at the cross-country level in Europe. Nonetheless, many of the implications of these hypotheses can be tested by using cross-section data at a specific moment in time, while others can be verified for a single country or for a particular type of competitive funding.

More generally, the result of the analysis indicates the need for a better balance between allocation mechanisms based on quasi-market schemes and more distributive approaches. In this way, the short-term benefits of the new system might be obtained while minimising the long term negative consequences. Also, institutional innovation is required to mitigate the potential negative consequences of the contractual-oriented model. Finally, universities need to more actively promote their role in society and mobilise political support on their behalf so that they can exercise countervailing power against purely commercial and short-term interests.

Appendix

Table 3: HERD Funding Sources by Countries

		B*	D	F	G*	Gr	I**	Ir	Nl	S	UK*
	1981	39.4	10.9	45.1	18.7	10.5	0	14.9	5.7	13.0	20.5
Direct	1985	43.4	12.2	47.0	19.8	n.a.	0	11.5	7.1	24.1	25.0
Govern.	1989	25.5	20.6	48.1	22.4	12.0	0	19.0	7.8	27.7	27.6
%	1993	25.3	20.9	46.2	21.0	15.7	0	23.0	5.2	20.4	27.4
	1995	38.0	22.6	46.0	n.a.	13.3	0	20.0	6.3	30.1	29.9
	1981	46.8	85.6	52.6	75.6	89.5	96.2	67.6	91.1	87.0	64.8
GUF	1985	43.4	80.7	49.4	74.3	n.a.	98.0	66.0	88.1	74.7	57.2
%	1989	52.2	70.5	45.5	70.6	71.6	96.4	46.7	87.6	62.0	47.3
	1993	50.4	66.5	46.1	69.9	43.4	93.4	41.1	90.7	69.6	41.9
	1995	34.9	66.8	44.6	n.a.	59.1	92.0	42.0	79.3	40.3	37.8
	1981	2.9	0	0.9	0	0	0	0.4	0.3	0	3.8
HE	1985	2.7	0	1.4	0	n.a.	0	2.3	0.2	0	4.2
%	1989	5.6	0	1.0	0	0.3	0	4.2	0.1	0	4.8
	1993	3.4	0	2.3	0	5.9	0	4.4	0.1	0	4.3
	1995	6.8	0	4.0	0	4.1	0	4.5	0.3	13.7	4.2
	1981	9.3	0.7	1.3	5.7	0	2.7	7.1	0.3	0	3.1
Business	1985	8.7	1.0	1.9	5.9	n.a.	1.5	6.9	1.0	1.1	5.2
%	1989	12.6	1.5	4.6	7.0	6.2	2.6	9.2	1.1	9.2	7.7
	1993	14.6	1.8	3.3	8.1	3.8	4.8	7.1	1.5	5.9	7.6
	1995	10.6	1.8	3.3	7.9	5.6	5.6	6.9	4.0	8.3	6.2
	1981	0	1.6	0.1	0	0	0	2.6	2.3	0	5.6
NPO	1985	0	4.3	0.1	0	0	0	1.9	3.1	0	6.4
%	1989	0	4.4	0.1	0	0	0	1.8	2.9	0.5	8.4
	1993	0	5.0	0.2	0	0	0	2.1	2.2	0.6	12.2
	1995	1.0	4.5	0.5	0	1.0	0	2.5	6.5	0.5	14.1
	1981	1.6	1.3	0	0	0	1.1	7.3	0.3	0	2.2
Abroad	1985	1.8	1.8	0.1	0	n.a.	0.6	11.4	0.4	0.1	2.1
%	1989	4.1	3.0	0.7	0	10	1.0	19.1	0.5	0.7	4.1
	1993	6.2	5.8	1.9	0.9	31.1	1.8	22.3	0.3	3.5	6.5
	1995	8.7	4.2	1.6	1.2	17.0	2.4	24.0	3.5	7.0	7.8

Source: elaboration OECD data.
*: 1983-1995.
**: Italy does not supply a breakdown between Direct Government and GUF, the value refers to total Government funds.
B=Belgium, D=Denmark, F=France, G=Germany, Gr=Greece, I=Italy, Ir=Ireland, Nl=The Netherlands, S=Spain, UK=United Kingdom.
GUF= General University Funds, HE= Higher Education (own funds), NPO= Private Non-Profit Organisation.

Due to the different ways of classifying the various funds, a zero value either refers to zero funds or the inclusion of the funding type in a different class. With the exception of Denmark, France, Italy, Ireland, and the UK in all the other countries there are breaks in the series for a few sources of funds. Portugal is not included due to incomplete time series.

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Trends in science policy: Governments priority setting

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Governments are strong players in science policy, and one of the strongest instruments used in science policy is allocation of money to research. National governments finance a substantial proportion of the total amount spent on R&D in all European countries, meaning that they finance a great part of research activity. In this way national governments are significant actors, playing the role as principals in science policy with research institutes, universities and research councils as agents.

The proportion of the total funding of research and development coming from government sources varies across Europe, from a little more than 20 percent in Belgium to close to 70 percent in Portugal. (OECD Science, Technology and Industry Scoreboard. Towards a Knowledge-based economy, 2001 fig. A.3)

The variation in the relative size of government financing out of the total financing of research and development is so big that it in itself raises the issue of the role governments in different countries assign to research and development, and that is an issue that can be studied as such, but it is not the object for this presentation. Another aspect of funding is the relative size of business financing of R&D across Europe, and the proportion of funding from other national sources and sources abroad to science and technology in Europe. Among these themes we could put special focus of the relative proportion of EU funding of research in each of the European countries. Each of these issues or themes can deserve a treatment in itself, but again that is not the object for this presentation.

Percentage of GBAORD as an indicator of priority
In this presentation we argue, that it is relevant to look at governments' budget allocations for research (GBAORD) as an indicator of national science policy. Especially it is an indicator of science policy when we look at changes over time specified according to the objectives for the funding, since the relative ups and downs of different objectives can be taken as indicators of changes in governments priority setting regarding different research objectives. The argument is that the greater proportion of the total budget allocated to a specific objective the higher priority the specific objective can be said to be given and vice versa.

Government appropriations or outlays for R&D, the so called GBOARD indicator measures the funds committed by governments for R&D to be carried out the following year. The figure for the single year is based on estimates coming from the different ministries etc., and for that reason the measure can be an object for change, but it is nevertheless the best indicator of a government's priority setting.

Data on government budget appropriations or outlays for R&D provide an indication of the relative importance of different research areas, and when the analysis is made for changes in the annual proportion of GBAORD allocated to the different socio-economic objectives, we get a picture of changes in priorities.

The actual size of the amount allocated to a specific objective is of interest to a discussion about science and science development, but when talking about priority-setting within science policy, it is the proportion and the changes in the proportion of total government funding of R&D that is of interest.

Method and data
In this presentation GBOARD data are shown for a series of European countries for a period of twenty years from 1981 to 2001. The data used come from the OECD BSTS database (Basic Science and Technology Statistics, OECD 2000, cd-rom version).

The figures 1 to 8 illustrate each the relative funding of a specific socioeconomic objective and it illustrates the trend in the relative proportion of GBAORD allocated by different European countries over the twenty year long period to a series of objectives.

Attached to the series of data in the OECD database there is a list of notes including information about brakes in series etc. For the purpose of the analysis presented here, we have not taken any notice of such notes; the notes are not expected to have serious influence on the overall picture to a degree that damage the presentation, since it is primarily the overall pattern and not the exact measure for the individual country that is of interest in this presentation.

Hypotheses about European trends
The hypotheses to test with the data contained in the GBAORD database specified for socioeconomic objective are the following:

Hypothesis no. 1: *The European integration impact model for science policy*

Due to growing European integration and due to increased European cooperation among scientists and not the least among science policy makers it is expected that the pattern in priority setting increasingly will tend to be the same for all countries. Over time, we will expect more and more likenesses in priorities the greater the integration becomes.

Hypothesis no. 2: *Nation specific differentiation in European science policy*

The alternative hypothesis is that there is a kind of labour division across Europe, so that governments allocate money to nation specific objectives. This type of allocation can be a result of a strong position at the national level, be it historical, cultural or scientific. If this hypothesis is correct we will find very big national differences according to differences in strength and former investments.

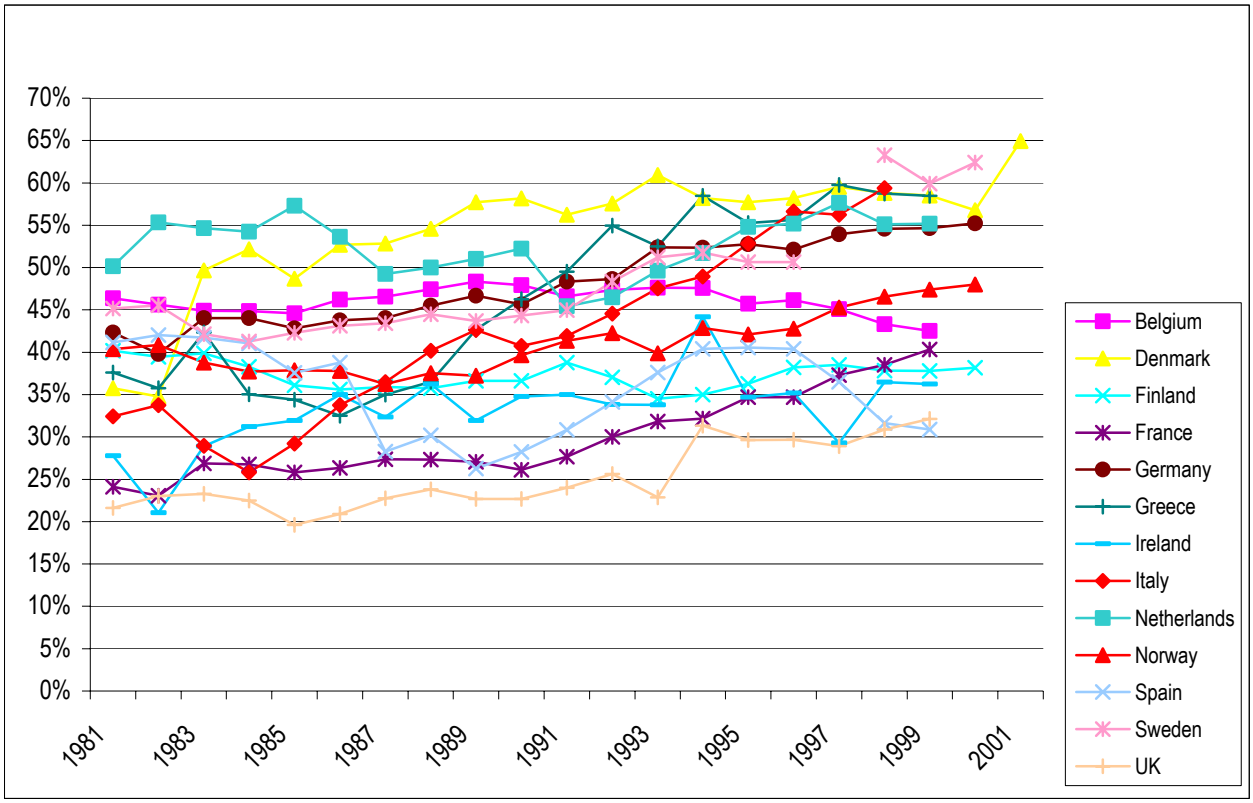
Finally there could be a third hypothesis: *Regional specific patterns in science policy*.

This hypothesis is more vague in its character, and it has its background in other types of explanations than the abovementioned integration influenced versus nation specific science policy. Regional differences might be explained by factors that might not be nation specific, but might be culture specific referring to culture or other types of common orientation in a region, defined as a series of countries. Such factors might be political ideologies, or political system character like for instance we usually refer to as a joint political and cultural frame for the Nordic countries, for Scandinavia. When the Scandinavian countries behave a like it can eventually be explained with reference to likeness in political culture, and the same can eventually be the situation for other groupings of countries.

Patterns of priorities in Europe
Below we present different figures, and we warn you that the scale is different for the different objectives, not to make illusions but due to a wish of greater options to follow the patterns, where there are small differences among countries, but nevertheless changes over time. Eight out of the eleven possible objectives given in the database are presented in objective specific figures. Health being an area for measurement in the R&D statistics is not included in this analysis since this objective is very much influenced by regional and local money in many countries. This research area has by OECD been treated as an area in itself with specific measurement problems, (see OECD Health-report), civil space and exploration and exploitation of the earth and atmosphere are the two remaining areas not presented in figures.

In the first figure it is the objective "general advancement of knowledge" that is the object for analysis.

Fig. 1: General advancement of knowledge.

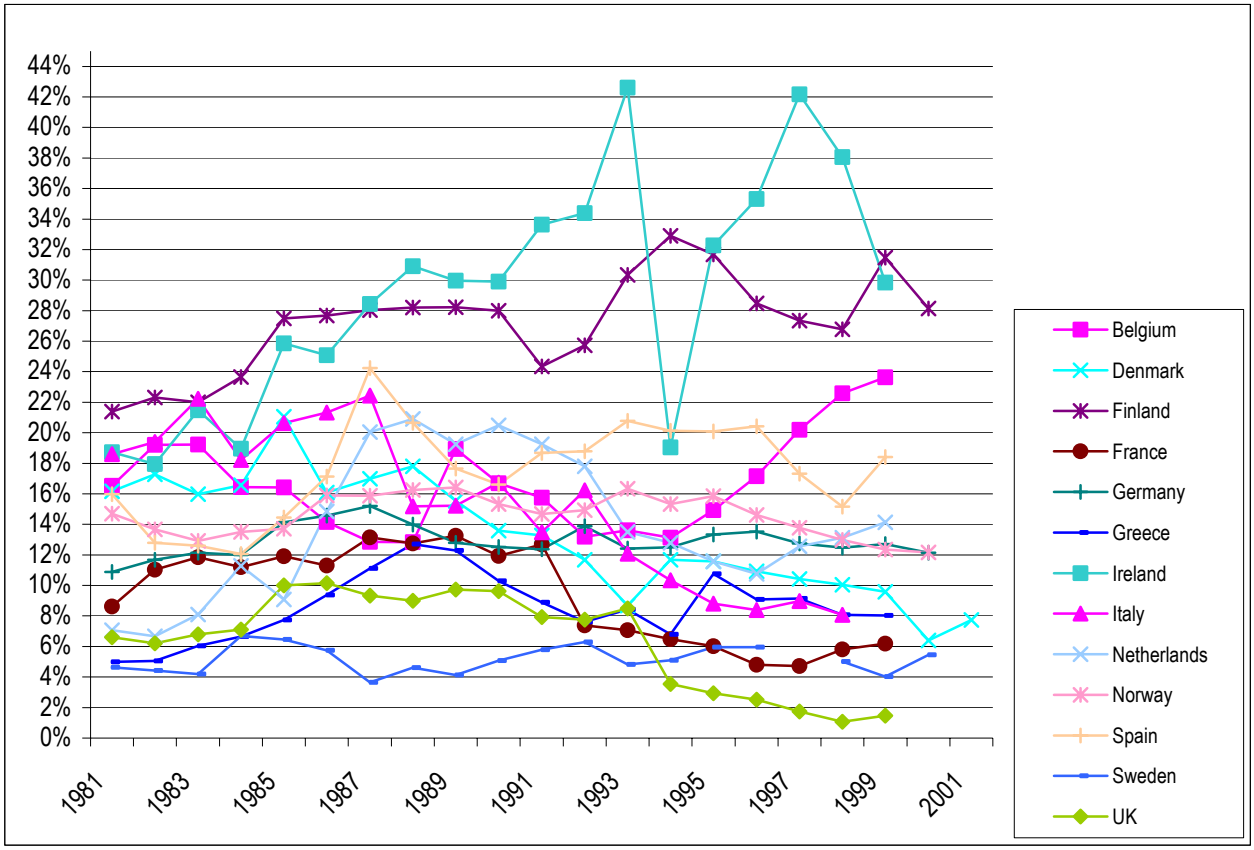


Source: OECD BSTS 2000 table 18

The objective in this figure can to a certain degree be taken as funding of universities and in this way of basic research, but it also includes other public types of funding of advancement of research, like those going through different research councils etc. This objective is far the biggest in all European countries; the variation across Europe in the percentage allocated to general advancement of knowledge out of the total GBAORD is between 25 and 60 percent in the end of the 1990'es. Albeit we in the figure can find some ups and downs, **the general picture found in this figure is growth in all countries but a few**. Only in Spain and to a certain degree in Belgium we find decline in priority regarding this objective in the second half of the 1990'es. (A remarkable increase in defence as a priority area for Spain in the second half of the 1990'es might explain the

changes, see figure 8, while the relative upgrading of industrial development in Belgium and higher priority to civil space might explain the relative changes for Belgium, see fig. 2).

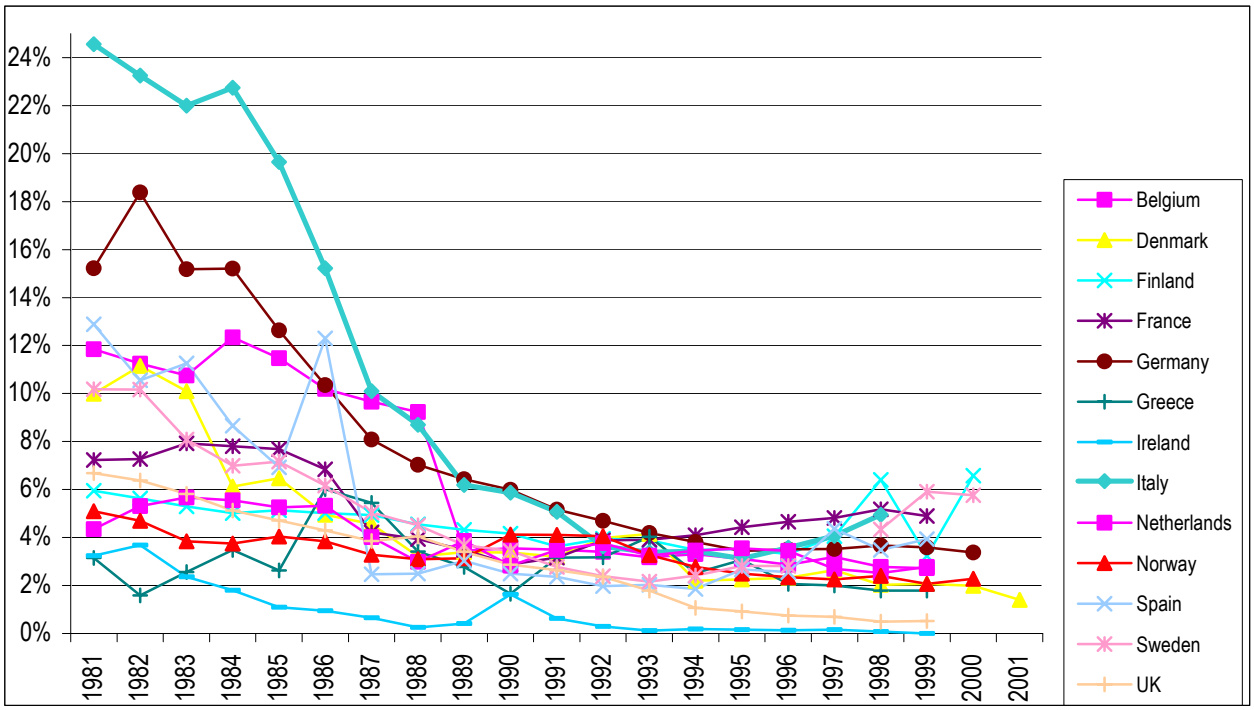
Fig 2: Promotion of industrial development and technology



Source: OECD BSTS 2000 table 18

The overall impression from the curves picturing the percentage of GBAORD given to promotion of industrial development and technology is that **the variation has increased**. Some countries, in the figure that is shown Finland and Ireland have given a significantly higher priority to the objective in the period with more than 25 percent allocated to this objective. The Irish data reflects some fluctuations that might need a special explanation, but the rest of the countries included in the analysis have given reduced priority to research of direct relevance for industrial development and technology. Finland is known for its high priority of industrial development supported by the government, so the figure does not only indicate higher priority in Finland than in most countries, but the Finish trend together with the Irish show that these countries over a long period, defined here by 20 years have put much higher priority to these objectives than all other European countries. The increased priority we find for Belgium is in a comparative perspective late, although we find the Belgian priority relatively high and ranking third among all European countries back in 1989, but then followed by a remarkable decline before the upward trend from 1995. In summary the picture shows falling priority for the majority of countries and special priority by the few. The figure indicates that Spain has given relatively high priority with a peak in 1987. **The socio economic objective, promotion of industrial development and technology has been an object for specific national policy**.

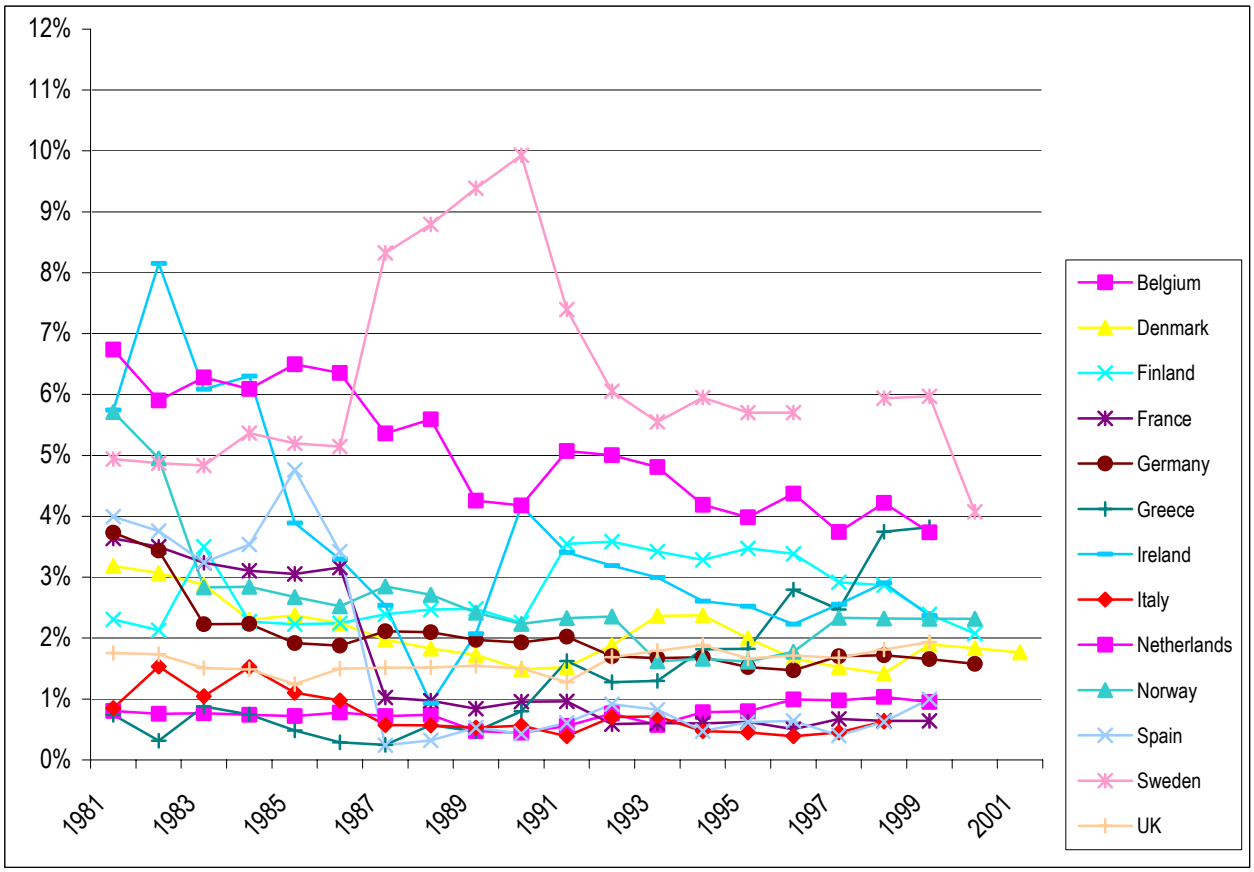
Fig.3: Production and rational use of energy



Source: OECD BSTS 2000 table 18

The data presented in figure 3 show clearly that there has been a general downgrading of this area in proportion to other areas in almost all countries. From a variation between 3 percent and 25 percent back in 1981 we find a narrowing in variation with a range of percentages (variation width) only varying between zero and 6 percent. It looks like the longer away we get from the oil crises the less Europe care for research and development with respect to energy. The picture drawn by all the European countries from 1989 to 2000 indicates **a European wide downgrading** of this research area in the research policy presented here measured as percentages of total government allocation of funds for research and development. Recently there are small signs of increased Finish priority, but still the percentage is not more than 6 percent.

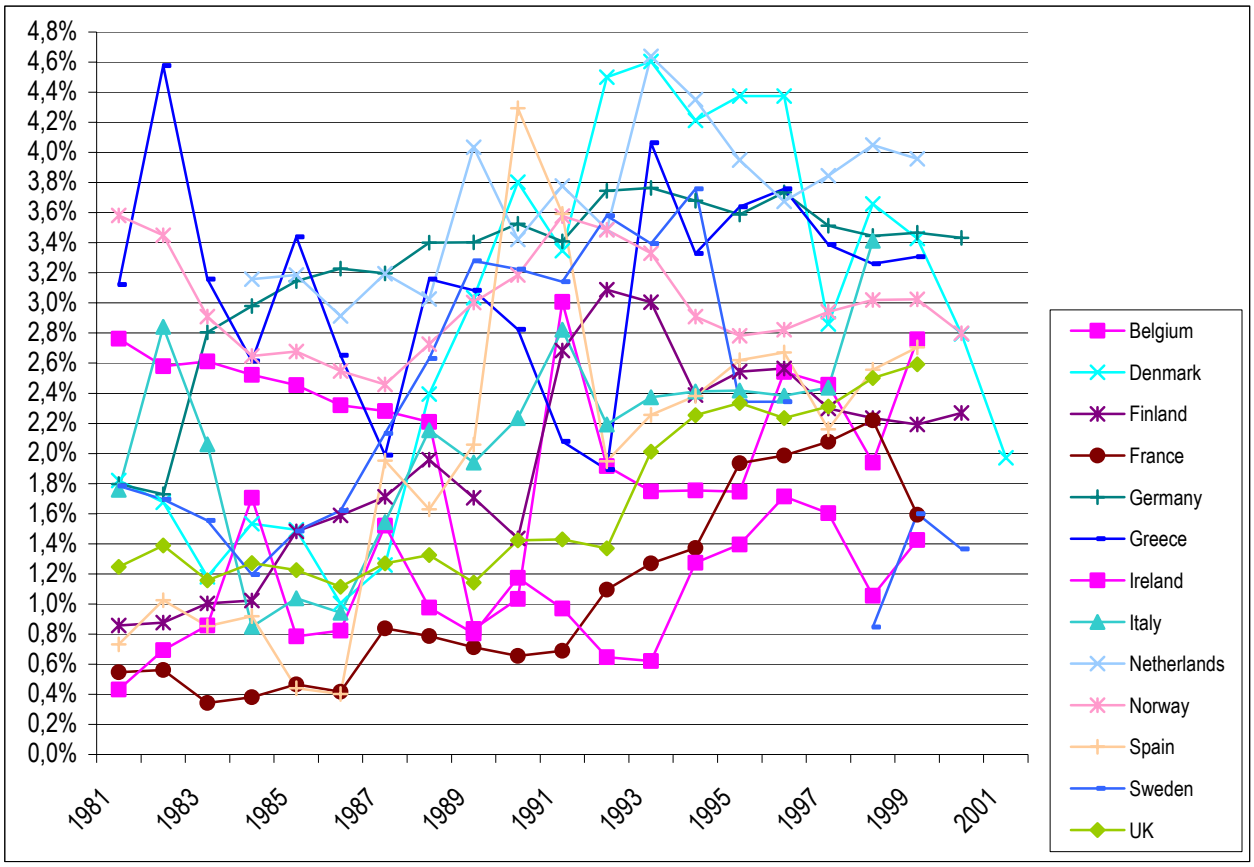
Fig. 4: Development of infrastructure



Source: OECD BSTS 2000 table 18

The figure with the percentages of total allocation to research and development given to development of infrastructure shows that the objective “development of infrastructure” for years have had a significant high priority in Sweden. For the majority of countries the relative percentages were below four and for the year 2000 the relative priority given by Sweden to this objective also was down to four percent. The Netherlands having had a relatively high profile has gradually reduced the priority down to four percent of the total amount allocated to research and development. In summary the picture is that of a European low priority at a level less than five percent of total GBAORD. **The European countries seems to agree that development of infrastructure has relatively low priority**. The most recent figure for Denmark for the year 2002 indicates changes in priorities, since this area according to the Danish budget proposals for 2002 is more or less the only area with a significant increase in the actual amount of resources as well as in the proportion of the total budget allocated to research.

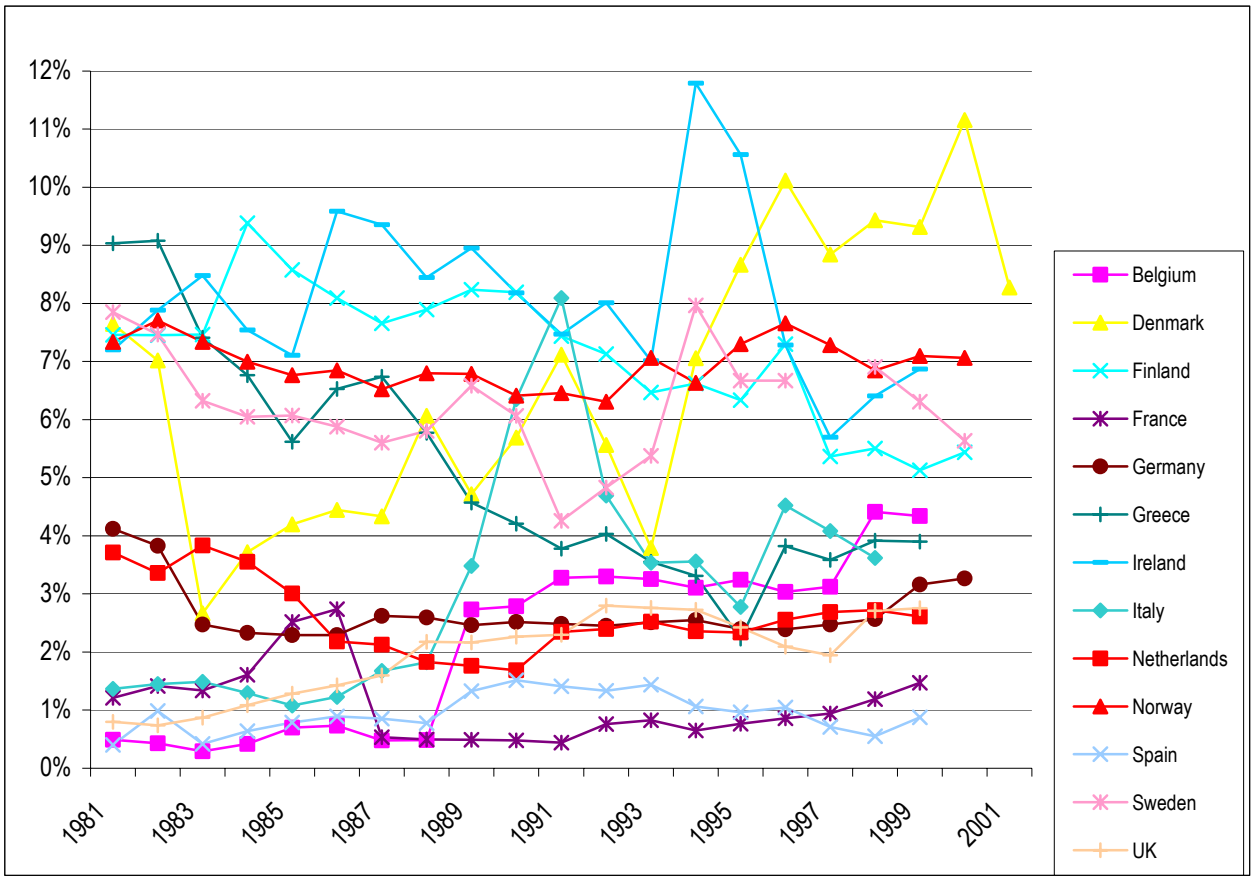
Fig.5: Control and care of the environment



Source: OECD BSTS 2000 table 18

This figure is extremely interesting, since it shows so many variations in the relative priority given to environment. It is probably relevant to conclude that it is situational determined in most countries. Only a few countries show general increase in priority setting with respect to environment, France and UK both showing an upward trend in priority of environment. But for all countries are the priorities given to environment during the period from 1981 to 2001 less than five percent of total GBAORD. The fluctuations for the research in environment in a given country are nevertheless great. In summary the message is that environment is **generally a low priority area** and varying a lot from year to year.

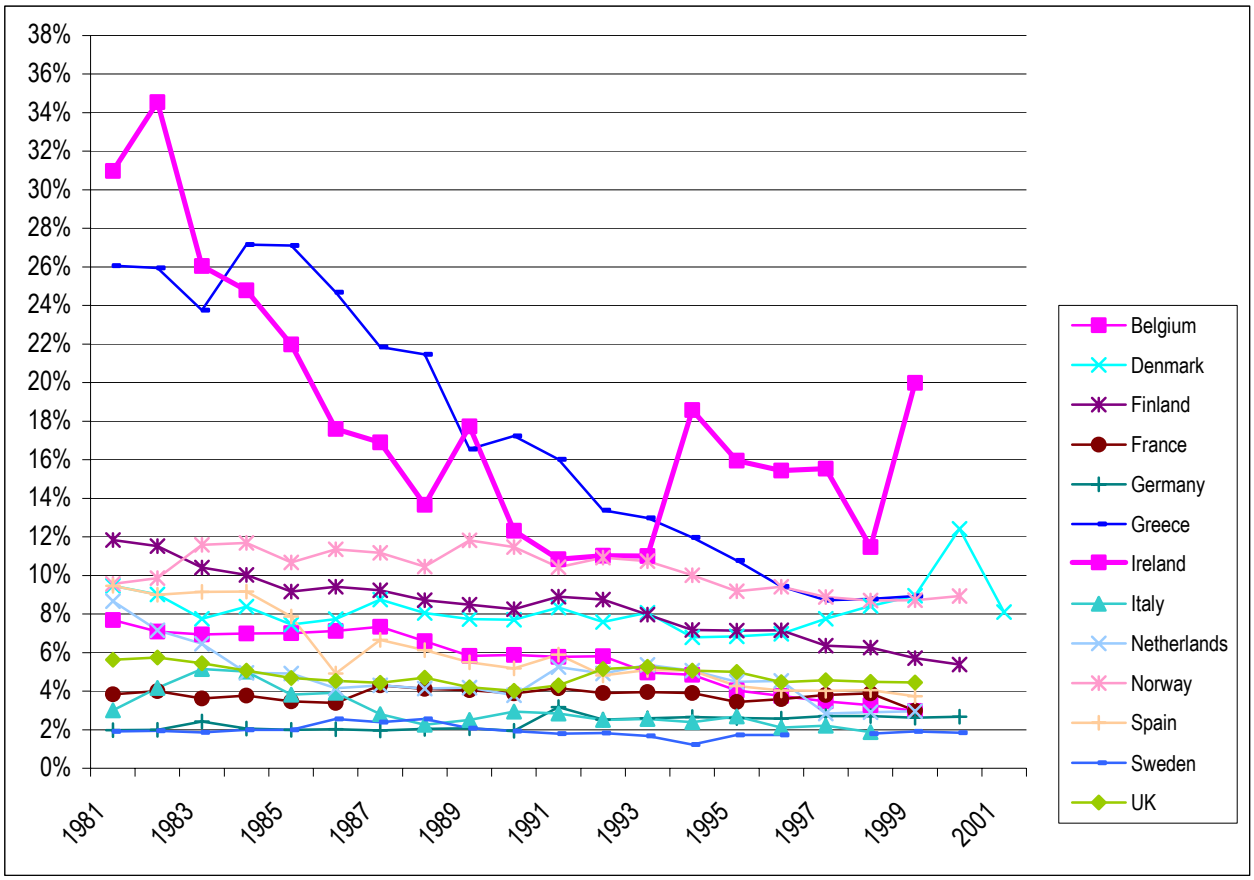
Fig. 6: Social development and services



Source: OECD BSTS 2000 table 18

With respect to investments in research within the objective “social development and services” we find the Scandinavian countries deviating from the rest of Europe due to generally higher proportional allocation within these countries to this objective. The Scandinavian countries together with Ireland are the only countries with more than five percent allocated to research within this area. During the period from 1996 to 2001 Denmark had more than any other country put high priority to social development and services. For Ireland we see a peak for 1994 and since then a reduction. The figure for the social objective named “social development and services” show signs of **national as well as regional priority differences.**

Fig.7: Development of agriculture, forestry and fishing.

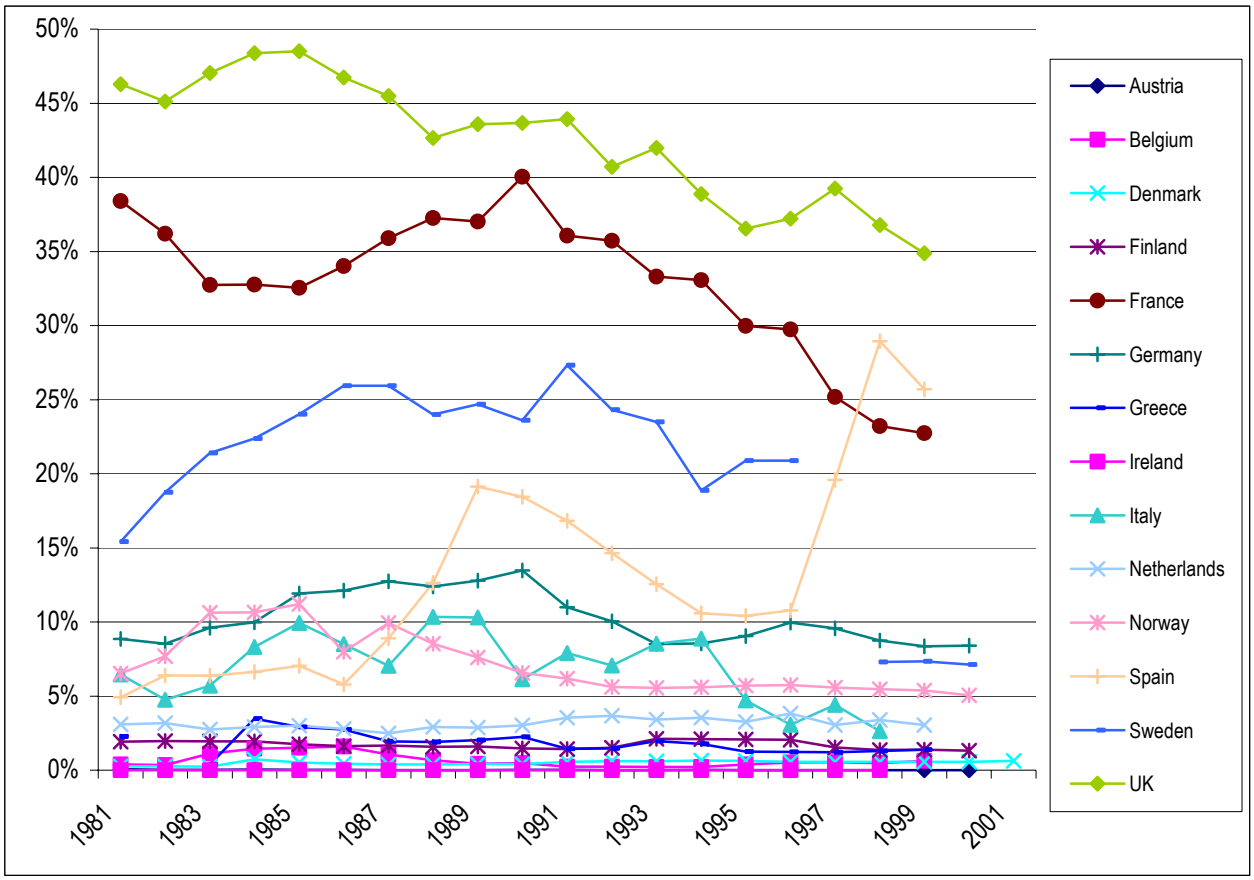


Source: OECD BSTS 2000 table 18

In figure 7 showing the relative allocations of funding to development of agriculture, forestry and fishing we find that almost all countries agree about a level of less than ten percent of total government appropriations allocated to this area. Countries like Ireland and Greece have for years given higher priority to agriculture, forestry and fishing than all the others, but since 1996 all countries but Ireland (and Denmark for a single year) allocate less than 10 percent to this objective. The economic development and the general focus on industrialization can explain these changes.

In summary we can argue that there is a **wide European agreement** with respect to priority given to this social objective, since only one country really deviating at the end of the 1990'es.

Fig. 8: Defence as socio economic objective



Source: OECD BSTS 2000 table 18

Defence is an objective, by some taken as the main objective for investment in science and technology. Figure 8 shows great variations between countries; for some countries it is a top priority, so it is for UK, for France and also for Sweden it has been a top priority area; for the rest it was not. For Sweden we see a break in the data series, this break might indicate more methodological changes than priority changes. **Generally it looks like a falling priority for all**, even for those traditionally giving high priority to research and development within defence eventually to be explained by increased distance in time back to the cold war. The recent attack on USA on September 11 2001 might change the priority setting. The only country showing significant change in prioritising of this area higher since mid 19990'es is Spain, where 25 percent of the 1998 and 1999 budget was allocated to defence.

Conclusion:
Changes in the percentage of government budget allocations (GBAORD) specified according to socioeconomic objectives is used as an indicator of priority-setting in this testing of the hypothesis about pattern of priorities being more and more a like due to a European impact on national Research policy. The information contained in GBAORD is not used as a measure of ups and downs in absolute funding of different research areas. The information contained in the OECD database might not for all years be correct, but the idea behind using the data has not been to report about individual country changes in priority from one year to another. The idea is that the overall picture in itself can indicate a trend, a trend that might be a European trend.

The argument behind this presentation has been that different patterns in changes in GBAORD for the European countries specified according to socioeconomic objectives over time can be taken as indicator of relative priority setting.

The trends found are European for most objectives and in this way a strong support for the hypothesis expecting European impact; so it can be said for “general advancement of knowledge”, showing general increase indicating higher priority to basic science all over Europe or at least showing higher priority to general knowledge, but also for most of the other objectives we find European trends.

For several socio economic objectives the variation is within a rather narrow range for most of the European countries, indicating again a European agreement regarding priority setting. That is the situation for energy, for environment and for agriculture, fishing and mining. And also for “exploration and exploitation of the earth and atmosphere” (no figure presented) we find a narrow range of countries with less than 2,5 percent of the total budget allocation for research and development with Greece as the only country outside this range of countries with a little more than 4 percent allocated to this socio economic objective.

We find regional patterns to be explained by political visions or political culture as we see it for the Nordic countries with respect to Social development and service.

Finally we find still country specific patterns supporting the competing hypothesis in form of relatively high versus relatively low priorities for the socio economic objective “development of infrastructure”. And also with respect to defence we find country specific priorities to be explained by patterns of national orientation.

We also find country specific patterns in form of high priority selected objectives, outstanding compared to all other countries in fig. 2 for industrial development and in fig. 8 for defence. An analysis of civil space (no figure presented) show likewise a very varied prioritisation with Belgium and France being the countries giving most priority to this area with more than ten percent of the total GBAORD followed by Italy, while all the other European countries allocates less than five percent to civil defence at the end of the century.

The area of science and technology that makes one wonders the most is the environment objective: Is it as situation-specific as it looks? Or has the area found other types of resources to keep a stable ongoing research activity. Is energy an area to which resources are coming from other sources than government sources? The last question can be asked in addition to the trends we find for all objectives; but that does not make the use of changes in government allocation of money to different objectives invalid as a measure of government priority setting.

Further analysis

The hypothesis about increased European likeness tends to be confirmed in this analysis, although there are significant signs of national strategic policy priorities. Further testing of the hypothesis can be made on the basis of data for new member countries over the years to come. Will all members of the European Union tend towards getting the same research profile measured in form of percentages of the total government budget for research allocated with more or less the same distribution. Will the national differences be left to the business sector or will that sector as well follow the European trend? A special analysis is needed.

The role of EU money is a chapter in itself. Will an increase in European funding in general increase the European likeness in research profiles? The future will show!

Chapter 8: Summary & conclusion

The idea of this concluding chapter is, first and foremost, to consider the implications of what has been learnt during the workshop for improving our understanding and management of the complex and hence uncertain links between science policy aims, processes and downstream scientific activity, outputs and outcomes.

Not surprisingly, the workshop did not lead to any unambiguous conclusions, but still a number of important insights were obtained and discussed. In broad terms the positive outcomes of the workshop can be divided into two categories. Firstly, the workshop enabled examination of a number of detailed presentations, which gave the participants opportunity for comparative discussions of how similar science policy problems were dealt with in different countries. Secondly, the workshop made the discussion of a number of more generic, theoretically inspired issues possible. These two aspects of the workshop are also central in the structuring of this conclusion, which has been divided into two separate parts. The first part is a relatively concrete discussion of the actual content and interrelations of the contributions and discussions, whereas the second part is a more abstract theoretical discussion of some of the generic conclusions that can be extracted from the workshop.

Science Policy - Setting the Agenda for Research - Summary and discussion

As described in the introduction, science policy is a relatively new policy area, which nevertheless already has undergone several structural changes. New political initiatives and new institutions have been created in many countries; often with the attempt to formulate and implement clearer priorities as a central aim. The consequences of these changes are highly uncertain.

Given these changes, this workshop has looked into the question of how science policy today functions as an agenda-setter for research. Uncertainty seems to have become a growing problem for science policy makers as the traditional foundations for science policy increasingly have been questioned by many; not only from a theoretical but also from an empirical perspective. In the following some of the main arguments and conclusions from the workshop will be drawn to attention.

Actors and institutions in the priority-setting processes

A main aim for the workshop and this report was to enable discussion of the role of different actors in the priority setting processes. Across Europe there are many different actors trying to set the agenda for research. Governments are actors in all countries, and in most countries they are the strongest single actors. Therefore government initiatives naturally were central for a workshop with the topic "S*cience policy - Setting the agenda for research"*. Government initiatives had to be discussed, and therefore also the trends in government initiatives regarding the agenda for research were highlighted at the workshop.

Seen from the point of view of the national governments the central object for science policy is, of course, the research, and the final target are the research groups, albeit they are not the only target group, and although many agents may operate between the decision makers and the actual researchers.

Gonzalo Leon gives in his presentation of the priority setting process at the national level a picture of the many forces influencing the setting up of priorities for research. And there are many. He argues that the thematic priority setting process is intertwined and closely related to the prioritisation of instruments as well as the budgetary prioritisation. The main drivers for policy action in this area are moving along three axes trying to find an equilibrium point.

On the basis of Spanish experiences he argues, that many different types of priorities are influencing the priority setting process. Foresight studies, skill evaluation, sectorial priorities and community and administrative interests are all significant elements.

Another important point is, that the increasing number of actors in the priority-setting processes makes coordination and cooperation at the national level more and more important. Gonzales argues that there will be a need for a more pro-active administration, since the ideas and the priorities have to be sold to citizens, as well as to researchers and other actors related to the science and technology system. The agora shall not only be informed but also persuaded that the right prioritisations are made in science policy.

Leon Gonzales and with him several other participants predict a further concentration of priorities, since there are not resources for everything, and at the same time he stresses that the process of prioritisation has to be seen as continuous. The publication of a plan, be it regional, national or European will not be the end. The system able to handle an indefinite row of plans will have to be professional and adaptive to different settings.

In the relation between the government and the scientific system a number of intermediary institutions play a very important role in the priority-setting processes. In most countries the research councils are the most important group of institutions at the intermediary level, and accordingly a number of contributions concerning this central institutional actor were discussed at the workshop. As described by Margareta Bertilsson the traditional research council system was originally based on aristocracies in the form of groups of excellent researchers, but as central institutions in the contemporary priority-setting processes the research councils have increasingly come under severe pressure. The contributions showed, that there has been attempts to reorganise the research council system in a number of countries to give the system a more strategic role, and this have placed the intermediary level in a difficult position between the increasing demands from governments and other external actors on the one side, and the expectations from the scientific community on the other side. To make matters worse, these actors are not necessarily unitary actors, as the Norwegian contribution showed. The demands from the government can often be divided into several different categories, where different sector ministries are trying to set their own agenda. Similarly the reactions and perceptions from the scientific community can differ greatly depending on disciplines or fields, as David Grønbæks contribution showed. In spite of widespread academic resistance towards large parts of these contemporary forces for change, the demands of strategy-planning and priority-setting have changed the working-conditions for the research council system in most countries significantly.

During the workshop it was accordingly discussed whether research councils were still a viable concept. What will their role be in the future? Bureaucratization and professionalization is under way as a demand for more efficient handling of the policies to be implemented. And research councils are also under attack from some researchers, not wanting councils to go between them and the money allocated from governments as Hans Skoie argues. It is argued by some that resources can be allocated directly to the research institutions without establishing a research council system. This seems to be the case in most of the countries in southern Europe including France, Portugal and Spain. In a MUSCIPOLI-perspective further research on how the priority-setting processes in these systems function without the existence of an intermediary level could be highly interesting.

Another aspect of the role of the research councils is their function as advisory bodies, besides their main function as funding agencies. Research councils are traditionally established as funding agencies, following to some degree governments initiatives, but beside these funding responsibilities, the agencies very often have the responsibility for giving advices of relevance for science policy. This advice is often limited strictly to professional disciplinary questions related to

the field of the council, whereas the more overall political questions are left to advisory bodies at the national level. As mentioned, not all European countries have the research council system, and accordingly not this advisory system, but we find the special national government advisory bodies without any kind of funding function in almost all countries. These institutions are not all alike, and differences in the structure of government advisory bodies in Europe were described by Enno Aufderheide from Germany. The identical feature is, that they all involve a kind of broader societal representation than the research councils, but at the same time there are major differences across countries, when it comes to influence, independence and institutional background of members and chairmen.

Besides the governments and the more or less independent institutions at different levels of the national public science policy system, we find in all European countries the private sector as an important policy maker. This type of actor is found to play a very significant role across Europe albeit varying in size and impact as described briefly by both Aldo Geuna and Karen Siune in their presentations, and discussed more extensively by Maureen Gardiner and Bjarne Lundager Jensen, who represented British and Danish business actors. The private sector represents one of the forces working across Europe for changes in the design of science policies, and as the Danish example showed very clearly it is an actor with a clear agenda, and at the same time an actor with the will and resources to actively trying to influence the priority-setting processes.

The multi-national dimension of large company activity creates the need for research relationships in a number of countries, but in general researchers and public research agencies operate on a timescale, which are very long compared to business planning cycles. A greater mutual understanding is needed between industrial actors and research agencies, it was argued by Maureen Gardiner. Involvement and experience is a necessary precondition to better the interplay between industry and research.

Another important actor discussed at the workshop was the European Union. So far the European commission has played a minor role, measured in percentage of European funding out of total funding of R&D within a given nation in each of the European countries, but in terms of input in form of setting the agenda for research the European commission and DG Research is much stronger, since the policy created at the European level also influences the policy at the national level. And the impact of the European commission is expected to grow. How will the interplay between national and European actors function, taken into consideration that there are well established, and in some countries very old, agencies for administering the research policy put on the agenda by one or another type of national policy maker?

The internal forces for change or stability

The pressures from the governments, industry and EU are just some of the many pressures coming from external forces. But also internally, that is within the research system itself, there are forces pressing for changes. As described above the *agenda for research* is under influence from different types of actors, but the research system itself is an actor, albeit it is sometimes treated only as a reacting body, reacting on the policy initiatives coming from outside the research system. The workshop took this type of actor into consideration and included researchers reactions to science policy initiatives as an act in itself influencing the agenda for research. And the conclusion was, that we need more studies of researchers reactions to science policy. Further exploration of what causes the differences in researchers response - whether intrinsic to the policy or related structures or processes, might yield some practical lessons for policymaking. It might also help modelling a more well-functioning system, as would a better understanding of how far research councils regard the outcomes of their policies as negotiable, and how this affects the nature of feedback into the policy-making cycle. As Kamma Langberg pointed out, the reactions of the research community are important for the impact of new initiatives.

Lena Tsipouri treated from a slightly different approach the perceived and the actual roles of academics in science policy. The focus here was not on the scientific communities reactions to new initiatives, but rather on the ways, in which the academic society can attempt to influence the priority-setting processes. In her contribution she looks at the level of involvement of academic community in the priority-setting processes at the individual, institutional and collective level. Similarly she discusses the nature and the type of this influence. She argues that all levels of representation appear in all countries, but at the same time that there are different mixes of influence in different EU-areas. And her advice is to make the system, independent of which, as transparent as possible.

Instruments in the priority-setting processes

To reach the objectives of the different science policy actors, a variety of instruments have been introduced, and a number of these instruments were presented and discussed in the workshop. The instruments that are used in science policy for influencing the agenda for research are many and varying from foresight exercises to huge strategic programmes. An attempt to create an overview of this group of instruments used across Europe was presented at the workshop by Karen Siune and Kaare Aagaard. The argument here was, that it can be useful to differentiate between the different functions of these science policy instruments. This logic divides the instruments into three groups, depending on whether they are used in the formulation of priorities, in the implementation of priorities or as instruments setting the frameconditions for research. The inventory can be seen as a supplement to the national presentations, making it possible to compare the use and non-use of instruments across Europe. One of the tentative conclusions was, that increasingly we find the majority of instruments used in all countries, albeit there can be great differences in the use and form across sectors, fields and national borders. This means, that even though there appear to be some convergence in the use of instruments across sectors and countries, there is still much left for variation in the actual design and use of instruments both at the regional, national and European level.

Policy making as well as decisions in science policy can be based on ideologies, or based on recognition of societal needs. Often indicators of different kinds form the basis for new policies. Indicators are important tools in all policy fields, and within science and technology a large set of indicators are used as basis for policymaking and policy evaluations. Annamaria Inzelt shows in her presentation about resource allocation and comparative expenditure trajectories what Europe looks like using these indicators. The conclusion is that relevant and comparable indicators are needed for all countries, and she argues that countries can learn from each other. She also raises the issue: can a European Research Area be created with participation from Eastern Europe, with CEE participation before political unification? The initiatives are there, the results not yet.

Another type of instrument is the university funding, which always has been one of the big issues in science policy. Lately it has been discussed whether there are negative unintended consequences of the current trends in European university funding? This question was raised at the workshop by Aldo Geuna in his presentation based on an article published in Journal of Economic Issues. His argument is, that we have to be very aware of negative consequences, and he argues that universities need to promote more actively their role in society and to mobilize political support on their behalf so that they can exercise countervailing power against purely commercial and short term interests, which he sees as an unintended negative consequence having greater impact than policy makers are aware of. The risk is especially great where a greater and greater part of the total funding of research come from the business sector, focusing on the short term output contrary to the long term output.

Evaluations are another important and increasingly used science policy instrument. Even though evaluation of societal quality is seen as an instrument to improve the role of science and society in the priority-setting processes, the majority of the evaluations have so far had emphasis on the

scientific performances, while methods to evaluate contributions to social and economic progress have remained underdeveloped, as both Van der Meulen and Ferreira showed in their contributions.

International trends
The actual agenda may differ from country to country as described in the national reports, but albeit national differences we find a growing likeness in the priority setting profiles across Europe, a conclusion also supported by the analysis of government priorities defined as percentage of the public budget allocated to a specific objective defined as research within a given research area. There is a growing likeness over the past twenty years across Europe in the research profile pattern. And there is growing awareness of commercial interests in science and research.

"Managing with uncertainty in science policy" that is still the topic on the agenda, and the conclusion is, that the sentence included in the title of the project describes the situation in Europe very well. Due to the uncertainty referred to several times during the workshop some will argue that there is a need for a stronger management, while others will conclude that there should be no management at all; it should all be left to researchers to decide, also the agenda. But the numbers arguing for the latter is diminishing, that is part of the picture of changes across Europe and a central element in the conclusion of the workshop. Søren Wenneberg, Nick Constantopoulos and with them many others argue that research management is one way to reduce the uncertainty.

Convergence or diversity?
Generally the workshop and this report show a picture of an increasingly complex science policy system. The priority-setting processes are important to many actors at many different levels of the science policy-system, and a variety of different instruments have been introduced to affect decisions in different systems. But even though convergence appears to be evident across countries in central questions, there also seem to be important differences. This inevitably leads to the question of how to characterize the evolution of science policy and the priority-setting processes across countries.

In a number of recent contributions to the field of science policy studies it has been commonplace to emphasize how the formulation, design and implementation of science policy have been characterized by a high degree of convergence across the western countries. Elzinga and Jamison have, among other characteristics, pointed to a methodological conformity in identifying future priorities, and an increasing international agenda-setting and "orchestration" from above through intergovernmental bodies leading to conformity in issue-perception and management (Elzinga &Jamison, 1995, 577). Similarly Ruivo has stressed that despite some national variations, there is a high degree of congruence on the core of views and instruments used. She also points to an internationalisation of science policy, where different countries are adopting the same views of science policy, their instruments and the management of science policy in general (Ruivo, 1994, 157). A theoretical explanation of this tendency can be found in the "new institutionalism", where it is argued that in situations of great uncertainty, actors search for ready-made models of what to do and imitate what appears to be a successful measure by someone else in a similar situation. When this kind of imitation happens, it leads to a convergence of policymakers' belief-systems, and the political perception of problems, orientations and goals become more and more similar across countries (Senker et. al, 52-53, 1999).

If this were the whole story, however, all national systems would look alike. But in other recent contributions it is emphasized, that even though societal dynamics and the challenges they imply for the public sector research system, the political orientations emerging in reaction to them, and the political goals arising from these orientations basically have been the same across the western countries, there are nevertheless great differences in the specific political measures, which are agreed and implemented to achieve the political goals, as well as in the effects of such measures

on the structure and dynamics of public sector research systems (Senker et al, 1999, 52). More or less the same conclusion has also been drawn by Van der Meulen, who stress how similarity in labels conceal differences in the way the relation between science and society has been organized and can be organized (Van der Meulen,1998). This is often explained as a consequence of path-dependency, where tendencies towards convergence, which might be produced by imitation, are resisted. The path-dependence results in a pre-selection of what is possible, feasible and rational in the future, and in that way the systems dynamics shapes the institutional arrangements, interest and power-constellations and the substantial tasks carried out.

This duality in the conclusions was also evident in this first MUSCIPOLI-workshop. The contributions and discussions of the workshop made it clear, that there is no unambiguous picture of the changes happening across countries. On the one hand the contributions show a number of similar development-patterns, that can be observed in most national systems, but on the other hand it also became obvious, that major nation-specific differences modifies this picture of convergence. There are definitely similarities to be seen in the funding trends, in the formulation of priorities, in the use of instruments and in organizational structures, but with a closer look some of these similarities come to appear rather superficial. Often apparently similar priorities have great differences in actual content. Even though almost all countries have for example biotechnology and IT as high priorities, there seem to be major differences in the actual formulation and implementation of these priorities.

Similarly, there seems to be a convergence in the use of instruments across countries, but even though the same instruments are used in almost all countries, there are great differences in the actual form they are given, and in the way they are used in the priority-setting processes. For example the use of central instruments as foresight, evaluation and programmes can be designed and used in a variety of very different ways, which can lead to very different outcomes.

Also the organizational structures across countries display a mix of convergence and diversity. On the one hand the basic structure of the science policy system seems to be similar in most countries (with some notable exceptions in southern and eastern Europe, where a research council system never has been institutionalised), but on the other hand important differences in the role and influence of institutions and actors could also be observed. Important examples of this tendency can in this report be seen on the question of the role and functioning of national advisory bodies and research councils.

Consequently the design of science policy and the actual outcomes of the priority-setting processes can be varying significantly between different countries depending on national policy cultures, where changing constellations of actors, processes, procedures and instruments strongly affect the final implementation of priorities.

The WHAT and HOW of science policy priority-setting

In this second part of the final discussion the primary focus will be on what has been labelled the WHAT and HOW of science policy priority setting, and especially the basic questions of the project will be drawn to attention again. Even though it has just been stressed that the science policy convergence-thesis should not be taken to far, the workshop also showed, that there are a number of more generic conclusions to be drawn from the contributions and discussions. In the following it will be tried to extract from the contributions and the discussions of the workshop some of these more generic issues or questions that have been raised, sometimes explicitly, sometimes implicitly. Similarly a number of issues and questions that have not been raised, but should be raised, will also be drawn to attention. These are issues, which transcend the differences between structural arrangements at the national level, and which would be pertinent to priority-setting efforts undertaken either within a ministry, research council, or other type of intermediary organization.

Furthermore they relate directly to what the originally focus of this workshop was supposed to be, which is essentially:

- WHAT is the agenda; and
- HOW is it designed and delivered?

Generally the majority of the contributions in this report are concerned directly with the question of HOW priorities are designed and delivered, and more indirectly with the question of WHAT priorities are – their aims and functions. Still the contributions to the workshop and this report can be helpful in answering both types of questions. In the following a number of important messages, questions and issues from the discussions and contributions will be summarized.

WHAT issues

What are priorities?
Some important issues that came out of the workshop were discussions of the basic questions: what is the agenda and what are priorities? It became evident, that there is a lack of clarity on these questions, and that these are issues that need to be examined further.
Do we see priorities in policy documents, do we see them in public expenditure profiles, do we see them in the themes that are attached to programs of various sorts, do we see them in themes in other kinds of incentives-schemes, or do we see priorities in what researchers actually do?

The OECD defines priorities as policy measures or activities that receive "special attention and thus special treatment as regards funds and/or other incentives" [OECD, 1991 #152@21-22]. Based on the workshop and this report this definition does not appear adequate, and in reality, priorities are expressed in a number of different ways (most of which have been examined or touched on in the workshop), and these different expressions may well give a different picture of what priorities are. They include:

- R&D budgetary allocations or expenditure profiles
- Topics or themes linked to national or research council programmes
- Topics linked to other types of measures, eg centres of excellence
- Overviews of actual research performance, projects actually funded
- Explicit statements in policy documents

Meaning and function of priorities
Secondly, priorities are more than just topics that indicate fields or areas or problems or disciplines, so it is also necessary to look at the meaning and functions of the list of priorities, agendas, plans and programs. Priorities can (and mostly do) mean other things, or function in other ways in different contexts, than the ones normally attributed to the term. Priorities are not always, or necessarily, or primarily about meeting the increased demands for social relevance, as the standard narrative tells us. From what we have heard during the workshop and read in the contributions in this report, priorities are also other things; they do other things. Priorities can have different meanings and different functions, including:

- They function as an organizing or coordinating tool, a way of categorizing or making sense of the R&D activities of, for example, a range of sectoral ministries or government departments (This is seen in the case of the Spain, as Gonzalo Leon presented the Spanish national plan, where it seems as if a main aim of the priority-setting process, is to coordinate the governmental R & D activity)
- They can be about creating research capacity in areas/fields/disciplines where there is international money to be had.

- They can be PR exercises, policymakers 'making noise' or showing that they are doing something (research councils showing the ministry, or the system showing society?)
- Priorities can also function as a means for creating linkages between science and society drawing societal actors in to the process of talking about what kind of research should be done (rather than, or in addition to, drawing those actors into the actual doing of science). There is an example of this function from the Netherlands, that shows that the themes themselves are less important than the interaction that happens around setting these themes.

Perhaps the distinction between meanings/functions touches on the "aims" underlying the policy process (as Chris Caswill touched upon with his model of aims — policy — science — outputs — outcomes). The question then is, whether policymakers are aware of these aims, whether they know in advance why they are setting priorities and what they intend those priorities to accomplish.

Different kinds of priorities
In relation to the previous point there is another issue, that needs to be mentioned. The workshop focused on thematic priorities, yet we need to ask ourselves to what extent one can actually distinguish between thematic and other types of priorities, for example structural priorities (which have to do with the functioning of the system) and operational priorities (which address the modus operandi of research). The primary objective of some national research programmes, for example, may be to promote collaboration with industry; the actual themes attached to such programmes then act as a way of focusing or giving direction to that structural/operational priority. Once again the themes are less important than the way in which the research is supposed to be done. We need to look at thematic priorities in terms of how they link with other types of priorities and goals in the policy process

The status of priorities
Another thing related to the "what" of priorities that came out of this workshop is; what is the status of these priorities, how authoritative are they? Not only how seriously do we take them, or how much do we believe in them. But also: do policymakers believe in them, do researchers believe in them? Do these perceptions differ between policymakers and researchers? And what affects such perceptions? We have come with different answers and ideas on the question of the status of the priorities. We have to ask ourselves: what affects the status? How much of it has to do with the meaning and function of priorities, and how much has to do with the process of setting the priorities, i.e., the 'how' of designing and delivering the agenda?

HOW issues

This leads to the other main question of this report: HOW are priorities designed and delivered? As already mentioned in this concluding discussion, the workshop did not result in any unambiguous conclusions. This is especially true for the question of how priorities are designed and delivered. This process is taking place at many different levels and in many different ways, and the groups of actors and use of instruments are not always easy to separate.

Links between science policy actors
Firstly, this has consequences for the theoretical frameworks presented: Both the principal-agent framework and the hierarchical versus network governance approach deal with the actions and interactions of different groups of actors, and they are both very focused on seeing priorities as a consequence of relations, actions and interaction within the policymaking process. In these approaches we tend to think about actors in collective/corporate terms. We set up oppositions between organizations/institutions: ministries, research councils, the academic or scientific community, industry and, even, society, but do not pay enough attention to the fact, that these

organizations and institutions are linked by people. Thus, for example, we've heard that in some cases research councils consist predominantly of scientists, or policy actors in some ministries are also scientists who hold university jobs. These kinds of linkages must impact in some way on the relationships between different groups of policy actors. The question is, perhaps, how different are these groups in reality? What does the realities of these linkages mean for the theories of relations between institutional actors and how we theorize these relations? If we ask these questions we certainly get a more nuanced picture of 'who governs science'. Exploring these kinds of linkages requires a more micro-level analysis, something we don't do enough of in science policy studies?

Democratizing the science policy process

For the theoretical approaches there are another challenge concerned with the democratisation of the policy process, that we have touched upon, but not mentioned directly. There is a lot of emphasis right now on the question of democratising the science policy process, but it is still rather unclear what this means, and how we do it?

In the theoretical approaches, the notion of 'other actors' (civil society or the public) remains a bit of a black box. Again, we need more micro-level analyses to ask questions about who these actors are. In terms of network governance, for example, we need to look at who is in the network. This can vary enormously in terms of criteria such as representivity, inclusivity, etc, and would suggest that one could distinguish between different types of networks (old boys versus ?).

But the challenge is not only theoretical. At a more practical level, the issue of democratisation raises questions like:

- How do we democratise the policy process: how do we identify society, and how do we actually get the public involved (From Portugal we had an interesting example of use of the internet in the evaluation processes)
- Why should we democratise: Do citizens know why they are drawn into the policy process, do policymakers have expectations of hearing something new from them, etc.?

Different levels of priority-setting

The workshop also raised the question of how different levels of priority-setting influence each other: We've touched mostly on the national level (ministries, research councils), yet priority-setting occurs also at the international, regional and institutional (as in universities or research institutes) level and even at the individual level. What are the dynamics between these levels, how does priority-setting at one level influence the other? To what extent is priority-setting at one level a process of adaptation to, or re-labelling of, priorities at another level.

Related to the above, is the role of the EU and of processes of Europeanisation. What exactly do we mean by the latter; do we regard it as an independent or dependent variable or both? This in turn raises questions about the convergence (or divergence) of priorities across different national contexts and the discussion of cause and effect with regard to European research activity. It also opens the way towards exploring questions about the WHY of policymaking. For instance why the need for the design and delivery of a policy for inter- and pluri-disciplinary research suddenly has come to the forefront of the political agenda?

Some of these questions will be the object for the next workshop in the MUSCIPOLI context, which will be held in Paris in May 2002. Related issues will also be on the agenda in the third and final MUSCIPOLI-workshop scheduled to October 2002, which will treat *Structural issues* concerning the optimal functioning of the science policy-system.

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MUSCIPOLI is based on a proposal to EU Fifth Framework Programme; Strategic analysis of specific political issues. Programme “Improving the Human Research Potential and the Socio-Economic Knowledge Base”, “Support for the Development of Science and Technology Policies in Europe”.

The MUSCIPOLI group has identified a number of activities, under the heading of *Managing with Uncertainty in Science Policy*. These include: three international workshops: *Priority Themes and Topics*, *Support for Transdisciplinary Research*, and *Building European Research Capacity*, handbook of policy guidelines based on experiences from a series of workshops.

The first workshop ”Science Policy – Setting the Agenda for Research” was held in September 2001 in Denmark.