Internationalisation of Research: Institutional Innovation, Culture and Agency in the Framework of Competition and Co-operation (INNOCULT)

Final Report

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The INNOCULT Final Report

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Abstract

INNOCULT is a study of RTD institutional change and innovation in the framework of the internationalisation of research, more specifically the European context.

The study features an integrated and transversal approach. Its focus is the modernisation efforts of the national research systems at the level of policy and with regard to two main institutional actors, namely, universities and research organisations. The emergence and role of research networks has been given special attention as indicative of the opportunities and problems entailed in international – and more specifically European – RTD collaboration and competition.

The study's research design combined a set of methodological tools. Besides desk review of literature and policy documentation, it included expert interviews with policy-makers of national S&T and research managers as well as surveys of research directors and researchers working at universities and research organisations as well as co-ordinators and partners of European research consortia and networks. All surveys relied on standardised questionnaires and were carried out through a mixture of electronic, mail and telephone interviewing.

At the conceptual level, the study relied on diverse theoretical perspectives. From political science it drew on the 'government and governance' literature, from sociology and anthropology it incorporated parts of 'cultural theory' and its 'grid/group' analysis, and from science and technology studies it used the concepts of 'national innovation systems', 'national research systems', as well as 'Mode 1 and Mode 2 knowledge production'. The study also drew on the 'networks' literature as well as on the latest developments in social network analysis. An extensive historical review of the evolution of the national research systems and RTD collaboration complemented the conceptual and contextual background.

The study's results show that research policy and practice in Europe – at the national level and with regard to international collaboration – operates mainly in the governance mode that relies on initiative and self-organisation supported through incentives in a flexible regulatory framework with regard to funding, priorities and evaluation.

National differences exist, yet they do not explain the variation or similarities with regard to patterns of collaboration or institutional innovation. New practices of funding, evaluation and priority setting are making inroads at policy-level and at the level of the

organisational culture of universities and research organisations, but they are not yet fully institutionalised at this level.

Networking for the purpose of jointly carrying out research is a most powerful and widely used instrument for collaboration and the transfer of knowledge. International research programmes, like the Framework Programmes, have provided a significant impetus to such efforts, but have not created networking anew. A European Research Area thus already exists – established gradually in a bottom-up way. Top-down initiatives ought to build on this rather than seeking to impose a new structure and mission in a command and control way.

1 Executive Summary

1.1 <u>The General Context and Scope of the Project</u>

The proposed INNOCULT study aims at analysing the ongoing research policies in Europe and tries to identify policies as much as strategies for the internationalisation of RTD, and, more specifically, for enhancing the opportunities for co-operation. Within these general aims, the project has concentrated on the public sector and, indeed, almost exclusively on the academic component of RTD.

The research objectives are in relation with research areas formulated in the Call for Proposals of DG Research.

Area	Research Objectives
National Science and Technology Potential	• To understand the national science and technology systems
	• To appraise the efficiency of policy and policy making in science and technology and to provide a framework for assessment taking into account the ongoing internationalisation of research;
	• Understanding commonalties and diversities of national public science and technology systems;
	• To analyse the role of the internationalisation of research and the possible emergence of a trans-national common European innovation system for the institutional transformations;
	• To consider the importance of the emergence of such a European innovation system for the competitiveness of Europe vis-à-vis the United States and Japan.
Innovation in Public Institutions	• To gain deeper understanding of how, in what circumstances and under the influence of what factors can significant institutional innovations and transformations in publicly funded research performers occur;
	• To study the relative importance of a variety of internal (such as level of cognitive development and institutional maturity) and external (such as the elements of the broader socio-cultural and political environment) factors for these institutional transformations.
Socio-cultural challenge	• Understanding the different S&T systems and the particular institutional system as result of the public political culture;
	• Understanding the regulative and prescriptive processes occurring within these as a result of cultural differentiation;
	• Understanding different reaction to the S&T-systems in the internationalisation process.

The study addresses three fundamental policy related questions:

• To what extent can one expect convergence of the RTD systems and policies in Europe?

- Is there a complementarity between the different national RTD systems; how can this contribute to the creation of a common European research area, and if not, how can this be improved?

- What role is played by the European agenda? How does this agenda, and, more specifically, the Framework Programme, influence national research policies and institutions and vice-versa?

In order to answer these questions, the INNOCULT considered both structural and socio-cultural factors that distinguish different national RTD policy regimes.

The study features an integrated and transversal approach and its goal is to provide a comparative view on institutional innovation and transfer in the public sector. The focus is on the original development and current modernisation efforts of the national innovation systems, especially ministries, public universities and public research organisations.

By focusing on European research programmes the study stresses a specific interest - often neglected otherwise – namely, the importance of stable networks for science and technology co-operation.

The study integrated research and policy experiences from Northern, Southern and Central Europe. It encompasses Austria, Sweden, Finland, France, Germany, the Netherlands, Portugal and the UK.

A wide range of dissemination activities have been provided by the INNOCULT consortium. In order to disseminate findings and recommendations, in most of the participating countries seminars and conferences were organised. A major conference took place in Brussels to discuss the implication of the findings for the New Framework Programme. Links have been established with related OECD initiatives. A series of publications and conference participations have emerged from the project. A network has been established to continue analytical work and to maintain the links between the research communities and policy-makers.

1.2 The Historical Context of Evolution of the National Research Systems and International RTD Collaboration

Is science subject to the impact of local cultures or are there innate tendencies to universalism in the scientific method? This question is fundamental for any European approach to science. After all, the 'take off' of university life occurred on a European level. Some major universities in medieval Europe attracted students from all over. It was under those conditions with students being far off the homeland track that they identified themselves with nations while pursuing studies of a universal scope. Maybe the seeds of contradiction were already sown then. It was well concealed at the time by the prevalence of a monolithic religion dominant in all scientific subject matters, which simultaneously rendered science a universal character.

Contemplating the last 500 years of European history of science one cannot help noting two parallel trends: *nationalisation* and *de-nationalisation* of science and technology. As the effects of the Enlightenment and the development of a universalistic Cartesian approach matured parallel with the rise of the European nation-state, an inevitable dichotomy was established. Whereas science according to the modernist perspective was inherently universalistic in both method and discourse, its de-nationalist epistemology demonstrated a resilient matrix. At the same time nationalist pressure kept pushing the idea of socially constructed technology which meant that the generation of scientific results was determined by national (cultural) factors.

From the Renaissance onwards science has assumed increasingly pluralist characteristics. In the long term perspective - what may seem as a paradox - this became important for the promotion of national coherence, homogeneity and prestige. As a means for economic growth, science and research were of national concern in the 17th century, when mercantilist theories flourished. Neo-mercantilism has since been perennial in the realm of science and today the phenomenon is ubiquitously discernible. As an almost analogous corollary science and technology have become de-nationalised. This term notably comprises both the universalistic spirit of a Baconian Republic of Letters, inter-national co-operation where each participating nation is eager to promote and guard its own interests, and trans-nationalisation as represented by, for example, R&D activities performed by transnational companies.

De-nationalisation can thus be seen as the dualistic process that leads to a concept of international science, half myth, half reality: the *République des Lettres*. The mythical aspect is based on ideal type visions which compete with the pull of national interests. In order to achieve equilibrium between universal thinking and the preponderance of national influences, a borrowing from Newtonian mechanics became profuse. Balance became the central concept, both in international relations and in the affairs of science.

The roots of international science are derived from the universalistic community of the medieval university which Sir Francis Bacon defined clearly in the early 17th century. The maintenance of scientific self-reflectivity was in its modern shape first manifested in what Robert K. Merton coined as CUDOS (communism, universalism, disinterestedness, and organised scepticism). The norms implied in CUDOS such as the universalistic premise, the relative disinterest in relation to the property of scientific results and myth bashing provided mankind with the benefit of the internationalist sphere.

The realist aspect of international science is based on a curious teleological perception of automatic linear progress. Scientific results are always beneficial to humanity in one way or another. Professional contacts are established across national borders between fellow scientists and scholars. Collaboration develops in an unprejudiced unselfish atmosphere. The immutable force of scientific knowledge accumulation prevails.

The realist aspect of scientific process on the other hand, must take the flora of funding sources into account. Consequently, there is a constant nagging suspicion of compromised and/or biased results in science. Hence, the politics of science has become an increasingly prominent field of research.

However, nationalisation and de-nationalisation may very well thrive together in certain circumstances. Certain fields of research, that is, those that can be characterised as *longue durée* disciplines, e.g. geology, meteorology, botany, are uncontroversial to the extent that a transnational collaboration has never been questioned. On the contrary, it is and has always been regarded as a highly natural course of development, the more so since the objects of research

are seldom confined within national borders. The same holds for physics and chemistry, so long as the research projects are of the purest 'basic science' kind.

As soon as a commercial interest enters the scene, science and research are seen as a means for economic growth. The national interest, like the Shakespearean second murderer, is a most troublesome character. As the full length report shows in detail, the history of European post-war collaboration in science and technology is full of projects where the desire to promote national interests has seriously hampered efficiency and progress. The ambition to spread production among participating countries leads to complicated production systems where costly delays easily appear. Furthermore, more recent national research policies which have been marked by the slowing of economic growth from the 1970s onwards, have largely focussed on applied science and industrial R&D, thus creating a conflict between basic and applied science. One might presume that basic science thrives best in an international setting. Applied science, on the other hand, is the primary interest of both company-funded R&D and a national research policy concerned with economic growth and competitiveness. Applied science may, to an extent, be self-generative but is often dependent on results from basic research. If the resources of a university or a whole national university system are directed primarily towards applied science, the notion of a scientific community is jeopardised as a whole.

The EU framework may provide and stimulate the dissemination of advanced technology. A condition seems to be that the parties involved fully accept their interdependence, not trying to promote their own national interests. In order to promote European scientific progress, the science community must take advantage of the full participation in peak-technological projects of also less advanced member states, regardless of any incremental costs involved. At the same time however, there is a growing awareness that the sole result of R&D is not an ever-growing supply of goods but also, in the modern 'Risk Society', an ever-growing supply of 'bads' or dangers. Should science policy shrink from tackling such problems it would be at its peril.

Even if there are basic agreements concerning criteria of high quality research for a sustainable development, there remain many visible and invisible obstacles which will be a difficult task for European science politics to sort out.

1.3   National Research Policies and the Shift from 'Government' to 'Governance'

1.3.1   Conceptual Framework

The chapter on science policies in Europe as a framework for the development and internationalisation of science and research analysis the influence of the state on the research systems. Relevant topics are policy innovation and Europeanisation. Insofar as policy innovation is concerned, the project examines the shift from government to governance. Insofar as Europeanisation is concerned, the project reports on convergence and complementarity between the European Member States.

The main distinctive feature of a ***government perspective*** is the belief that legal instruments of command can be used for policy purposes. There is considerable persuasive evidence that the inherent limits of government in this sense – which was from the post-war period to the mid-80s the *normative* policy mode in most countries – contributed directly to corporatist mediation. This was the *practically* dominant mode of research policy during the same period, and effectively underwrote a considerable degree of research sector autonomy, except in fields of "strategic" significance (e.g. nuclear physics and nuclear engineering, aeronautics, etc.).

For the purposes of analysis of research policy, the key features of a ***governance relationship*** may be stated as follows:

- the state has (or components of the state have) autonomously defined objectives (e.g. excellence, competitiveness, peaceful campuses, budgetary tightening, …),

- state actors believe that, with respect to these objectives, the research sector cannot be ordered about,

- they believe however that it can be influenced, and that appropriate policy levers exist,

- the research sector is capable of producing internally generated objectives,

- it is not however capable of existing entirely independently from the state.

The policy dynamic derives from the interaction between stimuli and systemic responses to them.

Evaluation, funding, career patterns and internationalisation are key factors in shaping the interaction between cultural styles. They are also crucial dimensions of the shifts characteristic of governance. A policy framework will be closer to a governance model when the state both recognises that the autonomy of the research sector is a policy resource and seeks to use the features of its autonomy as levers to steer it towards deliberately defined policy objectives. Once priorities have been established, funding, career patterns, evaluation and internationalisation are among the key levers available to promote indirect influence.

Policies can be implemented by three different means:

- *Orders* are issued by the state using the resource of sovereignty. They assume a relationship of authority and are backed by the availability of legal and other sanctions. The precise legal form of such orders (laws, decrees, ministerial instructions, informal commands,…) is less important than the kind of relationship they involve. Their effects on the outcomes of such activities are inherently subject to uncertainty.

- *Negotiation* implies a relationship of approximate equality between the state and some non-state actor, each of which has resources both useful and unavailable to the other. The principle of equality (at least for the purposes of negotiation) does however presume an ongoing dynamic of trust. No actor has any reason to engage willingly in negotiations if compliance with their outcomes is largely unpredictable.

- *Incentives* also presume asymmetrical resources but do not depend on any stable pattern of relationships.

As we have seen, orders are, by assumption, not relevant to a governance perspective. The characterisation of the research sector offered earlier

underlines the extent to which such a perspective is a natural response to the structural features of contemporary research systems. Even if the state was predominantly hierarchical in its internal cultural patterns, a command-based policy framework would require hierarchical resources within the research sector which are available to only a limited extent. Therefore, negotiation and incentives are the practically available kinds of levers.

The idea of governance thus offers an internally consistent working hypothesis to describe the evolution of research sectors and of policy levers in Europe.

1.3.2 Deliberate Policy Change and Policy Levers

The extent of deliberate policy change in the countries studied over the past decade is fairly limited. In addition, structures have remained broadly stable in most cases, as have funding levels and other indicators of aggregate research inputs.

A synoptic overview of policy initiatives and issues over the period 1987-2000 shows the common direction of change and the absence of any obvious pattern of diffusion or imitation. Convergence is a matter of separate trends, responding to specific measures and circumstances within each country. The political and administrative profile of research policy varies from country to country. In some cases (notably Sweden) change is a matter of explicit legislative reform; in others (notably Germany), more a matter of changing practices within established institutions with significant autonomy. In some countries, such as France, research policy has achieved a high public profile at very times during the 90s; in most other countries, research policy is usually of concern only to a very narrow policy community.

The impression of overall stability at the policy level does not tell the whole story. In most of the countries studied, perceptions within the research sector are of significant change, associated in particular with increased funding pressures, modified career structures leading, on the whole, to greater difficulties in attaining tenured positions (or stable positions with status similar to that of tenured faculty), etc. Furthermore, policy concerns about the research

sector have been very much on the agenda, and have often achieved some public prominence.

This climate of change can be better illustrated by looking at the evolution of the policy levers used by the various governments and state authorities. In most countries, legislation and regulations are less used, and incentives and negotiations are gradually becoming the most favoured policy levers.

1.3.3 National Research Systems as Five-Dimensional Spaces

In order to give a clearer comparative picture of this climate of change, it is necessary to develop tools that express the qualitative data in quantitative form. Using a range of sources, and especially the interviews and the national reports, the project analyses, in a dynamic perspective, the major characteristics of the eight National Research Systems.

The model depends on 5 dimensions: priority setting, funding, employment policy, evaluation and internationalisation. The ranking of each system on each dimension brings together the range of empirical data collected in the course of the project and describes the paths of policy change. The "pure model of governance" as a theoretical point of reference can itself be situated as a point in this five-dimensional space.

In order to compare actual systems to the "pure model of governance", it is necessary to specify which features on each dimension are relevant for a governance perspective.

- Concerning **priority setting**, governance is characterised by an explicit process of priority setting, and by the use of "top-down" instruments. Moreover, the governance mode is highly responsive to the public debates, and to internal state issues.

- **Funding** includes *basic funding*, *competitive funding*, and *partnerships between public and private sectors*.

- Concerning **employment policy**, the first feature seems to be the competitive nature of recruitment.

- **Evaluation** of research must be carried out within the scientific community, because evaluation by non-academics may call into question the research sector's autonomy. However, it has to be formally and institutionally external, in order to avoid suspicion about researchers assessing themselves.

- In the governance mode, **internationalisation** is an instrumental issue, because it is viewed as a way of promoting other objectives. If internationalisation of research favours them, then the state will actively promote it, otherwise not.

In sum, governance is characterised by the conjunction of explicit mechanisms and monitoring, by the absence of a command chain, and by a relative indifference towards the means used in order to reach the objectives.

Despite differences between countries, however, the general picture of a move towards governance remains basically valid. The main evolutions have been in internationalisation and funding.

Looking at 2000, three groups emerge:

1. The "norm" of the sample (Sweden, Finland, UK, Netherlands), which are closer to the "pure model of governance" than the other countries, especially in funding and employment policies. Three of them (Sweden, UK, Netherlands) had undertaken changes in that direction before the beginning of the nineties; some of them (Sweden and Netherlands) may therefore have remained structurally stable during the last decade. Change has been much more striking in Finland and in UK, where the move towards a governance style of policy largely results from the governments' initiatives.

2. Austria[1] and Germany are not structurally different from the preceding countries, but somewhat less governance oriented. Their current situations are nevertheless the result of totally different evolutions: Austria has undergone major changes in the nineties, especially in the areas of internationalisation, priority setting and funding, whereas Germany has remained relatively stable, except in the areas of funding and employment.

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[1] Up until 2001; the recent policy changes cannot yet be evaluated.

3. France and Portugal show structural differences from the others and from each other. In Portugal, the area in which policy in the R&D field gets closest to the "pure governance model" is employment, whereas priority setting is the from the pure model. In France, the situation is reversed, with priority setting at the highest level, and employment at the lowest. But it is undoubtedly in Portugal that the changes have been the greatest, with a political will during the nineties to undertake major reforms in the R&D field.

Overall, generally speaking, the interview data as well as the national reports support the presumption that research policy is "governance driven".

The real shift towards a governance model of research policy does not, however seem to be of a cultural nature, nor do differences between countries relate in any obvious way to cultural distinctions. Rather somewhat different strategic responses to changing environmental conditions appear adequate for explanatory purposes.

1.3.4 Governance and Internationalisation

Referring back to the original objectives, our concern is to identify policies (if any) directed at promoting internationalisation of research and to explain their emergence.

In practice, it proves difficult to separate strictly policies from a range of processes that constitute internationalisation as defined without necessarily deriving from the state, or even being deliberately designed by anyone.

The key findings are that internationalisation is a characteristic feature of research policy in general, which is currently in a phase of expansion. In this overall picture, neither self-conscious policy nor Europe are necessarily as significant as one might think. Rather, internationalisation is the result of a whole range of uncoordinated actions: to this extent it has a functional as much as a strategic logic. However, it would also be incorrect to regard it as unrelated to policy, which takes account of the functional dynamic, seeks to use it as a lever, and to some extent reshapes it.

To what extent are national policies (in terms of priorities or procedures) affected by internationalisation, and in particular by the European research agenda?

Looking at the research system as a whole, the main effect would seem to be an enhancement of those features inherently conducive to a governance oriented mode of policy. There seems to be a positive feedback loop between internationalisation and governance, where each reinforces the other.

This might suggest a tendency towards spontaneous policy harmonisation (at least in terms of procedures, levers etc.), which is not yet entirely clear. In particular, differences in evaluation cultures do not seem to be on the decline, and structural changes (e.g. privatisation, erosion of tenure, …) are still strongly resisted, even at the policy level, in many countries.

1.3.5 Conclusions

The picture that emerges from the considerations presented here is a complex one. Differences appear between countries, disciplines, generations, and institutions. It would, therefore, be highly misleading to seek to derive a simple, generally acceptable outlook. Some useful pointers can nonetheless be identified.

First of all, from a policy perspective, internationalisation seems, for the reasons discussed earlier, to be demand-driven. Low take-up is a problem for many bilateral and multilateral programmes. And even when take-up is adequate (e.g. the EU Framework Programmes), this seems to have more to do with individual initiatives than with institutional responses.

However, these demand-driven dynamics are not irrelevant in policy terms. Individual motivations to engage in international research may vary widely, but the general tendency seems to be that internationalisation is broadly synonymous with quality. The implication – which many policy-makers explicitly recognise – is that internationalisation is both a *lever* and an *indicator* with respect to general research performance.

The major complicating factor is that internationalisation is not simply a quality-control strategy that can be grafted on to any existing system. By its systemic effects, even regardless of the intentions of the actors involved, it tends to promote a research model that is broadly market-driven and governance-oriented. This shift may be favourable to research efficiency in an abstract sense, and also of course to a productive research–commercialisation interface, but it also has normative implications. In fact it conflicts sharply with widely shared conceptions of what research activity and research policy should be.

In prospective terms, the key question is therefore how the balance of structural pressures and normative counter-pressures is likely to develop. The INNOCULT research obviously offers no direct answer, but it does give some indications. It suggests that, in the absence of significant increases in core institutional funding and direct state involvement in research, internationalisation is likely to be both a natural policy lever and a systemic response. This seems to be self-consciously embraced by most intermediate-level policy-makers, and there are certainly no other reasons to expect counter-pressures to emerge from the policy process itself. It seems reasonable, therefore, to regard the future of internationalisation as a bright one.

1.4 Institutional Innovation and Europeanisation of University Research

There is a wide agreement among university policy makers and science policy researchers that research systems have gone through a transition since the eighties. Being a cornerstone of these research systems, universities played an important role in these changes.

We analysed

- the level of institutional change within universities as part of the transitions and the perception of these changes by research managers and researchers within universities, and

- the impact of these institutional changes on the participation of researchers in European collaboration.

As part of national research systems and the object of national policies, universities have been confronted with new pressures and opportunities. As complex organisations with historically vested relationships and positions they tend to be resilient towards pressures for change, but as part of the world of science there are also internal struggles and conflicts that may induce institutional changes.

1.4.1 Institutional Innovation and its Perception in the Academic World Funding, Employment and Academic Careers

The results in general show that universities are facing changes in employment structures and funding patterns, and that part of their strategy to cope with these changes is to implement new institutional practices such as evaluation of research and priority setting. These new institutional practices are still developing and are not as common and institutionalised as sometimes suggested. Not all research is evaluated, priorities are not set in all universities, or if they are set, they do not always guide actual research efforts. In addition, it should be noted that the working practices of researchers display patterns which do not seem so different from traditional ones.

Institutional change and the perceptions of institutional changes depend on the national context, the academic discipline and the type of university (age of university and its level of specialisation). There is, however, no systematic pattern. Several complementary explanations can account for this. The most obvious one is that although at a general level the transition of the research system points to a common direction, differences grow at a more detailed level: to cope with the transitions, universities apply a repertoire of responses rather than one dominant overarching strategy. Some measures applied are simply rhetorical, and others actually aim to achieve changes within their own organisations. The related explanation is that the transitions are still underway and new practices of funding, evaluation and priority setting have not yet really been institutionalised. Contrary to the perception of research managers who emphasise the transition of the research system, these new policy practices

have *not yet* been institutionalised to an extent that they bear consequences for the researchers.

Two conclusions can be drawn from these results.

- First, researchers are not directly affected by the changes in funding policies and employment structures.

- Second, universities have developed a level of research directors within their organisation who mediate pressures from the national research system. They identify changes and seem to be effective in reducing their authority on the actual research and on the researchers. To some extent they can only do so by developing internal innovation, strategies and cultures in which internal research practices and patterns are represented in a way appropriate for external relationships.

These conclusions are supported by another finding in the results: the different perception of change between research managers and researchers. The transition of the research system seems to be mainly a change in the relationships, in the rules of the game between the actors at the level of the research system. Research managers act as representatives of their department, institute or university in such games and are thus confronted with the transition of the research system. Researchers do not act at this level and tend to have no explicit opinions on what is perceived as transition by their representatives.

1.4.2   Europeanisation and Institutional Innovation

Europeanisation is defined as a specific aspect of the behaviour of researchers related to the transition of the research system. In this view, one would expect a that Europeanisation is related to institutional innovation: researchers from universities that had indeed implemented research evaluation and priorities would be better prepared to act at the European level than researchers from other traditional universities. However, there is no correlation between the application of new practices and Europeanisation. Whether researchers

collaborate within Europe depends primarily on their own perception of research performance and organisational goals.

In fact, little or no correlation could be found between institutional innovation and the participation in the European framework programme:

- Researchers from universities which require formal strategies and who formally assess research performance are not more involved in European research programmes and collaborations than other researchers. Nor are they more focussed on European funding and evaluations.

- Researchers of new universities are not more involved in European programmes, do not collaborate more in international projects, nor are they more dependent on funding by the Framework Programme, or oriented towards the outcomes of EU evaluation.

- Whether researchers collaborate within Europe depends primarily on their own perception of research performance and organisational goals. Individual researchers who are rather independent from the organisational context, decide whether they will apply for European funding and take part in European collaborations. Such decisions are influenced by their cultural bias: the researchers with a positive attitude towards the organisation of science in programmes with related formal definitions of performance and assessment procedures are more willing to get involved in EU programmes.

1.5 Research Organisations – Ever More Important Actors on the European Research Scene

> This purpose of this chapter is to present the analytical assumptions and findings of the INNOCULT study analysing the role of research organisations in the European system of research. Research organisations are an part and parcel of the national as much as of the European research system and are in many ways different from other publicly funded knowledge producers.

As universities, research organisations (ROR) show different features and have thus to be characterised according to different features. As strategic dimensions for the description of the different types the following were selected: 'funding', 'relationship with the State', 'functions' and 'type of research'.

According to this dimensions, the following types of research organisations emerge:

- *Type One – Academies*

  This group comprises research organisations that have a predominantly national public base line funding although they might show a tendency towards increased participation in competitive bidding.

- *Type Two - Public Research Institutes*

  Like Academies public research institutes have predominantly a national public base line funding. They usually have a close relationship with the state although in view of maintaining their scientific 'independence' the relationships might be mediated. In terms of functions they are mono-functional organisations.

- *Type Three - National Research Establishments*

  These research organisations have predominantly national public competitive funding though their share of industrial funding might be rapidly expanding.

- *Type Four - International Institutes*

  Research organisations that predominantly have international public competitive funding form this group.

- *Type Five – Private Research Institutes*

  This group of research organisations consists of institutions that have predominantly private funding (industrial or other).

This typology has been used in the process of analysing and interpreting the results from this study. The following main hypotheses underpin the analysis:

- Research organisations are more internationally active (active in Europe) than universities;

- The ways in which research organisations adapt to pressure may be significantly different from the ways in which universities cope;

- Where research organisations are concerned institutional innovations are contingent on national differences rather than institutional characteristics;

- Institutional innovation is contingent on national differences rather than pressures arising on the international research arena.

Using predominantly but not exclusively the results from two surveys with research managers and researchers across eight EU countries the following main findings have to be reported:

1.5.1 Funding structures and employment

- Where change in employment structures is concerned the following findings have emerged: i) research organisations tend to have stable employment on a full-time permanent contract basis; ii) the number of temporary research positions has, however, increased, researchers have become 'overworked and underpaid' and increasingly good graduate students choose alternative careers; iii) loss of tenure is felt more strongly by research organisations than universities; iv) in terms of loss of tenure significant country differences can be expected; v) that more good graduates choose alternative careers is an issue for concern since it erodes the very foundations of the research profession; vi) possibilities to hire

research staff if national and European funds are available have increased.

- A sharp relative decrease of institutional core funding has been experienced although this type of funding still constitutes a high proportion of the budget of research organisations. During the last five years research organisations have become more dependent on regional funds. Two main changes in terms of funding are experienced by the research directors: the procedures for obtaining European funding have become more bureaucratic and time-consuming and that a higher proportion of national funding has become competitive. Five years ago the institutional mechanisms for applications for European funding were stricter than those for applications for national funding. Today, national procedures are considered to be equally strict. While there is little satisfaction with either application procedure, the European evaluation procedures are perceived to be fairer and more transparent then the national ones.

- A clear aim for a more structured and systematic process of prioritisation occurred in the 1990s. This affects all publicly funded research institutions, although due to some of their inherent characteristics research organisations appear to have adapted more rapidly. Research organisation show have flexibility and discretion in promoting their priorities. Research managers from research organisations consider the institutional level to be leading in defining research priorities, followed by the European level. That researchers in research organisations should co-ordinate their personal research agenda first (and foremost) with the priorities of the institution only confirms the importance of the institutional level.

- Research managers from research organisations agree that the three most explicit changes in terms of research agendas and priorities during the last ten years are that

- research priorities have become more tightly monitored,
- multi-disciplinarity has become more important in deciding research priorities, and
- research priorities are increasingly decided at institutional level.

Research organisations are involved in external evaluation of their performance on a regular base and the results of such evaluations have consequences. These external evaluations have necessitated the development of internal assessment procedures evaluating the performance of individual researchers.

- Research managers from institutions that are regularly evaluated also consider that the quality of research performed by the institution has increased.

1.5.2 Internationalisation

- Although research organisations have been marginally more active in their international research co-operation than universities no clear cut conclusions can be drawn. There is evidence that the level of international activity is depending on the specific European/international initiatives. Furthermore, the level of international activity varies quite significantly between different types of research organisations.

1.6 Networking the European Research

The main task of this chapter is to map and analyse the networks of research performers in Europe, and in particular the research networks that have emerged from the European Union's initiatives in the field of science and technology such as the Framework Programme. We investigate in detail four Programmes of the Fourth Framework Programme with the ultimate intention to ascertain whether or not the FP4 has led to the creation of sustainable trans-national research networks.

1.6.1 The Policy Framework: Scope of Analysis and Methodology

The European Union's Fourth Framework Programme for Research, Technological Development and Demonstration (FP4) was adopted by the Council of Ministers of the European Union (in co-decision with the European Parliament) on 26 April 1994. The ultimate objective was establishing a common science and technology policy in Europe, to be achieved by funding research, technological development and demonstration activities in key technological areas, which should foster new innovative ideas and their implementation in the policy-making of the Union and its Member States.

The 4th Framework Programme was divided into specific programmes with several different characteristics. With respect to the INNOCULT project, four programmes were chosen for analysis: **ESPRIT** is by far the largest programme (18.5 % of all projects in FP4), the **Environment** programme is also relatively large (5.7 %), while **Transport** (1.9 %) and **TSER** (1%) are small. Research dealing with environmental problems and information technologies has a rather long history within Framework Programmes. Transport and social sciences are new. Finally, these programmes involve very different types of consortia and researchers: private companies dominate the ESPRIT programme and to some extent the Transport programme; public institutions are more dominant in the Environment and TSER programmes.

There was a total of 69,365 project proposals submitted to the Commission in the Fourth Framework Programme. 16,583 of them received funding, which represents approximately 24%, or roughly one in four proposals. Among our four programmes, the success rate was highest in Transport (32 %), followed by ESPRIT (26 %) and Environment (23,5 %) and lowest in TSER (13 %) (Säckl, 2000).

From a stratified probability sample 874 projects were selected[2]. The response rate achieved is 43.5%.

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[2] which represents 20 per cent of the reference base of 4493 projects

With respect of the goals of the INNOCULT project the five areas were covered by the questionnaire: general information on the organisation; networking experience; communication and co-operation flows; networking forms and effects; and evaluation of the Framework Programmes.

1.6.2   Main Characteristics of Participating Institutions and Networks

In terms of size of institution, the achieved sample of the survey was quite balanced, with small institutions (10 or less employees in full-time equivalent) represented with 39.1%, medium institutions (11 to 30 employees) with 31.6% and large institutions (more than 30 employees) with 29.3%.

Small institutions were dominant in the TSER and Environment programmes, whereas in ESPRIT and Transport, the answers came in nearly equal shares from small, medium-size and large institutions.

As far as the types of institutions are concerned, the following distribution was achieved (Table 7.4):

Table 7.4 Type of institutions

Type of institution	Number of answers	Percent
Research organisation	226	35.6
University	284	44.7
Private	125	19.7

The geographic distribution of the responses was as follows (Figure 7.2):
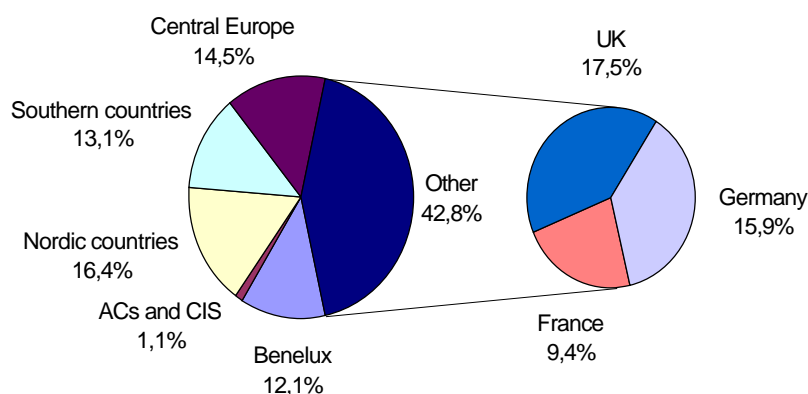
The large countries were dominant in all four programmes (and most notably in the Environment programme).

There are strong indications that some research systems are more ready for the process of Europeanisation than others. The major players in the European research landscape are the UK, Germany and France; a further important role is played by the Nordic countries.

A comparison between the three major players in the European research shows that whilst the French system relies on small and medium-sized research organisations, the Germans have a balanced system, and the UK relies on the universities, and particularly on the larger units. Small research organisations and the private sector in the UK play a significantly less important role in European research.

Table 7.9: Type and size of participating institutions in all regions

	Large countries	Nordic countries	Southern Europe	Central Europe	Benelux
S&M RO	19,8%	27,7%	25,6%	27,6%	23,7%
L RO	14,3%	14,9%	3,7%	6,9%	13,2%
S&M Uni	31,8%	32,7%	36,6%	32,2%	40,8%
L Uni	14,0%	11,9%	8,5%	9,2%	5,3%
S&M Private	12,8%	9,9%	17,1%	17,2%	9,2%
L Private	7,4%	3,0%	8,5%	6,9%	7,9%

The smallest network had only two partners (in five cases), and the largest 31. The median size was seven. There were altogether 181 small consortia (with up to five partners), 251 of medium size (with six, seven or eight partners) and 203 large consortia (with nine or more partners).

Roughly one third of the researchers (39.5%) had only been involved in one project, two thirds (60.5%) in more than one. One out of ten (11.8%) had been involved in five or more projects. Looking at participation across programmes, we find that eight out of ten (82.2%) only operated within a single programme. One fifth of the researchers (17.8%) had experience with participation across programmes.

At the level of institutions the picture is different: one fourth of the institutions (or 27%) had participated in European research across thematic programmes; and the share of institutions involved in more than one project is significantly higher: four out of five institutions (or 77.8%) were involved in more than one project.

1.6.3   Why and how to create a network

The most common way to enter a network is through previous personal contacts: 65.7% of researchers knew personally at least one project partner prior to the project. An equal number (64.7%) knew (a) project partner(s) by reputation, a smaller, yet still significant, number (57.6%) through previous collaboration, *albeit* not necessarily specific to the European Research Programmes. 34.2% of respondents named previous Framework Programme collaboration as their source of knowledge of (a) project partner(s).

At the institutional level the pattern is different: 70.8% respondents knew partner institutions from previous collaboration. Interestingly, a high number of researchers, namely 57.3% reported having previously worked for a partner institution. This seems to be an important way of establishing networks (indeed more important than previous FP collaboration) and speaks for a relatively high level of mobility of researchers between institutions involved in FP research.

It is very interesting to observe that the role of research-promoting agencies and national agencies in charge of research is extremely small: only six respondents reported having been mediated to projects through such agencies. An additional 21 respondents (3.4%) were approached by the European Commission officials to take part in the project – these were mainly researchers from Spain and Portugal and in Transport programme.

Intellectual motivations for participating in a network seem to dominate: intellectual reasons followed by opportunities for interdisciplinary experience were more often given as reasons for participating in a network then funding opportunities. Increase in

personal income seems to be the least important motivation for entering an FP project which might be related to the income structures of the participating institutions.

Funding reasons proved most important for researchers in Environment programme and those coming from universities, and least for those working in the Transport programme. At the country level, funding was most important for researchers from the UK and France.

The institutional reasons to participate in a programme seems to confirm the findings among the research directors: predominant are the researcher's own wish to participate, access to new knowledge and creating or entering new networks. Other important reasons are access to additional funding for doctoral and post-doctoral students and increasing the reputation of the institution.

1.6.4   Network maintenance

A good indicator of network relations over and beyond joint participation in a common European project is joint publications aside from the project deliverables:

The outcomes are biased by the two technical programmes: there was hardly any researcher of the ESPRIT and Transport programmes that had written a book together with his/her consortium partner. In the Environment programme the majority of researchers had joint publications with other consortium members. Researchers from private organisations were mostly involved in the publication of working papers, while university researchers cared most about papers in journals and books.

Another measure of communication flows within the consortium is the level of communication between members aside from that strictly related to the project. 62.8% of the respondents have regular social contacts with some of the other consortium members, 37.2% with even more than a half of them. Most sociable were researchers from Greece, Portugal and France, and co-ordinators more generally.

1.6.5   Support for Networks by National Agencies and the European Commission

The concept of national innovation systems is based on the idea of overcoming the traditional boundaries between the political and administrative system, potential users (be it industrial, be it political) and the research communities. This is even more true for a trans-national innovation system.

The data suggest that there is a high degree of satisfaction with the support provided by the European Commission. More than half of the respondents had   good

communication with and efficient support from the European Commission, but just one third did so from the national agencies. The best support came from the own department.

Table 7.15: Support for researchers from different institutions

Good communication with…	
...national agencies	30,8%
...European Commission	54,5%
Efficient support from...	
...own department	71,1%
...national agencies	33,0%
...European Commission	51,4%
...other	1,6%

1.6.6 The perception of the Framework Programme by the Research Communities

A European research system requires the close co-operation between the research communities and the policy makers not just on the day-to-day base of a research project but on the programme level as well. The data suggest a strong commitment from the researchers' side.

The commitment of the research communities was explored in an indirect way: the researchers were asked whether they think that the experiences gained in the FP4 were sufficiently considered in the programming of the FP5. As an option, the researchers could answer directly that they could not answer this question.

Remarkably, nearly three out of four felt enough informed to express an opinion. Of those who answered, about half were of the opinion that the experiences of FP4 were sufficiently taken into consideration, whilst the other half did not think so.

There are some differences in geopolitical terms: the large countries are apparently less interested in the programmatic development than the smaller ones; still, two third express an opinion. The Southern European countries, on the other hand, are the most explicit and the most satisfied.

Large research organisations and large university units tend to be more informed about the programming of the European Framework Programmes than all other groups. The lowest rate of knowledge is shown by the small and medium university institutes: one out of three did not voice an opinion.

1.6.7 Networking for Tomorrow: the Research Communities vis-à-vis the New Framework Programme

About two third of the institutions who participated in FP4 submitted new proposals to the Commission within the first year of FP5; about half of the respondents reported already an accepted proposal.

The picture of the high sustainability of the networks can be further supported by the fact that the rate of submission of proposals does not differ according to the size or the type of the research institutions.

Regarding the submission of proposals and their success there is no significant difference according to type of research or of networks; co-ordinators are, however, more likely to submit proposals; their success ratio is only slightly higher than that of other institutions.

1.6.8 European Research Programmes - a Hint from the Networks of Excellence

In this section we explore on the basis of our data whether there already exists a European Research Area. It is not our aim to analyse research topics and propose key actions for the New FP; to identify topics of research, national and/or European research profiles requires a different study.

Topical to this study are two dimensions:

- In what ways do the European research communities reflect the general goals of European policies as reflected in the FP? In this respect topics like subsidiarity, social cohesion, and strengthening mobility play an important role.

- What procedural aspects do research communities consider as important for the development of the New FP? In this respect prioritisation of research areas, better co-ordination of research programmes, output orientation and the bottom-up programming are the relevant issues.

Table 7.31 shows the topics researchers would like to see improved in the development of New FP.

Table 7.31 Priorities for the new FP

Research Policy Related		General European Issues	
Output Orientation	36,2%	Implementing Subsidiarity	17,0%
Bottom-Up	58,3%	Supporting Mobility	25,2%
Increasing Prioritisation	22,4%	Overcome Social Cleavages	12,3%
Co-ordination with other Research Initiatives	43,8%		

The general framework in which European policy-making operates, e.g. subsidiarity, contribution to social cohesion and alike, rank quite low on the agenda of the research communities. Relevant topics to be taken care of are rather the procedural questions like the bottom-up decision making process of research programming, better co-ordination with other research programmes within and outside the European Commission or the stimulation of the output orientation of research.

The most often mentioned concern of the research communities is the bottom-up orientation followed by the need of more coherent co-ordination with other programmes. Clearly more than half of the researchers interviewed hold the former for a relevant issue, nearly half call for more co-ordination. Strengthening the output orientation is another relevant issue.

1.6.9   Conclusions

Networks are very effective and efficient ways of international collaboration in the field of research.

The Framework Programmes have had a remarkable influence on networking. Yet they have been relatively less effective in creating new research networks than in augmenting existing research networks.

There is high sustainability of the networks both in terms of institutions and of individual researchers. Most of the researchers and institutions are involved in more than one project – a comparatively high ratio is engaged even in different programmes of the European Framework Programme. This hints to the existence of cornerstones for the (further) development of the European research area.

Institutions participating in EU programmes have different features than national research institutions. Indeed one could almost venture that research actors are more likely to succeed on the transnational level, the less well connected they are at the national level. In market terms, the European and national research areas are quite distinct, representing core rather than competitive ones.

Some countries would appear more prepared than others to become integrated in the European research area. There are variations across programmes, yet in general the bigger countries – UK, France and Germany – as well as the Nordic countries are more active and more successful. On the other hand, those countries most successful appear also least interested in the research policy issues involved in the setting up and implementation of Framework Programmes as the main vehicles of the European Research Area.

Size is also an issue with regard to research institutions. Larger research organisations, universities or companies are more likely to be successful in the European Research Area. They are also not surprisingly more informed about the research policy programming of the European Union. Otherwise there would appear to exist a certain degree of specialisation, with the private sector being more interested in the output orientation of the programme, and research organisations and universities in the bottom-up more open co-ordination approach.

Problematic with regard to the further development of the European Research Area is the low knowledge and interest of European researchers in the European policy agenda, such as mobility, subsidiarity and social policy (including sustainability).

1.7　Conclusions and Policy Implications

1.7.1　From Government to Governance

- There is real evidence for a move towards governance. This mainly reflects movement within the state.

- The trend is not based on harmonization or convergence between European countries. This can be shown as well by the fact that bi- and multi-lateral programmes are not developed systematically beyond the European programmes. International-isation, while driven by a range of factors, some highly context-specific, is internally related to governance.

- While a cultural perspective on policy is usefulness in structuring the analysis, structural elements are of higher explanatory value.

The *policy implication* is that the conceptualisation of governance is of crucial importance. With respect to the European White Book on Governance bench-marking exercises might lead to an understanding of good governance ensuring the participation of the research communities in policy-programming.

Internationalisation is an on-going process, however, this process seems to lack direct support from most national governments; the strengthening of bi- and multi-lateral research programmes beyond the European Framework Programme might be an important strategy in this respect. Bi- and multi-lateral programmes should, however, be seen as additional activities and cannot replace national research policies or the European Framework Programme.

1.7.2　Universities and Research Organisations

- There are some significant differences between research organisations and university research. The most important difference seems to be that universities claim to be more affected by the recent policy changes than research organisations.

- The most important changes in the universities are related to goal-setting and evaluation cultures. These changes appear not to

have been fully implemented and are more often referred to by the research managers than by researchers. In contrast, priority setting and evaluation seem to happen routinely within research organisations where external evaluations have lea to regular internal assessment strategies.

- Another aspect is employment strategies and career patterns. As a general rule, research organisations are more flexible than universities. This is in part related to different funding strategies. In both types of institutions, the flexibility has increased in the recent past. Stability in employment and clear career patterns are more likely to be found in research organisation than in universities.

- There are quite relevant national differences between universities, less so between research organisations. However, both the university systems and the research organisation can be differentiated according to structural elements like size, age and mission.

- With respect to internationalisation, both at universities and research organisations the individual carreer strategies and researchers' interests form part of the institutional strategies.

The ***policy implications*** are that evaluation and priority setting are very important tools for the increase of quality and internationalisation of research. Given the nature of science and research, however, the individual strategies of the researchers represent the key variable to understand success and failure. In this respect, specific attention has to be given to employment strategies, qualification processes and carefully designed incentive structures.

Core funding is still a very important element in the funding structures of universities and research organisations. Whilst in research organisations the core funding is clearly related to research as such, the structure of the core funding is more complex in the university system. Whilst the pressures to increase the funding sources on both universities and research organisations might be a (reasonable) result from governance, core funding is an important

tool to ensure a reasonable base for institutional stability, especially when related to goal-orientation and evaluation.

1.7.3   Research Networks

- Networks are very effective and efficient ways of international collaboration in the field of research.

- The European Framework Programmes have had a remarkable influence on networking. Yet they have been relatively less effective in creating new research networks than in augmenting existing research networks.

- Institutions participating in EU programmes have different features than national research institutions.

- Some countries are more prepared than others to become integrated in the European research area. There are variations across programmes, yet in general the bigger countries – UK, France and Germany – as well as the Nordic countries are more active and more successful.

- There is a high sustainability of networks both at the institutional and individual researcher level. Most of the researchers and institutions are involved in more than one project – a comparatively high ratio is even engaged in different programmes within the European Framework Programme. This hints to the existence of cornerstones for the (further) development of the European research area.

- Problematic with regard to the further development of the European Research Area is the low knowledge and interest of European researchers in the European policy agenda, such as mobility, subsidiarity and social policy (including sustainability).

The *policy implications* are that there exist cornerstones for the (further) development of the European Research Area. It is true that policy co-ordination among the Member States is a very relevant goal not yet achieved in a

satisfying manner. There have been no systematic bi- and multi-lateral programmes, and a mutual learning process towards succesful governance has still to take place. Still, it is important for the New Framework Programme to keep the successful elements of the 4th and 5th Framework Programme into consideration.

Given that transnational research tends to be dominated by quite a different set of actors than national research, the Framework Programme should take care to understand that National Centres of Excellence do not necessarily transform into transnational Networks of Excellence. There are structural differences between national centres and internationally active research organisations and university institutes on the one hand and National Research Centres on the other. The Commission should build upon those networks which have proven to be successful and sustainable whilst ensuring their openness to new researchers and institutions prepared for trans-disciplinary task-oriented "Mode-2"- research.

2   Background and Objectives of the Project

The INNOCULT study addresses three fundamental policy relevant questions:

- To what extent can one expect convergence of the RTD systems and policies in Europe?

- Is there a complementarity between the different national RTD systems; how can this contribute to the creation of a common European research area, and if not, how can this be improved?

- What role is played by the European agenda? How does this agenda, and, more specifically, the Framework Programme, influence national research policies and institutions and vice-versa?

In order to answer these questions, the INNOCULT considered both structural and socio-cultural factors that distinguish different national RTD policy regimes.

The study features an integrated and transversal approach and its goal has been to provide a comparative view on institutional innovation and transfer in the public sector. The focus has been on the original development and current modernisation efforts of the national innovation systems, with regard to policy and at the level of universities and research organisations. The institutional innovation potential was related to the capability to compete and to co-operate nationally as well as internationally.

By focusing on European research programmes the study stresses a specific interest – often neglected otherwise – namely, the importance of stable networks for science and technology co-operation.

The study integrated research and policy experiences from Northern, Southern and Central Europe. It encompasses Austria, Sweden, Finland, France, Germany, the Netherlands, Portugal and the UK.

This is the final report of the project. In the chapters 3 to 5 that follow we have sought to summarise the main findings of the research in line with the guidelines provided by the European Commission. This has involved keeping short many of the discussions –conceptual and empirical – in

order to focus on the essential and most policy-relevant results. However several of the findings reported below cannot be fully appreciated without reference to the more general theoretical framework and the details of the empirical study. For this, the reader is referred to the other INNOCULT deliverables – a list of which can be read in chapter 7 of this report – and in particular to the synthesis report of the project. The latter will be published in book format in 2002.

In order to facilitate cross-referencing to the longer synthesis report of the project, the numbering of the tabulations and figures has been left as in the latter.

3   Scientific Description

Change is a universal characteristic of social life. One expected consequence of social interactions is that entities (groups, communities and institutions) have always been under pressure to alter their ideologies/cultures (norms, rules, beliefs etc.), their structures and modes of operation. Publicly funded performers of research (universities and research organisations) are no exception. During the last two-three decades, however, the pressures for change experienced by research institutions have become more pronounced and their sources have undergone some transformations.

To begin with, perceptions about science and its place and role in society have significantly been modified. Thus, the view of science as predominantly 'common cultural background of humanity' has been gradually and almost completely displaced by a vision of science as embodying a major factor for increased industrial competitiveness. This has had a range of implications for change and policy. On the one hand, the expectations of national governments that science should contribute to wealth creation and quality of life were raised. On the other, governments have become increasingly uncertain about the efficiency and effectiveness of their current practices related to science and technology. The result is that all actors participating – directly or indirectly – in the knowledge production within a national state have been under increasing pressure to change their institutional practices and to respond to expectations reaching beyond what was traditionally seen as 'good science'.

It should be mentioned that the pressures for institutional change are not, and have not been, confined to factors originating within nation states. Although science is and has always been, by its very nature, international, we have witnessed an acceleration in the process of internationalisation of research in the last two decades, as well as alterations in its very essence. While previously the international character of research manifested itself predominantly through ad-hoc, small-scale research collaborations, internationalisation today is organised and channelled through research programmes at national and supra-national levels developed specifically for the purpose. In the context of change

in the national research systems in European countries, the activities of the Framework Programme of the European Union are of particular importance. This accelerated 'Europeanisation' of research accentuates the pressures for institutional change already existing within the national research systems. Some evident pressures include: i) attempts to influence European level policy; ii) necessity to align national policy and practices with European ones so that national research teams (entities) can compete for resources more successfully; iii) institutional isomorphism whereby institutions copy each other without apparent benefit.

It does not come as a surprise therefore that the study of institutional change and innovation, its underlying reasons and the ways in which it affects institutional behaviour and practices is gaining importance. Registering institutional change and attempting to attribute it is not only intellectually challenging and exciting (these are some of the most trying topics in social sciences) but is also relevant practically. Interdependencies between the institutional, the national and the supra-national levels of policy making and implementation are becoming a central concern for policy-makers in Europe.

> At the most general level, the objectives of the research reported here are to register and attribute social innovations occurring in the context of research institutions – universities and research organisations, as well as state institutions. Thus, the central research questions could be formulated as follows:

'What institutional innovations have taken place within national research systems (and within the main types of actors involved in knowledge production, namely state institutions, universities and research organisations), did these innovations originate from predominantly national or international pressures, and how have these enabled the institutions to cope better with pressures and opportunities arising at the European level?'

These questions also have a comparative dimension. Empirical evidence that some countries and some institutions display a higher propensity of involvement in Europe while others are very successful in attracting research funding from international/European sources is accumulating. One example for speedy and successful Europeanisation is provided by Finland, while according to statistical sources, UK researchers have been very successful in attracting European research funds (Second European Report on S&T Indicators, 1997). Could

varied levels of success be explained by certain differences in the culture and ideology of the national research systems and research institutions?

Following the overall objectives and questions of the research programme, lower level abstraction research questions and hypotheses underpinning empirical research were formulated. Thus, some specific research questions include:

- What institutional innovations, if any, have occurred within the national research systems of interest?

- Did these institutional innovations enable the country/institutions to cope better with pressures and opportunities from outside the national context (most notably, the European research level)?

- Did these institutional innovations impact on the ability of the organisations (state, universities and research institutes) to innovate, or, in other words, "did change facilitate change"?

- Could broadly 'cultural' factors help provide an explanation for the varied levels of involvement in international, and particularly European, research?

- Do emerging and persistent international (European) structures for research impact on the national level structures, mechanisms and practices at different levels of social aggregation and, if so, how?

A set of corresponding research hypotheses was also formulated. These include:

- Organisational structures affect the patterns according to which participants interact with outsiders (actors from outside the organisational context);

- Differences in levels of involvement in international/European research are contingent on national strategies rather than on institutional structures;

- Researchers from innovative institutions are more active in Europe than those from institutions that are not innovative;

- Social (and research) practices in innovative institutions can be expected to be similar across national boundaries;
- Research organisations are more active in Europe than are universities.

The research questions and hypotheses presented here provided the framework for formulating more specific questions and hypotheses directly relevant to the work on universities, research organisations and state institutions.

3.1   Theoretical Input and Historical Overview

In order to meet the stated research objectives and answer the research questions, it was necessary to include input from sometimes diverse theoretical perspectives. Consequently, from political science we have drawn on the 'government and governance' literature, from sociology and anthropology we have incorporated parts of 'cultural theory' and its 'grid/group' analysis, and from science and technology studies we have incorporated the concepts of 'national innovation systems' and 'national research systems', as well as 'Mode 1 and Mode 2 knowledge production' into our theoretical framework. In addition, we have drawn on the 'networks' literature as well as on the latest developments in social network analysis. The theoretical background of the study is outlined in detail in the various deliverables of the project and summarised in the project's synthesis report (Deliverable 7).

The project also included an extensive historical review of the evolution of the national research systems and RTD collaboration (chapter 2 of Deliverable 7). This covered the medieval universities, the period of enlightenment, the world exhibitions period between 1851 to 1900, the bilateral collaboration between hostile countries, in particular France and Germany, in the period 1860 to 1950 and the patterns of scientific collaboration after the second World War in the emerging European framework.

3.2   Analytical Assumptions

3.2.1   National Research System(s)

It has been decided that the concept best facilitating the achievement of our research aims and objectives is that of 'National Research Systems', rather than the one of 'National Innovation Systems'. Thus, according to the objectives of our research programme the interest is predominantly, if not exclusively, focused on publicly funded research performers, i.e., the emphasis is not on the

ways in which firms innovate (as is the case of National Innovation Systems). In addition, since the NRS is defined through the institutions participating in the knowledge production process at the level of the nation state and the interactions among these, the concept captures two levels of social aggregation crucial for our research, namely the level of the institution and the national level.

In terms of participating organisations we have defined the National Research System as comprising state organisations, universities and research organisations.

State organisations. This cluster of organisations includes relevant ministries (ministries active in deciding on research funding, directly funding research, participating in co-ordination of the national research effort, as well as taking part in the process of agenda setting and deciding priorities) within the countries as well as intermediary organisations such as Research Councils. Due to entirely practical concerns it was decided that purely advisory state organisations would be excluded from the empirical programme.

Universities. Since the major reform of German universities in the early nineteenth century, commonly associated with the name of Wilhelm von Humboldt, universities, albeit to a different degree, have combined the functions of teaching, learning and research (for more on this, see Clark, 1993, 1995). Moreover, 'research university' has become a term accurately describing the top universities in most countries. It is describing not only the level of research activity of academic staff but also the aim of the education and learning, namely to train the next generation of researchers. Teaching, therefore, necessarily combines elements of learning and independent and supervised research. In the context of this, it has been established that: i) universities are knowledge producing organisations in the National Research Systems; ii) these are sufficiently different from other knowledge producers, most notably research organisations and industrial research units; and iii) the features most likely to affect the research performance of a university at national and international level are whether it is 'old' or 'new', its size, its already existing capacity to carry

out research and compete successfully for research funding and its level of specialisation.

Research organisations. Due to a range of historical factors and economic and political concerns, different nation states have developed different institutional patterns for knowledge production. Thus while the universities in the UK are the main producers of publicly funded knowledge, in countries like Germany and France this role of the universities is being challenged by research organisations such as the *Max Planck Gesselschaft* and the *CNRS*. A very general definition of research organisations (also referred to in the literature as 'research labs', 'research establishments' and 'third sector institutions') is that they emerged in the mid-nineteenth century and are different from universities. One major difference is that, as a rule, these institutions do not teach (or do not teach undergraduate students). Since most research organisations are embedded into the national context, they display a significant level of variety that makes their study difficult, particularly where international comparison is involved. In an attempt to deal with this challenge and to aid our empirical programme, analysis and interpretation, a typology of research organisations based on four factors was developed.

It was also explicitly acknowledged from the outset that the research interest reaches beyond the elements of the National Research System to incorporate the interactions and interdependencies among those elements. Another aspect providing an axis for the analysis and interpretation is ideology and culture. Ideology and culture play an important role in the functioning of national research systems and their elements (beliefs, norms, values, practices etc.) provide the context for change within a system.

3.2.2   Levels of Social Aggregation

While accepting the central importance of the concept of National Research System for our research, we also acknowledge that the knowledge production process is defined by the complex interactions and interdependencies between actors positioned at three levels of social aggregation – institutional, national and international – and the interactions between these levels.

Institutional level. At this level of social aggregation the focus is on the publicly funded performers of research, namely universities and research organisations. No fewer than three broad clusters of interactions shape (or at least hypothetically could affect) the nature and outcomes of the process of knowledge production. One involves only (predominantly) researchers or academics, these interactions emerge in the very process of research and are confined to the members of the 'scientific community'. At the level of institution, the second cluster of interactions already includes relationships with (among) other groups involved in the process of knowledge production – most notably research managers – and, as can be expected, involves concerns reaching beyond the immediate research. And a third cluster of interactions is that comprising the relationships between different types of knowledge producers.

National level. Concerning knowledge production and utilisation, a large variety of social interactions affecting the processes occur at the national level. These involve different institutions funding research (government, industry, charities etc.), users of research results (which usually but not necessarily overlap with the funders of research), policy making institutions, social entities mediating the relationships between funders and performers of research (the Research Councils, for example) as well as the research performers themselves. At this level of analysis broader concerns related to economic advancement, national prosperity and increased levels of quality of life enter the realm of knowledge production and utilisation.

International/European level. Although research by its very nature has always influenced this level of aggregation internationally, the process of knowledge production has increased drastically during the last two decades. This is to a large degree due to the emergence of the EU (and its governance structures) as a supra-national governance level. One observable feature of the relationships at the international/European level is that these encompass most of the links mentioned in the discussion on the previous two levels. In addition however there are perceptible interdependencies between policy making institutions and policies at the national and international (particularly European) levels.

3.2.3 Institutional Innovation and Change

For the purposes of this research, the concept 'institutional innovation' was defined as being closely related to that of 'change' but different in the following important aspects:

- 'institutional innovation' is narrower than 'change' and refers to policy introduced, i.e., purposive changes (not including alterations that are the aggregate effect of a number of apparently not connected social actions which happen anyway);

- 'institutional innovation' refers to a particular sub-class of changes that occur in order to facilitate coping with a set of pressures and challenges which can be endogenous or exogenous to the particular system.

Registering and attributing change is a challenge that demands ways to limit the enormity of the task involved. Thus, five areas of interest were specified from the outset. These are:

- employment structures;
- resources and resource management;
- quality of research and evaluation practices;
- research agendas and priorities; and
- institutional cohesion and networking.

3.3 Research Design

The design of the empirical research ensues from the objectives of the research project and relates closely to our analytical assumptions. Thus, a methodology combining surveys with an extensive interviewing programme and secondary analysis of data was developed. More precisely, the following was carried out:

- a survey with research managers of universities and research organisations;
- a survey with researchers;
- a number of interviews with research managers;
- interviews with policy-makers for science and technology;

- a survey of European research networks participating in FP4.

> The study is international and covers eight countries, members of the EU – Austria, Finland, France, Germany, the Netherlands, Portugal, Sweden and the UK. These countries not only reflect the memberships of the study team but also provide a fairly good representation of the main clusters of countries in the EU.

Within the countries the empirical programme targeted three distinct groups of respondents – researchers, research managers (including heads of department as well as institutional level policy-makers) and national level S&T policy-makers. While compiling our samples, due attention was paid to ensuring representation from all relevant organisations, such as universities, research organisations, relevant ministries and research councils (and equivalent).

While discussing the scope of the empirical programme an important issue was the time-frame of the institutional innovations of interest. Relating to empirical considerations (national research systems have been particularly dynamic since the beginning of the 1990s) it was decided that the study would cover the last decade, 1990 – 2000.

With regard to the survey of European research networks, the empirical programme covered four thematic research programmes of the Fourth Framework Programme, namely, TSER (Targeted Socio-Economic Research), ESPRIT (Information Society Technologies), Environment and Transport.

3.3.1   Research Managers

The objective of this survey was to collect information on the following clusters of issues:

- **Involvement in international co-operation at institutional level.** This part of the questionnaire included questions regarding facts (number and value of contracts involving international co-operation, for example), opinion (how important is the international activity), motivation and the form that established links could take.

- **Change in employment structures**. Attempts to capture the dynamics of employment in terms of numbers of researchers who have joined the institutions and ones who have departed during a particular year and to

register change in institutional capabilities to hire new researchers were made. Also, the opinion of the respondents regarding a number of hypothetical changes was sought.

- **Change in resources and resource management**. Issues such as shifts in importance of different sources for research funding over the last five years and alterations in the availability and conditions for access of national and European research funding were explored.

- **Change in quality of research and evaluation practices**. This part of the questionnaire aimed at gathering data on the existence of established mechanisms for evaluation research performance at national and organisational level and their social significance.

- **Change in research agendas and priorities**. Transformations in the ways in which institutional and personal research agendas were being defined and priorities set up were subject to investigation in this part of the questionnaire.

The survey for research managers was designed as an approximately ten-page surface-mail questionnaire (in four languages: English, German, French and Portuguese). It was distributed in all eight countries represented in the consortium. It was deliberately designed in a way that would allow comparison with the researchers questionnaire, especially in those cases when the answers are given by research managers and researchers from the same institution. However, in order to avoid unnecessary overlaps, not all the questions were posed in both questionnaires – appropriate consideration was taken of the scope of responsibility and interests of both target groups. In the later stages of data collection, Internet, rather than surface-mail, was used for distribution of questionnaires.

The questionnaire contained a question asking heads of department to nominate up to ten research-active staff to take part in the researchers' survey.

3.3.2 Researchers

By following the structure of the questionnaire closely, questionnaire discussed below is different in three important ways. Thus:

- **Level of social aggregation**. The questionnaire aimed to collect information referring to the individual researchers and not to the research/academic units where he/she might be working; this was also true where opinions, motivations and attitudes were involved;

- **Level of detail of information**. Some issues, most notably the level of involvement in international research co-operation, were explored in considerable detail; and

- **Additional cluster of issues**. The questionnaire included an additional part (Organisation) aiming at registering any shifts from institutional structures to more temporary research networks as the social milieu of research.

As opposed to the questionnaire for research managers/directors, the survey for researchers was from the beginning designed as a Web-based questionnaire in the same four languages, located at the Web site of the co-ordinator.

3.3.3 National Level Policy-Makers

The issues that were investigated in depth through personal interviews included:

- change in policy objectives;
- change in policy mechanisms;
- changes in the NRS;
- policy drivers; national policies and the policies of the EU.

Interviews were scheduled according to the given design in all eight countries.

3.3.4 Institutional Level Policy-Makers

> These interviews aimed on the one hand to complement the information already collected by the questionnaires, and to provide a more detailed picture of the changes that have occurred/are occurring in research institutions on the other. Particular emphasis was placed on conducting interviews with policy makers from research organisations due to a noted slight imbalance of the questionnaire response.

The fairly loose interview schedule followed the clusters of issues explored by the 'research managers' questionnaire closely.

3.3.5 Research Networks

Four programmes were chosen for analysis as a representative sample of FP4 research: ESPRIT is by far the largest programme (18.5 % of all projects in FP4), the Environment programme is also relatively large (5.7 %), while Transport (1.9 %) and TSER (1%) are small. Research dealing with environmental problems and information technologies has a rather long history within Framework Programmes. Transport and social sciences are new. Finally, these programmes involve very different types of consortia and researchers: private companies dominate the ESPRIT programme and to some extent the Transport programme; public institutions are more dominant in the Environment and TSER programmes.

The questionnaire (presented in five languages, namely, English, French, German, Italian and Portuguese) was addressed first to project co-ordinators and subsequently (via the co-ordinators) to the project partner participants. It comprised questions in five areas: general information on the organisation; networking experience; communication and co-operation flows; networking forms and effects; and evaluation of the Framework Programmes. Respondents were asked questions on themselves as individual researchers as well as on their institution.

3.3.6 Sampling

The sampling was conducted for all eight countries with emphasis on institutions likely to be active in fields covered by four thematic programmes in the Fourth Framework Programme: Environment, ESPRIT, Transport and TSER.

The following rules for sampling were adopted:

Policy-makers: up to 15 policy-makers per country. Sampling criteria were: function in the research system, age (whereby new state agency was defined as one that has been established since 1980), level of governance (where we had national, regional and local state agencies) and sectional specialisation (where a sectorally specialised state agency was defined as one that concentrates on formulating, implementing and evaluating policy for a specific economic sector).

Universities: at least 8 but no more than 16 per country. Within universities, 1 board level research manager (vice-principal) and 5 research managers at unit/department/centre level. For each unit/department/centre, up to 10 researchers. Sampling criteria were: age of the university (new universities were defined as those founded after 1960), size (small university was an institution with less than 10,000 staff and students), proportion of research and teaching (non-research university was defined as university in which the research budget is less than 10% of the total budget) and specialisation (specialised university was defined as one that concentrates on one or two academic disciplines or fields).

Research organisations: at least 8 but no more than 16 per country. Within small ROs, 1 research manager was targeted. In larger ROs, 1 chief research manager and 4 unit/department/centre managers. For each RO, up to 10 researchers. Sampling criteria were: structure (where we distinguished single research organisations and compound research organisations), size (large ROs being those employing more than 80 researchers on a full-time, part-time or fixed term basis), legal ownership status (where we differentiated public ROs, independent non-profit ROs and independent for-profit ROs) and mission (with basic, applied and mixed ROs).

Research networks: Jointly the ESPRIT, Environment, Transport and TSER FP4 programmes funded 4493 projects in the period 1995 to 1999. We sampled one third of these projects to survey, i.e. 1504 projects on a random basis, stratified according to the size of the programme. Given that we relied solely on

an electronic survey, i.e. the questionnaires were sent by e-mail and were made available for response on the Web Site, the valid sample ended up being 874 projects (which represents 20 per cent of the reference population of 4493 projects). For 245 projects of the 1504 originally sampled we could not obtain e-mail information from the project documentation published by the Commission or the CORDIS database; for another 385 projects the available information was wrong or outdated and the correct one could not be traced despite repeated efforts using Search Engines.

3.3.7 Fieldwork

Policy-makers: The interviews with policy-makers were conducted in state ministries in charge of research and science, in other ministries and state administration bodies where research is commissioned, in research funding agencies and in intermediate bodies in charge of facilitation of internationalisation of research. The number of interviews conducted in each country is the following: Austria: 15; Finland: 12, France: 13, Germany: 9, Netherlands: 7, Portugal: 9, Sweden: 12, UK: 7.

Universities: The researcher's questionnaire which could be filled in and submitted through the Internet, resulted in 379 valid and useful responses from university researchers. The questionnaire for research directors resulted in 102 responses from directors at universities, of which 85 are directors at departmental or faculty level, and 17 at university level.

- Of the researchers, two-third are male and one-third are female. The total age profile is shaped like a bell curve, with 38,2 % of the researchers being between 39-44. In the younger age categories the proportion of female researchers is 36%, but falling to 19% in the older age category.

- In the total sample, 78% have a PhD or are professors. The remainder - less then 2% - have a Master's degree. Of the research directors, 21% have held their position for over 10 years and another 21% between 5-10 years. Of the remaining 58%, 32% have held their position between 1-3 years, 8% less than 1 year and 18% between 3-5 years.

- The distribution of researchers across the eight countries was fairly proportionate. In the research manager sample however, the three largest countries, France, Germany, and the UK are under-represented, and Portugal and Sweden over-represented.

- Nearly 35% of the researchers are from the social sciences and humanities, while other disciplinary categories represent a substantially lower percentage, probably due to a more detailed categorisation.

- The researchers in our sample work at both old and new universities (a fairly equal distribution). The size of the university was defined by student numbers, with a limit of 10.000 students. In some countries this limit was more reasonable than in others, as some countries' large universities often have 50.000 students or more.

- Approximately one-fourth of the researchers and 30% of the research managers work at what we defined as small universities. The third university characteristic is their specialisation.

- We defined universities offering courses and research in one or two disciplinary areas as 'specialised'. Between 20% and 25% of the researchers and research managers work at a 'specialised' university.

- 44% per cent of the sample are from old, large general universities. 35% are from new general universities of which 60% are large and 40% small. Very few researchers are from old small and general universities, or from new large specialised universities or from old small specialised universities.

Research organisations: We received 66 responses from research managers and 202 responses from researchers at research organisations in eight EU countries. These responses constitute 38% of the overall response rate to the questionnaire for research managers and 35% of the questionnaire response rate for researchers.

- In terms of response from research managers two types of research organisations – public research institutes (PRIs) and NREs – are best represented and that in terms of response from researchers, academies are also fairly well represented. The response from international institutes and private research institutes is fairly weak.

- The response by country is well distributed with the notable exception of France, Sweden and the UK in the case of research managers, and Sweden and the UK in the case of researchers. While the fact that there are very few research organisations in Sweden can account fully for the relatively low proportion of responses, a clear disincentive to respond was noted in France and the UK. Two main factors – survey saturation and the latest drive for privatisation – account fully for the low response rate from the UK. Since the variable response can be a problem when data are analysed by country, measures to complement this with interviews were undertaken.

- Our respondents are overwhelmingly male (86% of the responding research managers and 71% of the responding researchers are male).

- A significant proportion of our respondents from research organisations – both research managers and researchers – are between 35 and 55 years.

- Where the responding researchers are concerned, over half of these (55%) have a PhD while for a quarter (27%) a Master's is the highest degree.

Research networks: 380 projects responded to the survey (either through the co-ordinator alone or through the co-ordinator and partner institutions). This represents a response rate of 43,5 per cent at the project level. 186 responses were received from the Environment programme, 76 from Transport, 70 from TSER and only 48 from ESPRIT.

> At the institutional level, responses were received from 635 institutions (representing co-ordinators or partners to the above 380 projects): 304 (or 47,9%) represented institutions that participated in the environment programme; 135 (or 21,3%) institutions that participated in the transport programme; 121 (or 19,1%) institutions that participated in the TSER programme and 75 (or 11,8%) institutions that participated in the ESPRIT programme.

3.4   National Research Policies and the Shift from 'Government' to 'Governance'

3.4.1   Conceptual Framework

> For the purposes of analysis of research policy, the key features of a governance relationship may be stated as follows:

> - the state has (or components of the sate have) autonomously defined objectives (e.g. excellence, competitiveness, peaceful campuses, budgetary tightening, …),

> - state actors believe that, with respect to these objectives, the research sector cannot be ordered about (although binding legal rules can of course be formulated on a range of other issues),

> - they believe however that it can be influenced, and that appropriate policy levers exist,

> - the research sector is capable of producing internally generated objectives,

> - it is not however capable of existing entirely independently from the state (both the latter are of course matters of belief as much as objective constraints).

> The main distinctive feature of a government perspective, by contrast, is the belief that legal instruments of command can be used for policy purposes. It is arguable whether such a belief can ever be true – it is clear however that it is sometimes held. There is

considerable persuasive evidence that the inherent limits of government in this sense – which was from the post-war period to the mid-80s the *normative* policy mode in most countries – contributed directly to corporatist mediation. This was the *practically* dominant mode of research policy during the same period, and effectively underwrote a considerable degree of research sector autonomy, except in fields of "strategic" significance (e.g. nuclear physics and nuclear engineering, aeronautics, etc.).

The adoption by the state of a governance approach to policy by no means guarantees that policy will actually function according to a governance model. The policy dynamic derives from the interaction between stimuli and systemic responses to them (which are of course anticipated – possibly incorrectly – in the definition of the stimuli). It is possible in principle to define the conditions in which an *a priori* governance framework will actually lead to governance: to do so it is necessary to describe in more detail the features of the system to be steered – in this case the research sector.

In principle, a research sector can be characterised by a dynamic interrelation between four poles or cultural styles.

Figure 4.1
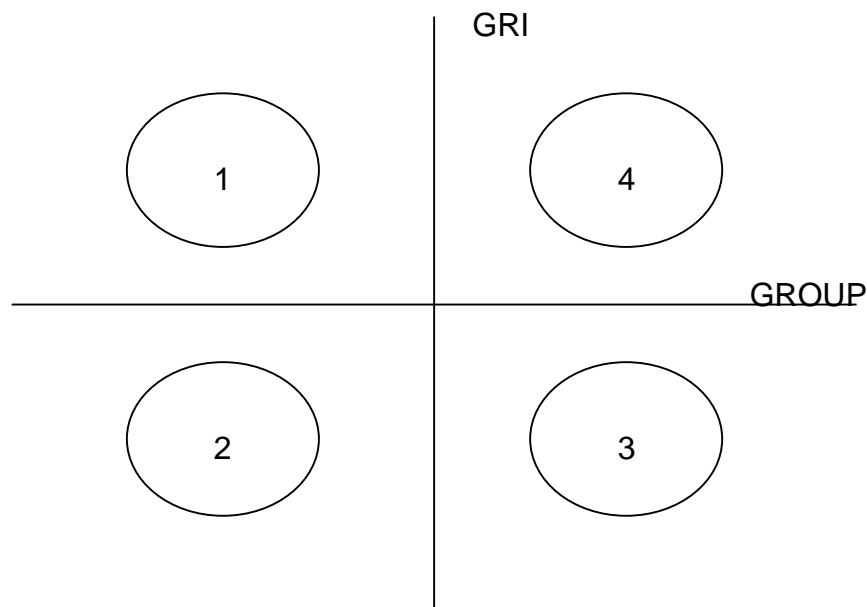
1. The first style is often called "isolate". In the case of research, we should imagine a series of researchers engaged in solitary research with little or no contact with colleagues, but subjected to strong

hierarchical control (e.g. by the director of the institute to which they belong).

2. The second style is often called "market". In the case of research, we should imagine series of researchers engaged in research either alone or in *ad hoc* groups, constituted by the researchers themselves for the purposes of specific activities, and subject to little or no hierarchical control.

3. The third style is often called "sectarian". In the case of research, we should imagine a group of researchers engaged in collective activity, with little hierarchy within the group, and strongly self-defined and particularistic intellectual principles, paradigms, etc.

4. The fourth style is often called "hierarchical". In the case of research, we should imagine a group of researchers engaged in collective activity under the strict control of, e.g., an institute director.

It is important not to analyse these "styles" in isolation. They map a single social system onto a specific analytical framework: institutions or processes characteristic of one of the "styles" interact with and impact on the others. These dynamics respond, among other things, to external stimuli. In the case of research systems, policy processes may affect the balance of incentives and opportunities that govern the grid-group equilibrium.

It is necessary, therefore, in order to give theoretical and empirical substance to the combination of a governance perspective and cultural theory as applied to research, to specify the sociological dynamics of the interaction between cultural "styles" and the effect on them of shifts in the policy framework. This is of particular importance with respect to government strategies since, from a governance perspective, these crucially include an understanding of the functioning of the research sector and the opportunities for "steering" that it entails.

Figure 4.2: Cultural "styles" of research: a summary of the sociological dynamics
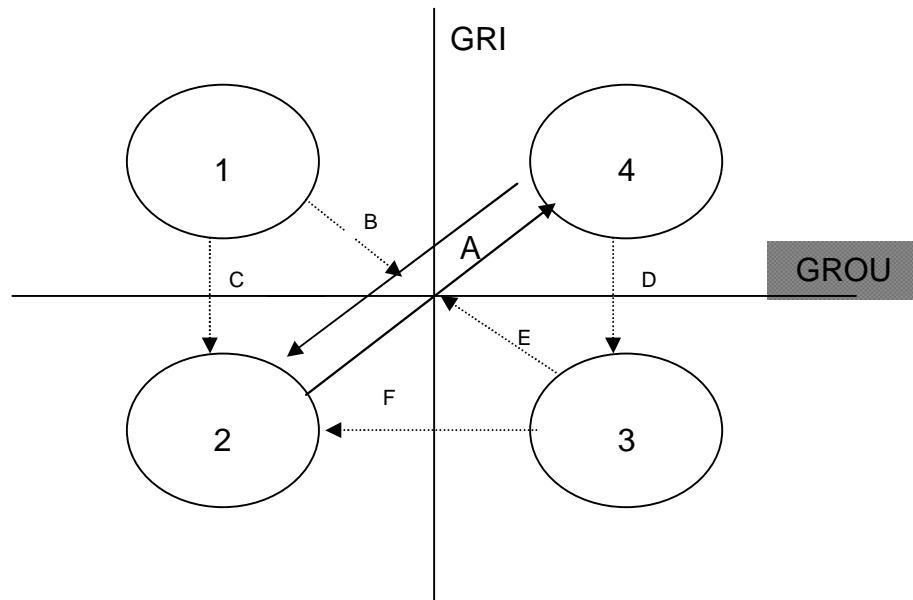
Each letter identifies a sociological dynamic that contributes to the cultural topography of the research field.

A : effects of career patterns and of strong differences between scientific disciplines (these effects are dynamic over time, and may operate in either direction)

B : co-operation is favoured by the effects of evaluation, career patterns, funding procedures, and by internationalisation

C : effects of career patterns (which may enable researchers successful in the terms of their own system to escape from, or to mitigate, hierarchical control)

D : possibility of a drift from functional hierarchy to sectarianism as a consequence of oligarchy and inadequate evaluation

E : effects of evaluation procedures, when they are accepted (a subsystem or an institution that organises itself on the basis of externally formulated and implemented normative principles cannot, strictly speaking, be in a "high-group" position)

F : effects of functional specialisation (which may encourage or force sectarian institutions to rethink themselves as components of a broader system)

The link between the governance perspective and cultural theory is provided by the effects of governance on the cultural patterns of the research sector. As

Figure 4.2 shows, evaluation, funding, career patterns and internationalisation are key factors in shaping the interaction between the four cultural styles. They are also crucial dimensions of the shifts characteristic of governance. Broadly speaking, a policy framework will be closer to a governance model when the state both recognises that the autonomy of the research sector is a policy resource and seeks to use the features of its autonomy as levers to steer it towards deliberately defined policy objectives. Once priorities have been established, funding, career patterns, evaluation and internationalisation are among the key levers available to promote indirect influence. Their effect is to marginalise styles 1 and 3, primarily by offering enhanced exit strategies to those who wish to make use of them while limiting access to academic credibility to organisations structured in such ways. Of course, these can *coexist* with the public research system so long as they can draw on other resources (including ideological commitment as well as commercial or voluntary funding), but they can be *part* of it only to a limited and transitory extent.

The dominant patterns, in theory, should thus be low-grid / low-group (2) and high-grid / high-group (4). Both are exemplified in the study. The former is the dominant mode of organization in many countries, at least in disciplines where neither resources nor dependency of young researchers on seniors (e.g. by lengthy doctoral or *Habilitation* procedures) impose a collective dynamic. Social sciences in Europe generally seem to fit this pattern (although entry into the profession undoubtedly follows rather different paths in, say, Germany and the UK). However, certain harder sciences combine, at least for young researchers, strong hierarchical/financial constraints. Even in a country such as France, where model (2) is generally dominant, such constraints are explicitly recognised. What the CNRS calls *actions incitatives jeunes chercheurs* are specifically targeted at researchers whose prospects might be thus constrained – and young refers here to *tenured* academics, albeit, in principle, only for five years after obtaining their doctorate. The general model might thus be sketched as a combination of a dominant low-grid / low-group pole and a subordinate high-grid / high-group pole. Negotiation is the natural mode of governance for a medium-group / high-grid state confronted by high-grid / high-group research

(although government is also possible on condition research hierarchies are co-opted). Incentives, on the other hand, are the only tool available for the low-grid / low-group case.

> We may, therefore, reasonably work with the hypothesis – to be tested empirically – that a governance-oriented policy style will tend to produce – possibly as an unintended, unforeseen and perhaps even negatively assessed effect – a research sector structured around two poles, which are related sociologically by the countervailing pressures of co-operation and patronage on the one hand, and increased autonomy through career progression on the other. This is only an ideal-typical equilibrium, unlikely to be exemplified as such in existing systems, but it remains a very useful point of reference.

The implementation of a policy framework depends on the use of what we might generically call "levers": resources available at the level of the state that can be mobilised in the pursuit of specified objectives with at least partially predictable outcomes.

> A full analysis of all actual or possible levers – even limited to research policy – would be impossible. It is possible, however, to reduce the range of levers to three generic categories, differentiated according to the kind of resource mobilised by the state and the kind of relationship assumed between state and non-state actors.

- *Orders* are issued by the state using the resource of sovereignty. They assume a relationship of authority and are backed by the availability of legal and other sanctions. The precise legal form of such orders (laws, decrees, ministerial instructions, informal commands,…) is less important than the kind of relationship they involve. By their very nature, orders can only mandate or forbid the performance of certain activities. Their effects on the outcomes of such activities are inherently subject to uncertainty.

- *Negotiation* implies a relationship of approximate equality between the state and some non-state actor, each of which has resources both useful and unavailable to the other. Whether negotiation arises out of the supposed impossibility of command, or simply from the belief that command would be less efficient, is of secondary importance. The principle of equality (at least for the purposes of negotiation) does however presume an ongoing dynamic of trust. No

actor has any reason to engage willingly in negotiations if compliance with their outcomes is largely unpredictable.

- *Incentives* also presume asymmetrical resources but do not depend on any stable pattern of relationships. Whereas one necessarily negotiates with an identifiable partner, incentives can be applied to any system about which enough is known to predict with some credibility its responses.

As we have seen, orders are, by assumption, not relevant to a governance perspective. The characterisation of the research sector offered earlier underlines the extent to which such a perspective is a natural response to the structural features of contemporary research systems. Even if the state was predominantly hierarchical in its internal cultural patterns, a command-based policy framework would require hierarchical resources within the research sector which are available to only a limited extent. Therefore, negotiation and incentives are the practically available kinds of levers.

As we have done with research "styles", we can map the space of possible policy levers on the grid – group scheme. Concerning the grid axis, *orders* can be placed at a high-grid position, because they always imply a relationship of authority and coercion. *Incentives*, on the other hand, are inherently low-grid because they are based on a free and non-coercive relationship. Although they are based on a principle of equality between partners, *negotiations* are usually medium-grid, because they presume the acceptance of a commune framework and agenda.

The positions on the group axis depend on the individual or collective nature of the levers: for example, negotiations are usually high-group, but incentives can be either low-grid, if they aim at individuals (e.g. international mobility of researchers), or medium-group if they favour networks (e.g. building of international or thematic networks). We thus obtain, for the purposes of policy analysis, the following figure.

Figure 4.5: The cultural space of policy levers
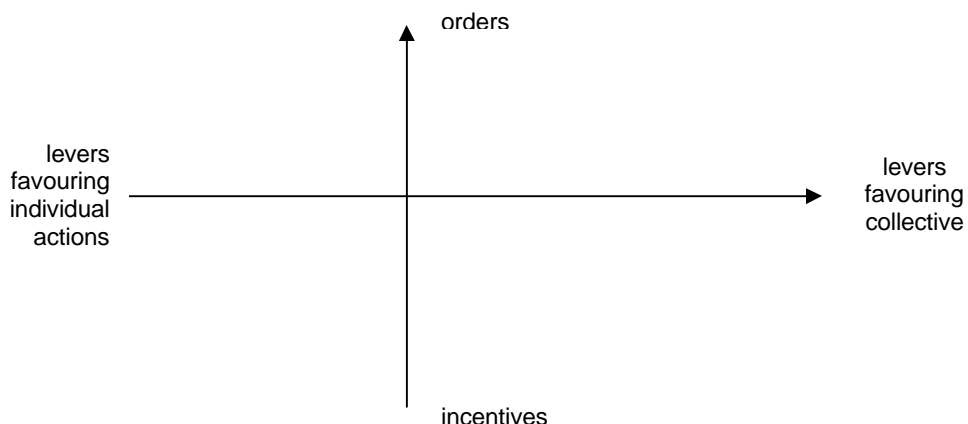
The idea of governance thus offers an internally consistent working hypothesis to describe the evolution of research sectors and of policy levers in Europe.

3.4.2 Deliberate Policy Change and Policy Levers

The extent of deliberate policy change in the countries studied over the past decade is fairly limited. In addition, structures have remained broadly stable in most cases, as have funding levels and other indicators of aggregate research inputs.

A synoptic overview of policy initiatives and issues over the period 1987-2000 shows the common direction of change (there are no major policy initiatives that actually go back on the governance trend) and the absence of any obvious pattern of diffusion or imitation. Convergence is a matter of separate trends, responding to specific measures and circumstances within each country. It is particularly striking that the political and administrative profile of research policy varies from country to country. In some cases (notably Sweden) change is a matter of explicit legislative reform; in others (notably Germany), more a matter of changing practices within established institutions with significant autonomy. In some countries, such as France, research policy has achieved a high public profile at very times during the 90s; in most other countries, research policy is usually of concern only to a very narrow policy community.

The impression of overall stability at the policy level does not tell the whole story. In most of the countries studied, perceptions within the research sector are of significant change, associated in particular with increased funding pressures, modified career structures leading, on the whole, to greater difficulties in attaining tenured positions (or stable positions with status similar to that of tenured faculty), etc. Furthermore, policy concerns about the research sector have been very much on the agenda, and have often achieved some public prominence. Reforms may not have been implemented (as in France) or have produced less dramatic results than might have been expected or intended (as in Austria or the UK), but the climate is nonetheless one of change.

This climate of change can be better illustrated by looking at the evolution of the policy levers used by the various governments and state authorities in our study. In particular, the grid – group scheme shows us a general shift towards the use of less high-grid levers. In other words, orders are less used, and incentives and negotiations are gradually becoming the most favoured policy levers. Evidence of *perceptions* in this respect are fairly explicit in the interview data gathered in the course of the project, but it seems equally warranted in view of the other material (see for instance Table 4.1) to regard these perceptions as corresponding to actual changes.

Using a small number of suggestive examples, the following figure illustrates this evolution.

Figure 4.6: A cultural mapping of selected policy initiatives
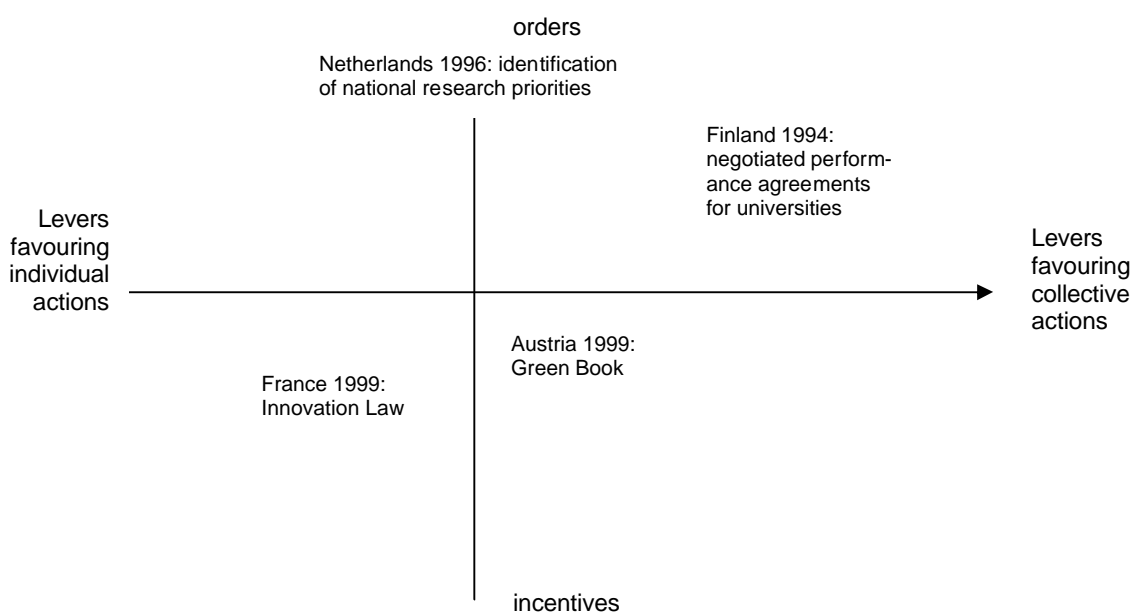
How might we explain and interpret this general shift, given that it cannot simply be subsumed within a deliberate series of reforms inscribed in a self-conscious state strategy? Three main reasons, which are complementary rather than mutually exclusive, can be listed:

- First, the nature of research itself. Research, as discussed earlier, is "positive" for policy purposes. It is not amenable to command, because it depends on researchers' autonomy and active collaboration (as opposed to negative compliance). Incentives and negotiations would therefore seem to be the primary policy levers.

- Second, the research sector's structure reinforces and favours such levers. There is thus a positive feedback, whereby the levers strengthen the structures they are applied to.

- Third, the general context seems to favour this shift towards "lower-grid" levers. This context refers firstly to internationalisation, which has many consequences on the research sector: it favours its autonomy vis-à-vis the national government, it enhances external evaluation procedures, it produces new sources of funding and modifies the meaning and impact of concerns about "competitiveness". But national demographics in the research field are also part of this context, as national research sectors seem unable to provide stable positions for their researchers, and as competition between candidates seems, in most countries studied, more intense than ever.

These various reasons provide a basis for a general shift towards governance, but this evolution is in no way homogeneous. In countries where priorities such as internationalisation of research were adopted earlier, the move towards governance also happened earlier (Sweden is an example in this respect). In some cases, this shift has occurred relatively recently, as in of Portugal and Austria, which may thus seem to "lag behind" – and indeed seem to be perceived precisely so by many members of their own policy communities.

3.4.3   National Research Systems as Five-Dimensional Spaces

In order to give a clearer comparative picture of this climate of change, it is necessary to develop tools that express the qualitative data in quantitative form. Using a range of sources, and especially the interviews and the national reports, we have tried to summarise, in a dynamic perspective, the major characteristics of the eight National Research Systems.

The technique chosen is to define the situation of any national system at any time as a point in a five-dimensional space, the dimensions of which are priority setting, funding, employment policy, evaluation and internationalisation. The ranking of each system on each dimension brings together the range of empirical data collected in the course of the project. While the scale is necessarily arbitrary, the figures used have been calibrated for comparability between countries and across time. Paths of policy change are thus paths in this five-dimensional space. This multidimensional scale has

the advantage of not reducing the notion of governance to one or two axes, and therefore it gives us a much more precise view of the different possible "paths towards governance". However, it is important to remember that it is the whole combination of the five criteria which is relevant in the final analysis, because the axes are interdependent. For example, internationalisation may have effects on the way evaluation is conducted (e.g. peer-review with foreign experts), or on funding procedures.

Our hypothesis is that the pure model of governance can itself be situated as a point in this five-dimensional space. Therefore, the combination of the five criteria for each system gives a picture of its position relative to governance. In addition, the path of a system over time can be analysed with respect to decreasing or increasing distance from governance.

Points in five-dimensional space can be conveniently represented as pentagons in two-dimensional space. Figure 4.7 shows the "pure model of governance", arbitrarily situated at "10" on the scale for each of five criteria, as such a

Figure 7 : The pure model of governance
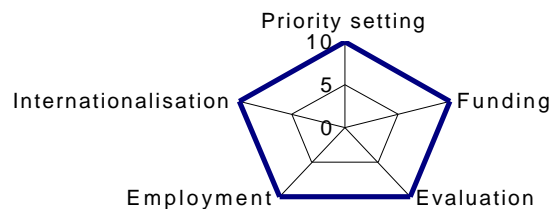
pentagon. Subsequent graphs for national systems will be drawn using the same technique.

In order to compare actual systems to the "pure model of governance", it is necessary to specify which features on each axis are relevant for a governance perspective.

- Concerning **priority setting**, governance is characterised at the level of the state by an explicit, and at least theoretically autonomous, process of priority setting, and by the use of "top-down" instruments. Moreover, the governance mode is highly responsive to the public debates, and to internal state issues.

- **Funding** includes *basic funding* (but at a lower level than in the government mode), in order to maintain the running of public organisations, *competitive funding*, and *partnerships between public and private sectors*, which can take the form of privatisation. The basic idea is that when the private sector is able – and willing – to finance research, public research organisations do not interfere; but if the private sector does not provide the funds for a research perceived as necessary at the social level, the public research organisations are invited to do it, but on a competitive basis.

- Concerning **employment policy**, the first feature seems to be the competitive nature of recruitment. A system of tenure is *prima facie* suspect, despite its contribution to the research sector's autonomy. On the contrary, the governance mode favours fixed-term contracts, with competitive renewal. This renewal can take place either in a broad market perspective, or in a situation of internal competition, with promotions for career advancement.

- **Evaluation** of research must to be carried out within the scientific community, because evaluation by non-academics may call into question the research sector's autonomy (which enhances its capacity to meet characteristic contemporary policy objectives). However, it has to be formally and institutionally external, in order to avoid suspicion about researchers assessing themselves; for example, evaluation may be carried out by peers, but not by colleagues. The purest form of this formally external evaluation is in-ternationalisation, of which the involvement of foreign researchers in peer-reviews is an important aspect. This evaluation aims at assessing the outcomes, the relevance or the impact of research activities. Policy has to be evaluated too, in an "outcome versus objectives" perspective. This means that the state may be more interested in the outcomes themselves, than in the ways the goals have been reached. Policy evaluation remains limited in all countries

studied, which is why no very high marks were attributed on this axis.

- In the governance mode, **internationalisation** is an instrumental issue, because it is viewed as a way of promoting other objectives. If internationalisation of research favours them, then the state will actively promote it, otherwise not. The more a policy framework uses internationalisation as a lever (e.g. making funding, promotion etc. conditional on it), the higher its mark on the axis. The point here is not to assess the internationalisation of researchers from the various countries, which is primarily a matter for other parts of this study.

In sum, governance is characterised by the conjunction of explicit mechanisms and monitoring, by the absence of a command chain, and by a relative indifference towards the means used in order to reach the objectives.

The following graphs have been constructed from this model of governance. The first set represents the positions of the respective countries in 1990 and in 2000, compared to the pure governance model.

Figure 4.8 : Austria
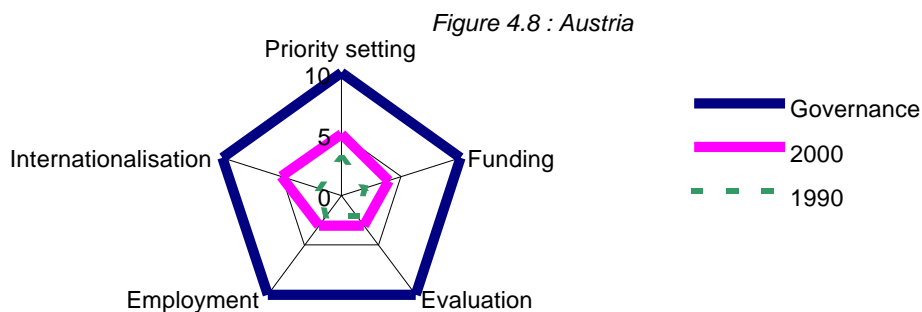
The move towards governance is an explicit objective of many participants in the Austrian policy community. Its implementation, however, remains limited, especially as Austria started from a very low base of strong research community autonomy. The main changes have been in the area of priority setting, funding (which is related to internationalisation, because competitive funding is predominantly international), and European accession has also modified perceptions of the contribution of internationalisation to research quality. Moreover, internationalisation as such is formally used as a policy lever. Recent political shifts, however, make the current situation unstable.

The significant shift towards the governance model in Finland again reflects explicit policy priorities, sharpened as in Austria by the implications of EU accession.

65

Internationalisation and funding have been the most striking dimensions of change that are traceable to deliberate policy initiatives: direct funding to universities has decreased dramatically, while competitive funding has increased; internationalisation of research has been emphasised in Finnish S&T since 1988; today, in addition to the emphasis on EU collaboration, there is also an emphasis on international evaluations and on extensive international collaboration. The significance of shifting employment patterns, however, should not be underestimated, even though these have been as much the indirect consequence of demographics and other factors as of policy change.

Figure 4.9 : Finland
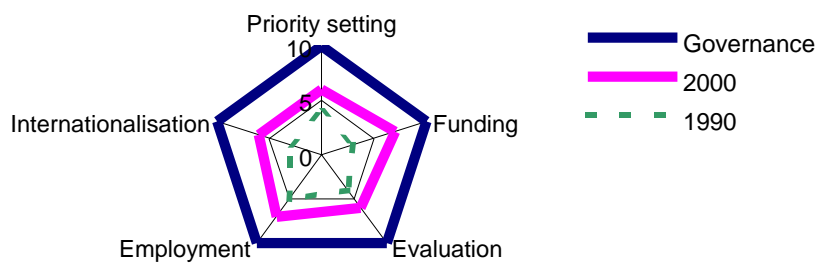
Figure 4.10 : France
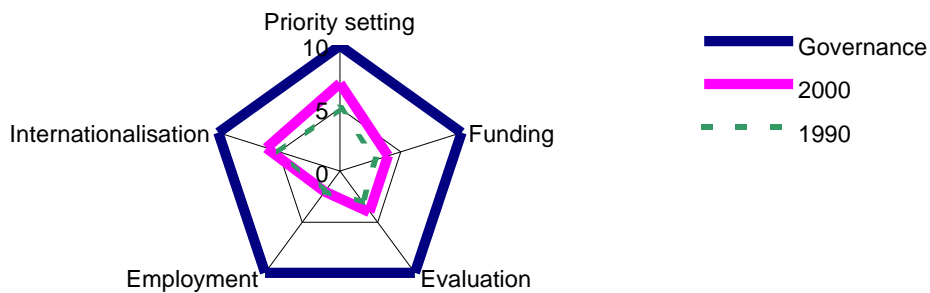
Despite continuous and sometimes heated political debate, the French policy framework remained largely unchanged through the 1990s. In particular, France has so for been immune to changes in patterns of funding evaluation and careers characteristic of the governance and exemplified in various forms in many other countries. This relates less to suspicion of governance in general – as shown by shifts in public management in other policy sectors – than to reluctance to embrace internationalisation, and its implications, as indicative of research quality.

Figure 4.11 : Germany
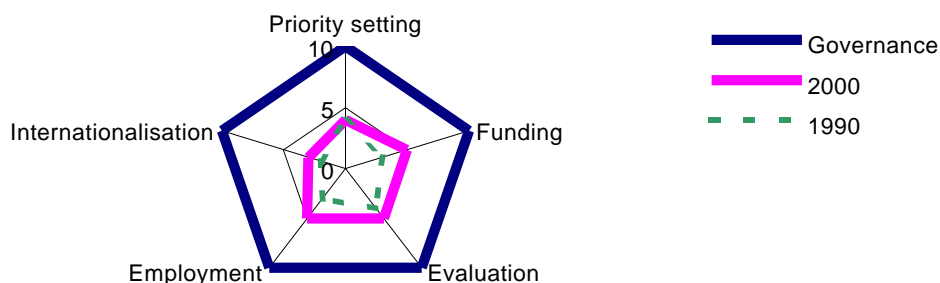
As in France, Germany has been characterised by structural stability over the past decade. Also as in France, one important aspect of this stability has been a comparative reluctance to embrace internationalisation as either a good thing *per se* or an obvious indicator of quality. To the extent that change is observable in Germany, however, its direction is sharply different from that in France. In particular, career patterns, driven by demographics and institutional reluctance to offer tenured positions, tend to promote forms of market-oriented behaviour.

Figure 4.12 : Netherlands
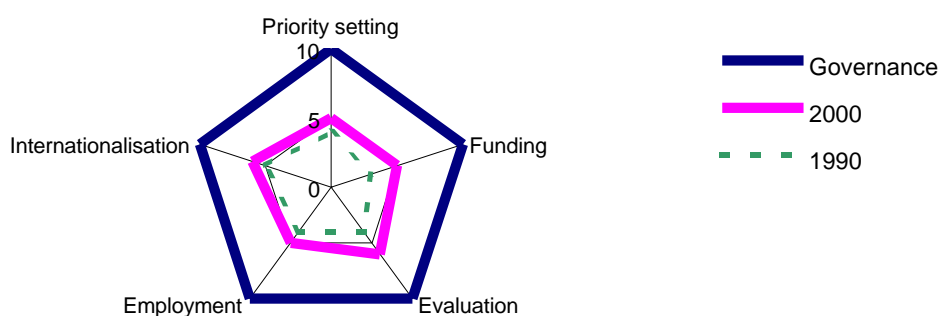
During the nineties, the Dutch situation has remained basically stable: some changes have occurred in evaluation and funding, with many policy initiatives in the area of funding (many of which actually failed), and emphasis put on measuring the researchers' performances through indicators. Employment has become more flexible and market oriented, but historical contract Rights still prevail. Most of the changes that have occurred were policy driven, with the idea that a "small country" needs to be innovative if it wants to be competitive.

Figure 4.13 : Portugal
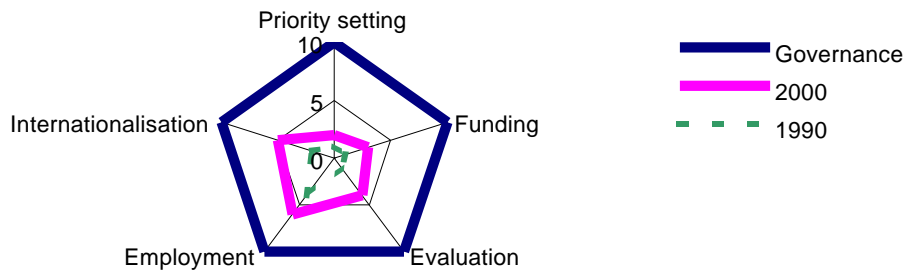
Portugal started from a very low base. The movement towards governance has been significant, as a response among other things to the perceived need to catch up with the EU. This has been particularly the case with respect to internationalisation, which has been deliberately used as a tool, and correlates with other changes, especially in evaluation (see Case Study 4.3).

Figure 4.14 : Sweden
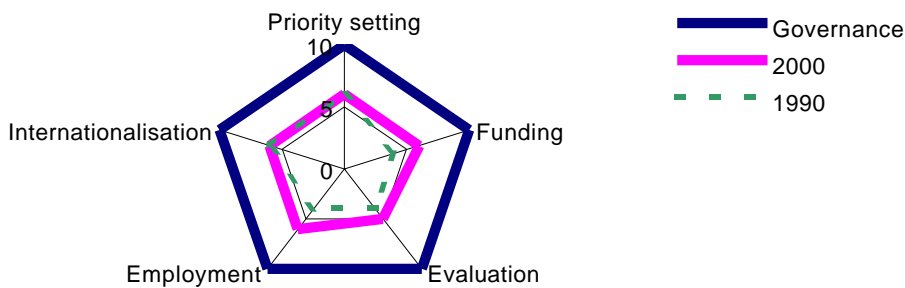
During the nineties, Sweden has remained structurally quite stable. This stability is partly due to the fact that it started from a comparatively high base on a "governance scale". In addition, research communities have considerable capacity to respond to and to divert external pressures. For example, emphasis has been put on evaluation in R&D rhetoric, but this has not resulted in great changes; however, the increase in competitive funding has indirectly lead to the generalisation of evaluation procedures of research. The (limited) changes in employment policy seem closely related to demographics in impact on career structures (in many respects as in Germany, Finland and the Netherlands).

Figure 4.15 : United Kingdom
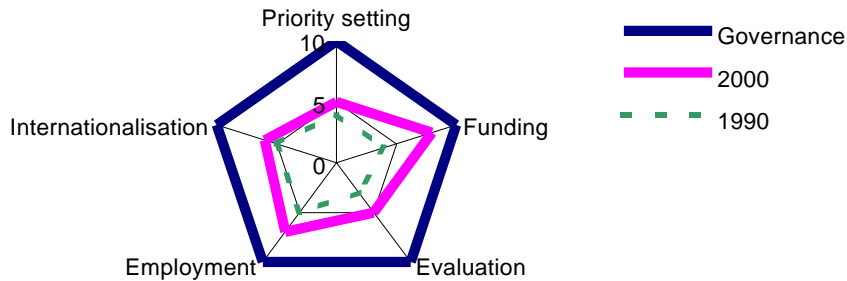
Major structural change has occurred in the United Kingdom in the past twenty years. However, most high-profile reforms – which were policy-driven, often for ideological reasons – came too early to be reflected in this graph. It is unclear whether the practical effects of these changes have been as significant as their symbolic impact. Certainly, the INNOCULT data suggests that the UK has been both more stable and less distinctive over the past decade than sometimes assumed.

All these graphs show that even though there clearly have been shifts towards governance – meaning perhaps most importantly *conditionality* as a policy lever – in every country, this does not mean that there has been harmonisation between the ways policies in the research sector are conducted.

Despite differences between countries, however, the general picture of a move towards governance remains basically valid. The main evolutions have been in internationalisation and funding, which are to some extent related (through competitive funding at the international level).

Looking at 2000, three groups emerge:

4. The "norm" of the sample (Sweden, Finland, UK, Netherlands), which are closer to the "pure model of governance" than the other countries, especially in funding and employment policies. Three of them (Sweden, UK, Netherlands) had undertaken changes in that direction before the beginning of the nineties; some of them (Sweden and Netherlands) may therefore have remained structurally stable during the last decade. Change has been much more striking in Finland and in UK, where the move towards a governance style of policy largely results from the governments' initiatives.

5. Austria and Germany are not structurally different from the preceding countries, but somewhat less governance oriented. Their current situations are nevertheless the result of totally different evolutions: Austria has undergone major changes in the nineties, especially in the areas of internationalisation, priority setting and funding, whereas Germany has remained relatively stable, except in the areas of funding and employment.

6. France and Portugal show structural differences from the others and from each other. In Portugal, the area in which policy in the R&D field gets closest to the "pure governance model" is employment, whereas priority setting is the from the pure model. In France, the situation is reversed, with priority setting at the highest level, and employment at the lowest. But it is undoubtedly in Portugal that the changes have been the greatest, with a political will during the nineties to undertake major reforms in the R&D field.

Overall, generally speaking, the interview data as well as the national reports support the presumption that research policy is "governance driven".

How can this "broader tendency" of research policy be specified? The simplest statement is perhaps that policy-makers now generally believe that government (in the sense specified earlier) of research is neither possible nor desirable. Whether they genuinely believed otherwise in the past is not always clear. We can at least say, however, that explicit policy statements (in say the 80s in many countries) were premised upon research government, i.e. the explicit formulation of national objectives and the use to promote them of such policy tools as resource allocation (on the basis of priorities), structural change (creation of new institutions, etc.). There are both theoretical and empirical reasons to think that, whether sincerely held or not, such views were always misleading. What is quite clear is that they have now been abandoned.

The real shift towards a governance model of research policy does not, however seem to be of a cultural nature, nor do differences between countries relate in any obvious way to cultural distinctions. Rather somewhat different strategic responses to changing environmental conditions appear adequate for explanatory purposes.

3.4.4   Specific Focus on Internationalisation

Referring back to the original objectives, our concern is to identify policies (if any) directed at promoting internationalisation of research and to explain their emergence.

For these purposes, we define internationalisation as movement towards more international forms of activity, such as:

- Researchers from different countries collaborating on an individual or institutional basis in project design, fieldwork, publication, dissemination and evaluation, including in particular collaboration based on exchange schemes, visiting positions, etc.;

- Research funded by several countries on a bilateral or multilateral basis or by international organisations;

- Research policy designed, implemented or monitored by authorities from several states on a bilateral or multilateral basis or in the context of a supranational body such as the EU, or by an international organisation. (This is the aspect that gave its original title to the work – governmental co-operation strategies –, although it has turned out to be less significant than originally expected.)

In practice, it proves difficult to separate strictly policies from a range of processes that constitute internationalisation as defined without necessarily deriving from the state, or even being deliberately designed by anyone.

The key findings are that internationalisation is a characteristic feature of research policy in general, which is currently in a phase of expansion. In this overall picture, neither self-conscious policy nor Europe are necessarily as significant as one might think. Rather internationalisation is the result of a whole range of uncoordinated actions: to this extent it has a functional as much as a strategic logic. However, it would also be incorrect to regard it as unrelated to policy, which takes account of the functional dynamic, seeks to use it as a lever, and to some extent reshapes it.

A range of reasons contribute to policy-makers' focus on internationalisation. Some of these are purely a matter of fashion, but some do seem to respond to genuine dynamics at work within the research sector.

- Institutional engagement with Europe creates its own dynamic, partly because it forces countries to fit national policies into an existing framework for EU-wide co-operation, partly because it creates a standard of competitiveness for new entrants. It is striking that, in recent accession countries, respondents often refer explicitly to accession as a reason for changed policies, both internally and as regards internationalisation.

- Internationalisation is perceived to be both an indicator of the state of the NIS and a response to its possible inadequacies. A phrase quoted in the German fieldwork has quite broad resonance: "we may not stay in the Champions' League". There is in many cases an explicit link between teaching and research in this respect. Many interviewees stressed that institutional competitiveness is inseparable from the attraction of foreign students, especially at post-graduate level (which implies of course that the key issue is competing with the US). For example, in France, a clear distinction emerges between the physical and life sciences, which are perceived on the whole to be competitive because they are already highly internationalized, and the social sciences which are perceived to be parochial, and therefore under-performing.

- The cost of certain major programmes makes internationalisation the only viable option (examples: fusion research, some aspects of computer-intensive molecular biology, particle physics). This point is at some distance from the programmes specifically targeted in the INNOCULT fieldwork, but it is worth keeping in mind.

- Certain thematic issues also contribute to policy-makers' interest in internationalisation. Comparative research is often of direct policy relevance, particularly as far as best practice is concerned (e.g. in social policy). For institutional and sociological reasons, policy-makers are not well placed to organise or commission comparative research directly. Therefore, they have to rely on national contacts being integrated into international networks. In addition, certain fashionable themes have a transnational and trans-disciplinary nature, for example: social exclusion, climate change and environmental issues generally, epidemiology of diseases such as AIDS.

To what extent are national policies (in terms of priorities or procedures) affected by internationalisation, and in particular by the European research

agenda? The INNOCULT evidence is sketchy. There is considerable explicit criticism of the European agenda, especially of the "diplomatic" (i.e. minimal consensus) way in which priorities are established, but this does not necessarily mean the effects are limited.

Looking at the research system as a whole, the main effect would seem to be an enhancement of those features inherently conducive to a governance oriented mode of policy. We might therefore postulate a positive feedback loop between internationalisation and governance, where each reinforces the other. In particular, we can list the consequences of internationalisation on the other criteria we used to "map" the shifts towards governance, namely priority setting, funding, employment policy and evaluation (repeating, by necessity, certain points already made).

- Concerning priority setting, internationalisation reduces opportunities for direct control, but increases opportunities for indirect control (e.g. via competitive funding) even in systems where at the national level such opportunities are limited (e.g. France). Moreover, even though their impact still seems limited, the agreements on R&D policy between the European states, which are partly embodied in the Framework Programmes, represent a major shift in the way national priorities are determined.

- Funding patterns, as suggested before, may both be conducive to internationalisation and in turn be modified by it. There is evidence that internationalisation (e.g. in the European context) may serve to compensate for inadequate national funding. Conversely, as in Germany until recently, availability of adequate national funding reduces the incentive for researchers to participate in international activities. These effects, however, are not simply mechanical. Internationalisation also has potentially profound impacts on the *climate* of research policy. In particular, the forms of evaluation characteristic of many forms of international research familiarise and ultimately legitimise similar practices at national level, which may

significantly affect, for instance, the balance of conditional/competitive and unconditional funding.

- Employment policy as such seems less influenced by internationalisation, but the consequences of the opening of national employment markets clearly reinforces a governance-style policy. Most of the consequences of internationalisation on employment and career patterns seem to be indirect, but very real: first, internationalisation allows "exit" strategies for researchers when the national markets are blocked; second, as with funding, internationalisation increases competition between researchers, by placing their work in competition with foreign publications, by allowing comparisons on a larger scale, and by creating competition between researchers who wish to go abroad.

- Evaluation is largely affected by internationalisation too. As shown earlier, evaluation in a governance perspective implies internationalisation, because it depends crucially on techniques such as the involvement of foreign researchers in peer-reviews, which though it is carried out within the scientific community, is formally and institutionally external. It therefore offers a compromise between evaluation by non-academics, which deprives policy of the resource of autonomy, and self-evaluation, which effectively removes evaluation as a lever from the hands of policy makers. Evaluation as modified by internationalisation is thus an aspect of an "objectives versus outcomes" approach.

This might suggest a tendency towards spontaneous policy harmonisation (at least in terms of procedures, levers etc.), which is not yet entirely clear (the graphs show that there has been a general move towards governance, but still no harmonisation). In particular, differences in evaluation cultures do not seem to be on the decline, and structural changes (e.g. privatisation, erosion of tenure, …) are still strongly resisted, even at the policy level, in many countries.

The picture that emerges from the considerations presented here is a complex one. Differences appear between countries, disciplines, generations, and institutions. It would, therefore, be highly misleading to seek to derive a simple,

generally acceptable outlook. Some useful pointers can nonetheless be identified.

First of all, from a policy perspective, internationalisation seems, for the reasons discussed earlier, to be demand-driven. Low take-up is a problem for many bilateral and multilateral programmes. And even when take-up is adequate (e.g. the EU Framework Programmes), this seems to have more to do with individual initiatives than with institutional responses. More money for international research, therefore, does not necessarily mean more or better international research.

However, these demand-driven dynamics are not irrelevant in policy terms. Individual motivations to engage in international research may vary widely, but the general tendency seems to be that internationalisation is broadly synonymous with quality. A "good" researcher is one who is internationally re-cognised; and while international activity does not suffice for recognition, it is, on the whole, a prerequisite for it. The implication – which, as we have seen, many policy-makers explicitly recognise – is that internationalisation is both a *lever* and an *indicator* with respect to general research performance.

The major complicating factor, as we have seen, is that internationalisation is not simply a quality-control strategy that can be grafted on to any existing system. By its systemic effects, even regardless of the intentions of the actors involved, it tends to promote a research model that is broadly market-driven and governance-oriented. This shift may be favourable to research efficiency in an abstract sense, and also of course to a productive research–commercialisation interface, but it also has normative implications. In fact it conflicts sharply with widely shared conceptions of what research activity and research policy should be. In prospective terms, the key question is therefore how the balance of structural pressures and normative counter-pressures is likely to develop. The INNOCULT research obviously offers no direct answer, but it does give some indications. It suggests that, in the absence of significant increases in core institutional funding and direct state involvement in research, internationalisation is likely to be both a natural policy lever and a systemic response. This seems

to be self-consciously embraced by most intermediate-level policy-makers, and there are certainly no other reasons to expect counter-pressures to emerge from the policy process itself. Similarly, whatever objections researchers have in principle to internationalisation (not *per se* but because of its systemic effects), it is too much of a rational response not to be commonly adopted. Such adoption will of course occur differentially, as the INNOCULT research shows, and those differences will fall into complex patterns reflecting disciplines, generations, national peculiarities, institutional modes. Some of these factors may be best understood in cultural terms but, as we have seen, the overall picture is rather a structural one. It seems reasonable, therefore, to regard the future of internationalisation as a bright one.

3.5   Institutional Innovation and Europeanisation of University Research

Using the surveys of research directors and researchers within the universities in eight European countries, this Chapter examines the extent of the institutional innovation, as well as the researchers' and directors' perceptions of the changes and their effects on Europeanisation. Regarding the overall aim of the INNOCULT project, the Chapter focuses in particular on the question of how European participation is related to institutional innovation. European success is defined as the participation in the European Framework Programme and in other international programmes. Institutional innovation – elaborating ideas of new public management – is defined by the extent to which the university in question has (a) developed research policies, (b) regularly evaluated research performance and (c) set priorities.

3.5.1   Funding structures

Most countries have a research funding system that involves three types of funding, namely, institutional funding – provided as a lump sum to the universities for teachin and research – competitive funding from national research councils allocated for specific projects, programmes or designated

centres of excellence and contract research from various sources, including government, industry, the European Commission, charities, etc.

We asked directors to indicate the proportion of the total budget from different sources today and five years ago. Although the answers were not unambiguous, a general trend towards a diversification of sources is visible. Considerably more university research directors report that they receive funding from national and European competitive funding sources, from contract research and from regional funding. To understand the extent to which these changes are perceived from within universities, we asked researchers and research directors about their perception of changes in research funding, drawing on seven statements (see figure 5.1).

Research directors did agree (strongly) with the statement that more research funding is competitive and available, although institutional funding has decreased and the procedures to obtain national or European funding have became more complex. They disagree with the statement that European funding is easier to obtain and less bureaucratic than national funding.

> Like the research directors, most researchers disagreed with the statements that European funding is easier to obtain and less bureaucratic than national funding. About an equal number of researchers (strongly) agreed and (strongly) disagreed with the statements on the complexity of the procedures and the level of competitive and institutional funding. Interestingly, while most research directors agreed that more research funding is available, researchers think otherwise: 50% (strongly) disagreed with this statement and only 20% (strongly) agreed.

Figure 5.1 Perception of research funding by research directors
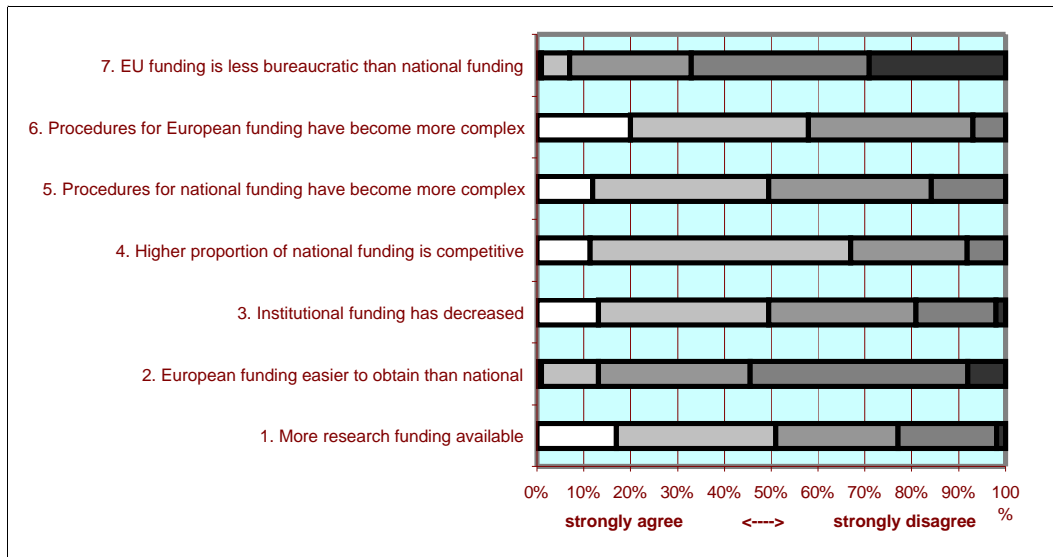
The perception of changes in funding structures presents significant differences from country to country. 80% of the researchers from Finland and Portugal say the level of competitive funding has increased. Researchers from France, Germany, Austria, and the UK tend to say that national competitive funding has decreased. In the Netherlands and in Sweden we find a significant disagreement among researchers about the question whether competitive funding has increased or decreased.

On the assessment whether competitive funding has changed, there are large differences *within* areas of expertise and *between* areas of expertise. The overall tendency of researchers was to disagree with this statement; however in Health and Life Sciences and in Biology, Earth Science and Environment there was a high percentage of agreement with this statement.

We asked researchers whether the changes in funding structure had an impact on the content of their own research. Of the 276 researchers who responded to the question, 37,3% said that the changes had affected their research significantly, while 43,8% said it affected their research only marginally. The remaining 18,8% responded that the changes had no impact at all on the content of their research. Research content is affected most in Portugal, Sweden, and the UK, and the least in Germany. If we look at the field of

expertise, we again have deviant response patterns for Health and Life Sciences and Biology, Earth Sciences and Environment.

3.5.2 Employment Structures

One of the changes universities have to cope with is that university employment contracts have to be more flexible then they used to be, but at the same time have to be competitive compared with other knowledge producing institutions. The questionnaires for both researchers and research directors contained a section on employment structure for the analysis of the perceptions of change along this dimension, and whether rules and regulations for employment had become tighter. These questions were answered by approximately 80% of the researchers asked and 95-97% of the research directors. We confronted both groups with eight statements about changes in the employment positions of researchers and asked them to indicate whether they agreed or disagreed (on a five point scale) with the statement or perceived no change at all (figure 5.2).

Figure 5.2: Perception of changes in employment structures by researchers
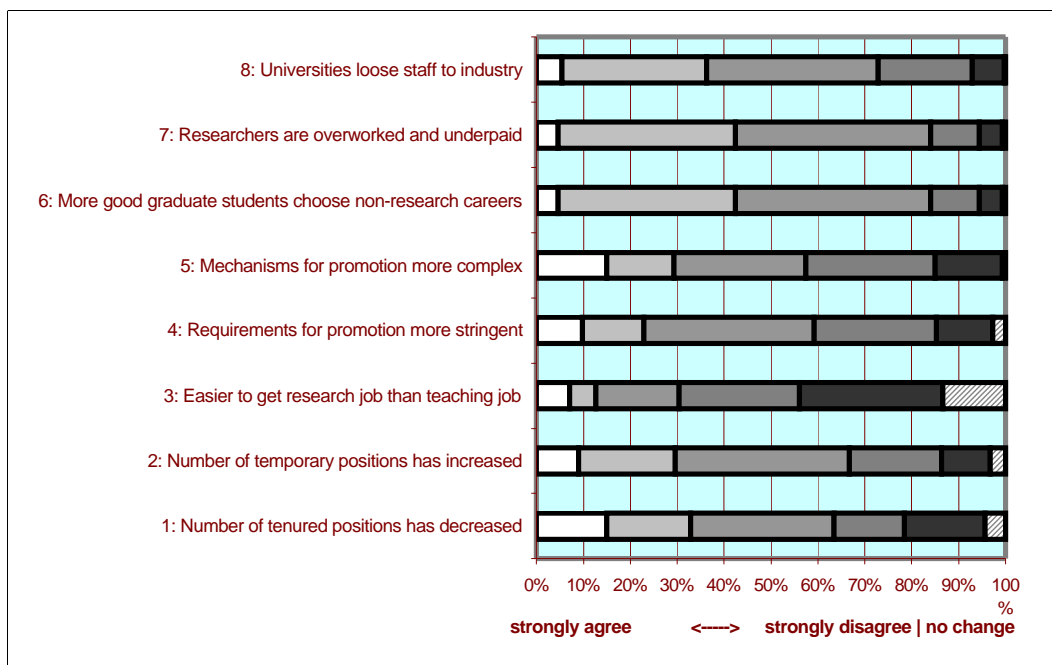
We also asked research directors about the possibilities of hiring new staff today and five years ago. The differences are significant: five years ago, it was impossible for about 10% to hire new researchers, while today this percentage has increased to 18%. However, if competitive funding is obtained, it is now more possible to hire new researchers in most universities than it was five years ago. These results indeed suggest a slight development towards more flexibility of contracts and employment policies, as well as a more difficult position of universities at the employment market. However, it is not as uniform as suggested in the literature. This is confirmed by the contextual variation of findings by country, type of institution and field of expertise. Thus, for instance:

- The statements on the availability of research positions at the university is the more controversial question at country level. In Germany and France we found strong agreement with the statement that the number of tenured positions have decreased, while in Finland, Portugal and Sweden there was strong disagreement with this statement.

- Researchers from old/specialised universities agree with the statements that tenured positions have decreased, and disagree with the statement that temporary positions have increased. Researchers from new/general universities strongly disagree with the statement that tenured positions have decreased and agree that temporary positions have increased.

- Researchers from 'business management and accountancy' disagree significantly more with the statements that temporary positions have increased, that mechanisms for promotion have become more complex and that researchers are overworked and underpaid. In 'health and life sciences' we find strong agreement with the statements that tenure positions have decreased and temporary positions have increased, while for 'information technology and mathematics', another new technology field, we find that researchers disagree more with the statement that tenured positions have decreased. Researchers in environment-related research fields feel that although it is easier to get a research job, the conditions are not very good, and the mechanisms and requirements for promotion are complex.

3.5.3   Working as a Researcher

From the responses we received we can construct a general image of a researcher's working position and working hours:

- Most of the respondents have considerable research experience. About 60% have been involved in research for more than ten years. Of the other 40%, half of the respondents have been working in research for more than 5 years.

- Unlike the often heard complaints about staff immobility within universities, about 60% have not been at their current position for more than 6 years. The career of 26% of the respondents has been interrupted for a number of reasons.

- 26% consider leaving the research profession, mainly for career and financial reasons.

- Most of the respondents have a full time permanent position. The percentage of respondents working full time is about 90%, but considerably less have a permanent position (65%).

- 77% have teaching responsibilities, differing from considerable (>8 weeks a year) for 13%, medium (4-8 weeks) for 24% and a small teaching responsibility for 40%.

- Regarding the number of days at the office, 54% of the respondents work at the office 5 days a week; 22% spend even more days at the office and 14% spend 4 days at the office.

Although national overviews, policy documents and observers have perceived major changes in the national governance of research organisations, including universities, and therefore tend to speak of 'transformations' of the research systems, we find that the actual effect on individual researchers might be far less than the various studies suggest. That does not imply that the changes do not occur, but it would be a hasty conclusion to say that because relationships between governments, intermediary organisations and universities as such have changed, individual researchers have also been affected. Remarkable in that respect is the differences in perceptions of change between university directors and university researchers. The former group tends to agree with statements that changes have occurred, the latter does not, or to a much lesser extent.

Two conclusions can be drawn from these results. First, researchers are not directly affected by the changes in funding policies and employment structures. Second, within the university - and this is in accordance with one of the main findings of Henkel (Henkel, 2000) - that universities have developed a level of research directors within their organisation who mediate pressures from the national research system.

3.5.4   Evaluation Perspectives

A focus on the quality of research is at the core of the reported changes within the academic system, and in accordance with the ideas of new public management. An examination of the OECD in 1997 revealed that the new

evaluation procedures are embedded within the research system in different ways, some linked to funding systems, others to reforms and some to institutional management (OECD, 1997). In general, the evaluation procedures are developed at a national level and mediate the relations between government and research organisations and universities in one way or another. In addition to these new evaluation procedures, literature on new modes of knowledge production (Gibbons et al., 1994) asserts that the notion of quality has changed, and that in addition to scientific perceptions of quality, those of users and societal actors are important as well. In this Section, we are interested in the extent to which this new 'evaluation culture' has affected institutional practices within universities, and whether it affects the individual researcher.

> The questionnaires do not provide details of performance evaluations and their outcomes, but insight to what extent performance evaluation occurs and how such developments relate to contextual factors. Of the research directors 55% indicated that their institute's research performance is evaluated on a regular basis, 28% stated that it is evaluated occasionally and only 17% said it is never evaluated. Evaluation is currently the norm in approximately 20% of the universities surveyed. More than 50% say evaluation results are (very) important for allocation of base line funding and institutional priority setting.

> Within institutes, evaluation of the research performance occurs less frequently. We asked specifically about the evaluation of the research performance of individual researchers. Of the research directors, one-third say individual research performance is evaluated regularly, one-third say it is evaluated occasionally and in one-third of the cases it is never evaluated. When research performance is evaluated, research directors think the results are especially important for the researchers' career and reputation. To a less extent, it is considered important for attracting research funds and agenda setting. In only a few cases, results of evaluations are translated in financial remuneration.

Figure 5.3 Consequences of University Research Evaluation
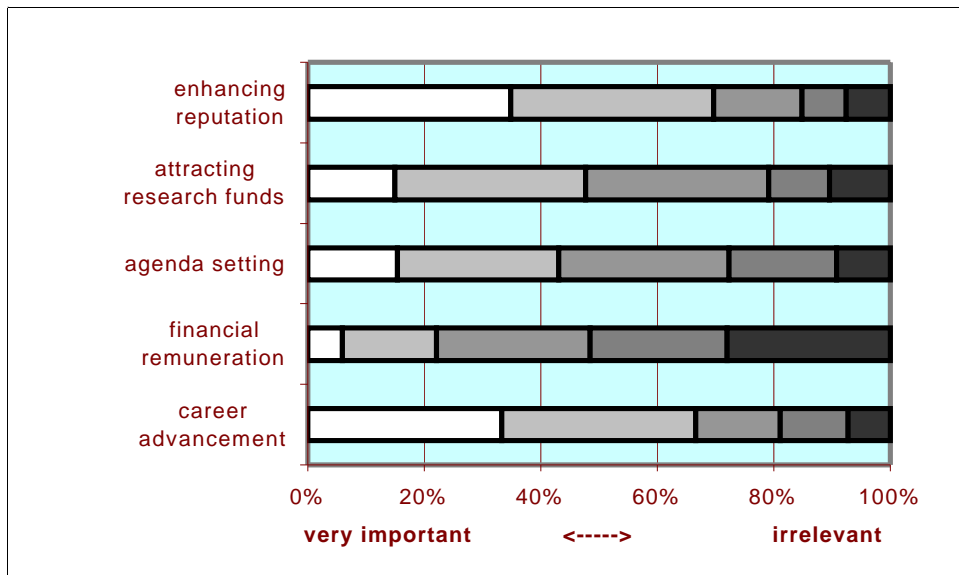
Nearly all respondents from Austria, France, Netherlands, Portugal and the UK say that research is regularly evaluated. In Finland and Sweden research is evaluated occasionally; one-third of the respondents from Germany reported that the research of their institute is evaluated regularly, one- third report occasional evaluations and one-third say it is never evaluated.

Individual performance evaluation occurs predominantly in the UK, France, and the Netherlands. In the other countries, some 50% say it never occurs. Within specialised universities individual research performance is evaluated more frequently than at general universities.

3.5.5   Priority Setting

At the end of the eighties, Martin and Irvine published their seminal book on Research Foresight subtitled "Priority Setting in Science" (Martin and Irvine, 1989). The book reviews numerous projects by governments and other national bodies to define priorities for science and technology policy. In the nineties, such projects labelled foresight developed further, but with different effects on the relation between government and scientific organisations. In the UK and the Netherlands, a main objective of the projects was to improve priority setting within universities (Meulen, 1998). Through priority setting, the universities' role

in economic and technological development and within the broader knowledge society was to be increased. At a number of universities the national priority setting projects were complemented by internal priority setting. Budget restrictions, development of new areas, the creation of centres of excellence required that instead of equal distribution of funding, or allocation based on just a formula, priorities had to be set. One example is the University of Aveiro, which in a short time boasted 10.000 students and had to develop a research policy in order for research to keep in step with education.

Apart from these external pressures for priority setting, the implementation of new public management within universities requires universities to define organisational goals more explicitly than before. Responses from the research directors indicate that 61% of them are heading a university or university department in which priorities are set. 21% were already setting priorities before 1990. Between 1990 and 1995, 25% set priorities for the first time, and the other 45% have done so in the last five years. These results are confirmed by the responses of researchers. Five years ago, 31% were expected to formulate a research strategy; today this percentage has increased to 50%. More researchers have to discuss these strategies with the head of unit or have to be approved by them, and more researchers have to co-ordinate these priorities with priorities at institutional, national and European level (table 5.5)

Table 5.5: Formulation and Co-ordination of Personal Research Strategies

	Today	5 years ago
Formulation of research strategy	50.3%	31.0%
Discuss with head of unit	63,2 %	45.1%
Approval of head of unit	50.4%	36.8%
Co-ordinate with institutional priorities	58.6%	31,6%
Co-ordinate with national priorities	31,6%	15,0%
Co-ordinate with European priorities	16,5%	6,8%

Like for statements on employment, funding, and evaluations, research directors agree noticeably more than individual researchers that important changes have taken place in priority setting. They particularly agree with the statement that multidisciplinary research has become more important. More than 50% agree that research priorities are more sensitive to social issues, are increasingly set at European level and are more tightly monitored. More than

40% agree with the statement that priorities are increasingly set at institutional and national levels (see Figure 5.4).
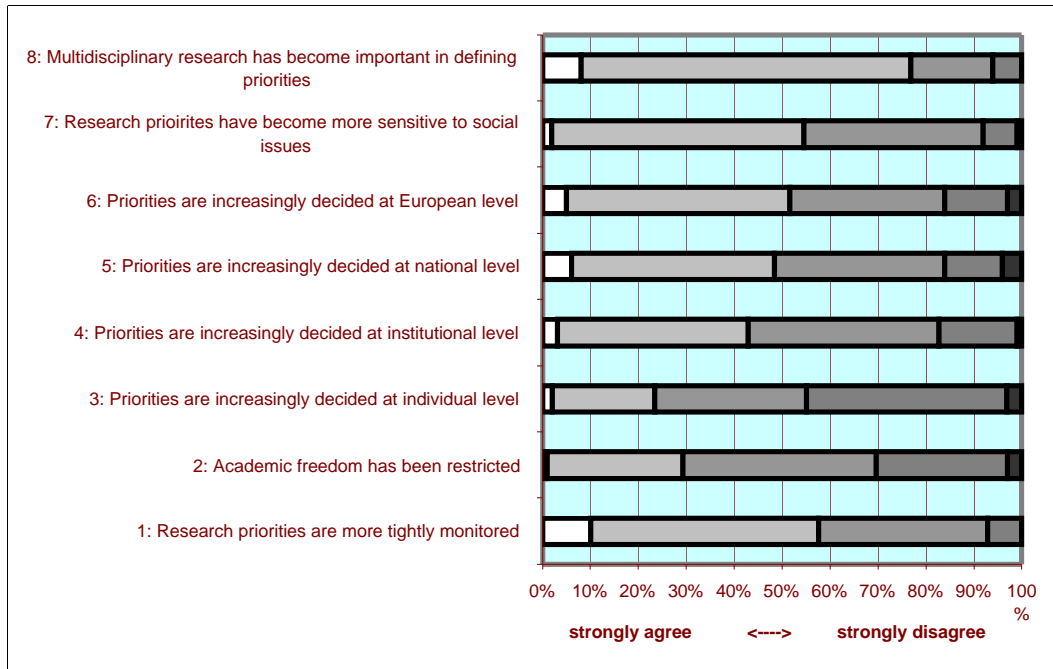
We examined whether priority setting and levels of agreement were related to country, field of expertise and type of university.

For country, we found a rather large disparity. In the UK and Austria, only 30% are required to develop a research strategy, but if they do, a rather high percentage has to co-ordinate this strategy with his/her department, and to some extent with the university. In the Netherlands, we see a strong focus on departmental and university priorities, but very little co-ordination with those at national and European level. A similar pattern can be found in Finland, Germany, and Sweden. France and Portugal are yet again different, as co-ordination with university and national priorities is important for more researchers than co-ordination with departmental priorities.

Researchers from new specialised universities disagree more with the statement that priorities are increasingly being decided at institutional, national and European levels. And they agree more with the claim that priorities are sensitive to social issues and more tightly monitored.

In general, we can conclude that looking at the responses of the research directors, priority setting has not only increased outside the university, but also within. However, these priorities seem to be more important for managing the relationships at the level of the research system than at the level of researchers' research practices. Most researchers do not agree with the statement that the importance of priority setting has increased.

In an evaluation of the impact of Foresight, Hanney et al. conclude that: "Foresight did not penetrate key institutions sufficiently to generate change in academic values and agendas. […] Individual attitudes to an initiative such as Foresight will depend on its relationship to other imperatives that dominate academic life." (Hanney et al. 2002). We found that for some countries, fields of expertise and specific type of university researchers were more positive on specific statements, maybe related to Hanney et al.'s results.

3.5.6 University Research Cultures

So far we have analysed changes in governance of and within universities at the level of practices – Is research being assessed? Are priorities being set? – and at the level of perception of these practices. Have these changes also affected the organisational cultures of universities? The literature on 'entrepreneurial universities' suggests that new organisational cultures are developing in these universities, but does not systematically analyse organisational cultures.

In this Section, we explore the development of different cultures within universities. Rather than considering organisational culture as a pattern of thinking and behaviour shared by all organisational members, it is more effective to elaborate a perspective in which organisational cultures are analysed through the way members of the organisation relate to the organisation and its environment. Such a perspective also takes the results of the previous sections into account, where we established that perceptions of researchers do not or hardly correlate with contextual factors (Douglas, 1978, 1997; Schwarz and Thompson, 1990; Thompson and Rayner, 1998; Martin and P. Frost, 1996, Turpin, 1999, Ebers, 1995, Schein 1991).

For universities, this implies that we could start mapping organisational culture by examining the practices of evaluation and the responses of researchers regarding these practices.

> In the researchers' questionnaire we asked researchers to indicate the relevance of different forms of social accountability on a scale from 1-5 scale: formal and informal ones, internal and external evaluative events and forms situates in the scientific arena and those outside of it. A "5" indicated that the process is irrelevant for maintaining or

improving the researchers' research performance. A "1" indicated that the researcher believes the process is indispensable. Nine processes were listed of which eight were used to calculate grid-group biases. (We did not include the European evaluations in our calculations to avoid interference with the dependent variable of Europeanness).

The result is that we can identify four possible cultural biases for researchers of which the group dimension is somewhat more complex than predicted by group-grid theory. The possible focus on the self versus the community is replaced by an orientation towards the university as a research organisation versus the scientific community as a context of research (Figure 5.7).

Figure 5.7 University researchers positions towards quality assessment

	Grid	
	Research as work Researcher is oriented on the formal definitions and indicators set by the own institution. Internal quality assessments are considered necessary for good performance.	*Organised science* Researcher is oriented towards formal definitions and indicators of research quality as they have emerged within the own disciplinary community.
Group university		**Group science**
	University as community Researcher is oriented towards the performance of his/her own institution. To assess his/her own performance, the researcher is guided by comments from immediate colleagues and users.	*Science as community* Researcher is oriented towards the own disciplinary community and guided by direct interactions with colleagues. Formal evaluations can be valuable if they are performed by peers, and are not too formalised.

In the introduction to this Chapter we hypothesised that researchers with a hierarchical bias towards an evaluation process to determine research quality are more positive towards institutional innovations than those with a market bias. The findings would suggest that this hypothesis is falsified. Perception of institutional innovations did not correlate with any of the grid-group dimensions.

3.5.7 Internationalisation of University Research

How international are the researchers who responded to our questionnaire? We asked researchers about different international activities and performances. Fifty per cent of the university researchers are members of an international organisation. Very few researchers have never collaborated with researchers from their own country, and about 30% collaborate with colleagues from the same country frequently. International collaboration with European colleagues occurs more often than with non-European colleagues. 26.1% collaborate frequently with European colleagues and 42.6% do so occasionally.

Trends in collaborations were highly correlated: those who collaborate more within their own country also reported to collaborate more with European and non-European colleagues. 73% of the university researchers intend to expand international collaboration. But this intention is not related to past or current

patterns of collaboration. The main reason for expanding international collaboration is for intellectual reason. About 80% indicate this as their reason for wanting to expand collaboration. About fifty per cent indicate financial reasons, about fifty per cent indicate interdisciplinary reasons. About 35% say reputation and career incomes are reasons for expanding international collaboration.

These motivations are reflected in the factors that promote a participation in European collaboration and the perceived benefits. Intellectual stimulation is the most important motivation, followed by additional funding and by the skills and knowledge of partners. The opportunities to publish and travel are also relevant, as are reputation and career advancement.

We also asked about publications with other colleagues in the last five years. The figures indicate that most researchers have some international publications, and 28.1% publish with colleagues from abroad twice a year or more. Only 8.9% published no publications with colleagues from abroad.

Unfortunately, the question regarding the number of contracts has a non-response rate of 69%. Of those who responded to this question, the percentage of researchers not having any international contracts decreased from 53.4% in 1995 to 22.0% in 1999, which indicates a general increase in international contracts.

3.5.8   Europeanisation of University Research

Researchers within our sample differ regarding the extent of European collaboration and have different perceptions of the European research level. For our analysis we used four indicators of Europeaness which reflect different notions of Europe and different motivations linked to the European level. The indicators include:

- Involvement in European projects/programme. For this indicator, we used the total number of Europe-related contracts (FP, Eureka, COST, ESF, and other) in 1999 and the proportion of working time spent on European projects that year.

- The level of collaboration with colleagues from other European countries, indicated by the respondents on a three point scale: frequently, occasionally, never.

- The importance of funding from the EU Framework Programme, indicated by respondents on a five point scale from indispensable to irrelevant.

- The importance of the evaluation of research projects by the European Commission for the respondent's quality of research, indicated on a five point scale from indispensable to irrelevant.

Correlation analysis based on Spearman's rho asserts that the number of total European contracts, the proportion of working time spent on European projects and the importance of European funding are positively correlated with $p< 0,05$. The importance of EU funding and of evaluation by the European Union also positively correlate. The level of collaboration is positively correlated with the latter two as well, but only weakly and with a significance at the 0,1 level, and not with the number of European contracts and the proportion of working time spent on European projects.

We expected new universities to be more European-oriented than old universities. Because both the Framework Programme and new universities are sensitive to user needs and interdisciplinary work, we also presumed that researchers from new universities can be more successful within the EU Framework Programme. We did not find such a relationship with any of the aspects of Europeanisation. Researchers of new universities are not more involved in European programmes, do not collaborate more, nor are they more dependent on funding by the Framework Programme, or oriented towards the outcomes of EU evaluation.

The second hypothesis asserts that researchers from universities that have implemented institutional innovations set priorities, assess research performance, and will be more involved and oriented towards the European level. Correlation analysis using Spearman's rho shows that this hypothesis is incorrect as well. Researchers from universities which require formal strategies

and who formally assess research performance are not more involved in European research programmes and collaborations than other researchers. Nor are they more focussed on European funding and evaluations.

The third hypotheses takes the individual researcher as the main independent factor for explaining differences in European participation. Whether researchers collaborate within Europe depends primarily on their own perception of research performance and organisational goals. Individual researchers who are rather independent from the organisational context, decide whether they will apply for European funding and take part in European collaborations. Such decisions are influenced by their cultural bias. We presume that those researchers who are biased towards their own organisational goals and performance criteria to be less European than those who are receptive of external assessments. We also suppose those who have a positive attitude towards the organisation of science in programmes with related formal definitions of performance and assessment procedures to be more willing to get involved in EU programmes. Using Spearman's rho we find significant but weak correlations pointing in this direction.

3.6 Research Organisations – Ever More Important Actors on the European Research Scene

Four characteristics of research organisations (ROR) were selected to describe their essence and form specific 'types', namely: 'funding', 'relationship with the State', 'functions' and 'type of research'.

Theoretically, a large number of combinations based on the variations of the criteria described above are possible. In reality however, some of these attributes cluster together to outline 'ideal types' of research organisations. Following a process of operationalisation the following 'types' of research organisations can be specified:

Type One - Academies

This group comprises research organisations that have a predominantly national public base line funding although they might display a tendency towards increased participation in competitive bidding for national and/or international resources. As a rule, these research organisations have a close relationship with the state and are either government agencies or fulfil the functions of a Government department. In terms of functions these are composite organisations involved in both basic and applied research across fields and participating in policy-making. Academies tend also to be quite large with complex social and management structures. An example of research organisations representing this group is the CNRS in France.

Type Two - Public Research Institutes

Like Academies public research institutes have predominantly a national public base line funding. They usually have a close relationship with the state although in view of maintaining their scientific 'independence' the relationships might be mediated. In terms of functions they are mono-functional organisations and though they might participate (usually indirectly) in the science and technology policy-making process they do not have policy-making functions as such. Research organisations of this type engage in predominantly basic and applied research. The research institutes under the Research Councils in the UK are good examples of this type of institution.

Type Three - National Research Establishments

These research organisations have predominantly national public competitive funding though their share of industrial funding might be rapidly expanding. Research organisations falling under this category usually are either agencies or have 'customer-contractor' relationships with the State. However, it is possible that these are owned by another organisation. From the point of view of functions these organisations are mono-functional and do not have policy-making functions as such. The focus is on basic and applied research or the provision of research-intensive services.

Type Four - International Institutes

Research organisations that predominantly have international public competitive funding form this group. Their relationships with the State are a bit more distant and these are either independent agencies or have 'customer-contractor' relationships with the State. The research organisations in this category are as a rule mono-functional and focus on producing basic and applied research and/or providing research-intensive services.

Type Five – Private Research Institutes

This group of research organisations consists of institutions that have predominantly private funding (industrial or other). These are usually agencies and/or have 'customer-contractor' relationships with the State. Institutions falling under this group are mono-functional in that they do not participate directly in national level policy-making for research but can produce any type/level of research and/or consultancy work.

This typology has been used in the process of analysing and interpreting the results from this study. The following main hypotheses underpin the analysis:

- Research organisations are more internationally active (active in Europe) than universities;

- The ways in which research organisations adapt to pressure may be significantly different from the ways in which universities cope;

- Where research organisations are concerned institutional innovations are contingent on national differences rather than institutional characteristics;

- Institutional innovation is contingent on national differences rather than pressures arising on the international research arena.

3.6.1 Level of Activity in International/European Co-operation

One of our research hypotheses has been that research organisations are more active than universities on the European/international research arena. In turn we expected the level of European/international co-operation to relate to institutional structures (and changes). To test these hypotheses three sources of information were used: i) data for participation in three research programmes of the Framework Programme provided by the EC; ii) results from the survey with research managers to register international co-

operation at the level of the institution/department; and iii) results from the survey with researchers.

Table 6.1: Participation in FP by type of institution and role in the project

	ROR		Universities		Corporate		Others	
	P	C	P	C	P	C	P	C
TSER	37%	32%	61%	66%	0%	0%	2%	2%
ESPRIT	4%	6%	10%	4%	85%	89%	1%	0%
TRANSPORT	36%	32%	15%	16%	39%	44%	10%	8%

Source: European Commission

P: Participant
C: Co-ordinator

In fact and as can be seen from Table 6.1, the level of activity varies considerably across the thematic programmes. Thus in the case of TSER and TRANSPORT about a third (37% and 36% respectively) of all participants work at publicly funded research organisations but only 4% of the participants in ESPRIT are from such institutions. While participation in TSER is dominated by universities, ESPRIT and TRANSPORT have a very strong participation from industrial research units.

Research managers responding to the questionnaire reported 3,735 international research links over a four year period (1996-1999). These included research contracts under the EU Framework Programme, EUREKA, COST, ESF and other international initiatives. 42% of these links were reported by the 42 responding research organisations (on average 36 contracts per institution), 58% by the 57 universities (on average 38 contracts per institution).

Due to small numbers a full analysis according to type of research organisation can be misleading. It is nevertheless worth noting that national research establishments display a considerably higher than average level of international activity: these reported 705 contracts altogether which corresponds to an average number of contracts per institution of 44.

Another indicator of level of international commitment is the number of research outputs co-authored with colleagues from abroad (Table 6.2). According to this indicator our respondents show a relatively high level of international co-operation and reported 5,221 research outputs in the last five years. Researchers in research

organisations account for 2,269 of these. Only 7% of the respondents from research organisations have not published any co-authored research outputs in the last five years.

Table 6.2: Internationally co-authored output by type of institution

	Research organisations	Universities	Academies	Public Research Institutes	NREs
	(mean)	(mean)	(mean)	(mean)	(mean)
Published reports	2.32	1.31	1.24	2.86	2.56
Unpublished reports	2.01	1.46	0.97	1.84	2.96
Working papers	1.65	1.16	1.15	1.59	1.74
Conference papers/presentations	5.25	3.17	5.24	7.86	3.46
Articles in refereed journals	3.61	2.53	6.29	5.00	1.00
Books	0.54	0.40	0.26	0.92	0.52

Overall, researchers from research organisations have been more active in producing output co-authored with at least one colleague from abroad than university academics, whereby there are differences across types of research organisations.

Insofar as intentions regarding international co-operation during the next five years are concerned, both research managers and researchers report positive inclinations: 77% and 66% respectively stated their intention to increase co-operation. Slightly more than half of the research managers also express a preference for European forms of co-operation among international activities. In comparison 42% of research managers at universities are of the same opinion.

3.6.2 Employment Structures

Evidence pointing towards change in employment structures at knowledge producing institutions has been accumulating over the recent years. The change is particularly pronounced within the university sector where studies have found that tenure has tended to disappear with academics and researchers being hired on short-term contracts. According to some scholars the universities have changed to become one of the least attractive employers. The situation regarding research organisations is much less clear.

> Contrary to our expectations we found a higher proportion of researchers in research organisations employed on permanent full- and part-time contracts than at universities: 76% of researchers in research organisations as compared to 52% of researchers at universities are employed on permanent contracts. Internationalisation also appears to pay off in terms of employment stability: 65% of researchers in internationally active research organisations as compared to 51% of those working for internationally passive institutions are employed on permanent contracts.
>
> All respondents agreed that one major change that has occurred during the last ten years is that more good graduate students are choosing alternative careers, namely careers in industry and/or government but not research. Universities appear more affected by this trend.

The institutional possibilities for employing new research staff are perceived as having increased during the last five years – both for research organisations and universities – albeit under contract research. Thus, 76% of the responding research managers from research organisations and 77% from universities report that they can hire researchers if funding from national sources is available (compared with 61% and 65%, respectively, five years ago). Regarding funding from European sources the increase in recruitment possibilities is particularly impressive: 64% of the respondents from research organisations and 72% from universities consider they can hire research staff under European projects as compared with 49% and 50% respectively five years ago.

Evidence was also found that overall, research organisations have higher discretion in deciding employment policies than universities. It is easier for research organisations for example, to open new full-time permanent research positions.

3.6.3   Resources and Funding Mechanisms

Funding mechanisms and resources influence the research strategies of research institutions. *Table 6.3* provides information on the change that the level of funding from different sources has undergone during the last five years.

Table 6.3: Change in proportions of research budget formed by different sources by type of institution (mean)

	Research organisations		Universities	
	Five years ago	Today	Five years ago	Today
Institutional core funding	62.14	48.24	53.79	44.70
National competitive public research funding	25.06	27.30	31.53	32.06
EU Framework Programme	13.39	14.85	13.90	13.54
Eureka/COST/ESF	6.25	4.63	9.43	6.00
Regional funds	10.50	14.64	7.43	11.26
Contract research or consultancy services	25.14	24.29	23.33	19.83
Commercialisation of research	5.17	4.90	7.33	8.50

The most drastic change for both research organisations and universities is the relative decrease of national institutional core funding. This decrease is much more pronounced in the case of research organisations. It is also apparent that while the relative proportion of funding from competitive sources – national or European – has increased, this increase is not sufficient to offset the decrease in core institutional funding.

Table 6.4: Opinions regarding change in resources and funding mechanisms – research managers (percentage 'agree' and 'strongly agree')

	Research org.	Universities	PRIs	NREs
More funding for research is available	49	50	64	48
Easier to get European than national funding for research	15	14	16	9
Nationally the core funding for research has decreased	59	52	65	40
Nationally higher proportion of research funding allocated through competitive bidding	76	68	83	73
Procedures for obtaining national research funding have become more bureaucratic	49	52	60	47
Procedures for obtaining European research funding have become more bureaucratic	71	59	73	66
Obtaining European research funding is less bureaucratic than accessing national funds	5	7	3	5

Research managers from research organisations and universities consider that today a higher proportion of the national research funds are subject to competitive bidding. Research organisations have experienced this change more sharply than universities. Managers of research organisations are also more likely to think that the procedures for obtaining European funding for research have become more bureaucratic and time consuming (Table 6.4). Similar opinions are held by researchers.

Five years ago the institutional procedures for applying for European competitive funding were considerably stricter than those for national competitive funding. The situation has changed and today the procedures for applying for national competitive funding are very similar to the European procedures (Table 6.7).

Table 6.5: Institutional rules for submitting applications for competitive funding by institution (%)

	Research organisations				Universities			
	European competitive		National competitive		European competitive		National competitive	
	5 yrs ago	Now	5 yrs ago	Now	5 yrs ago	Now	5 yrs ago	Now
Content of proposal checked and approved by Head of Department	77	72	56	75	67	65	44	66
Budget checked and approved by Head of Department	76	76	53	77	71	68	44	67
Budget checked and approved by a central administrative office	51	50	36	46	51	50	28	45

At the same time over half (51%) of the researchers in research organisations and two fifths (40%) of university academics concede that the procedures for applying for European competitive funding are inadequate. Respondents overwhelmingly agree that these procedures are bureaucratic and time-consuming (94% from research organisations and 95% from universities). The picture is somewhat different where national research application procedures are concerned. While there is a high level of consensus that the procedures are bureaucratic and time-consuming (85% from research organisations and 88% from universities) high concerns regarding the lack of guarantee for fair evaluation of the proposals have been voiced (63% research organisations and 68% universities).

3.6.4   Quality of Research and Evaluation Practices

Institutional research performance is formally and regularly evaluated. This was reported by 72% of research managers of research organisations. The

respective figure for university research managers is 55%. Respondents from research organisations also more frequently report prior involvement in institutional evaluation than respondents from universities: 70% of the research organisations as compared to 86% of the universities were evaluated for the first time in 1990 or later.

The picture is quite similar with regard to internal evaluation practices: the research performance of individual researchers is regularly assessed in 57% of the responding research organisations and in only 36% of the responding universities. The universities have traditionally been viewed as 'autonomous' and as being outside social control and though this vision is in practice no longer valid, it is still fairly strong in terms of perception, and especially among researchers. In contrast, research organisations have always been expected to pursue research of utility, useful research. Being so, these have traditionally been involved in control mechanisms whereby their performance is judged according to their objectives.

Table 6.6: Importance of evaluation result by type of institution – research managers (ranking place)

Evaluation is important for:	Research org.	Universities	PRI	NREs
Base-line funding	2	2	3	2
Competitive funding	4	4	4	4
Agenda/priority setting	1	1	1	1
HR development	3	3	2	3

Respondents agree that the results of institutional evaluation primarily affect the institutional/departmental agendas and priority setting (*Table 6.6*). On the other hand, these results influence least the ability of the institution to attract competitive funding for research. In the case of evaluation of individual researchers this is most important for career advancement (research organisations) or enhancement of research reputation (universities).

Table 6.7: Positive change over ten years by institution (research managers, percentage)

	Research organisations	Universities
Quality of research increased	86	78
Amount of basic research increased	46	56
Amount of applied research increased	71	79
Amount of consultancy increased	51	47

Table 6.8: Positive change over ten years by institution (researchers, percentage)

	Research organisations	Universities
Quality of (institution) increased	58	63
Quality of (researcher) increased	65	67
Amount of basic research increased	26	42
Amount of applied research increased	66	62
Amount of consultancy increased	43	43

An impressive proportion of research managers in either research organisations or universities believe that the quality of the research conducted by their institution has increased during the last decade (Table 6.9). This is not a view shared to the same extent by researchers (Table 6.10). In both cases we are here faced with a certain bias to talk positively of either one's institution or one's own development.

3.6.5 Research Agendas and Priorities

A significantly higher proportion of research managers in research organisations as compared to universities report that their institutions have explicit priorities for research (86% research organisations and 60% universities). Our data also provides evidence that for both research organisations and universities, the process of formulating explicit research priorities has become particularly pronounced during the 1990s (two thirds of the respondents have stated that the priorities were explicitly formulated for the first time in 1990 or later).

Research organisations also appear to have a higher level of flexibility when it comes to using measures to promote institutional research priorities. Thus, a significantly higher proportion of the research managers in research organisations have reported that they establish new units to promote priorities (55% research organisations as compared to 31% universities) and roughly twice as many hire managers (14% research organisations and 7% universities) and/or hire expert researchers (62% research organisations and 30% universities). Moreover, while 53% of the respondents from research organisations point out the use of funding mechanisms as a way to enforce institutional research priorities, this proportion is only 42% for respondents from universities.

According to the responding research managers, researchers from research organisations and from universities are expected to develop their own research agenda (80% research organisations and 84% universities). Personal research agendas however, are more affected by the institutional priorities in research organisations than at universities (73% research organisations and 63% universities).

Table 6.9: Perceived change in terms of research priorities - research managers (percentage 'strongly agree' and 'agree')

	Research org.	Univer-sities	PRIs	NREs
Research priorities have become more tightly monitored	79	61	91	82
Academic freedom has been restricted	38	33	44	43
Research priorities are increasingly decided at individual level	18	22	4	32
Research priorities are increasingly decided at institutional level	72	45	83	64
Research priorities are increasingly decided at national level	34	50	39	36
Research priorities are increasingly decided at European level	59	54	74	55
Research priorities have become sensitive to broader social issues	59	59	61	52
Multidisciplinarity has become more important in deciding research priorities	78	79	78	76
Research priorities have become more sensitive to market demands	70	70	74	73

Research managers from research organisations agree that the three most explicit changes in terms of research agendas and priorities during the last ten years are that research priorities have become more tightly monitored, multidisciplinarity has become more important in deciding research priorities and research priorities are increasingly decided at institutional level (see *Table 6.9*). While a high proportion of the respondents from research organisations believe that research priorities are increasingly decided at institutional level, respondents from universities are more inclined to believe that research priorities are increasingly decided at national level. This once again suggests that research organisations are and perceive themselves to be more flexible and independent institutions. Another possible explanation might be that universities are not as experienced in setting up their research agendas and deciding research priorities. The insignificant proportion of research managers at universities who are aware that National Foresight exercises have been conducted in their countries lends support to such interpretation.

Table 6.10: Perceived change in terms of research priorities, researchers (percentage 'strongly agree' and 'agree')

	Research org.	Univer-sities	Acade-mies	RIs	NREs

Research priorities have become more tightly monitored	23	30	37	28	16
Academic freedom has been restricted	21	29	27	23	18
Research priorities are increasingly decided at individual level	15	12	19	15	16
Research priorities are increasingly decided at institutional level	13	16	32	13	16
Research priorities are increasingly decided at national level	14	19	16	9	11
Research priorities are increasingly decided at European level	18	20	22	23	12
Research priorities have become sensitive to broader social issues	19	19	25	19	19
Multidisciplinarity has become more important in deciding research priorities	27	28	27	36	19

At the most general level the researchers responding to our survey agree with the research managers that two of the main changes that have occurred include the increasing importance of multidisciplinarity and that research priorities have become more tightly monitored (Table 6.10). As expected, researchers are more sensitive to issues regarding academic freedom than research managers; also, more researchers at universities believe that academic freedom has been restricted. Here some differences between types of research organisations can be noted. Accordingly, for example, researchers from academies hold an opinion closer to that of their colleagues at universities.

Requirements to formulate a formal research strategy have become more stringent during the last five years. The shift has particularly affected researchers in research organisations but can also be noted in universities (Table 6.13).

Table 6.11: Influences on personal research agenda (percentage)

	Research organisations		Universities	
	Five years ago	Today	Five years ago	Today
Discuss with Head of Department/unit	61	84	46	65
Approved by Head of Department/unit	53	63	37	50
Co-ordinate with institutional research priorities	51	72	32	59
Co-ordinate with national research priorities	19	42	14	32
Co-ordinate with European research priorities	15	33	6	16

In formulating their personal research agenda 84% of the researchers employed by research organisations have to discuss this with the Head of Department; in 63% of the cases the agenda has to be approved by the Head of Department/unit. In terms of co-ordinating the own personal research agenda with broader priorities, the most important of these broader priorities are those of the institution (72%) followed by national priorities (42%) and European priorities (33%). This is evidence that prioritisation works in a stratified manner whereby researchers co-ordinate their research agendas with the research priorities of the institution, the institution with the national research priorities etc.

It is not only that research organisations are more efficient when it comes to defining research priorities but also have more flexibility and discretion in promoting the priorities. Research managers from research organisations consider the institutional level to be leading in the definition of research priorities, followed by the European level. That researchers in research organisations should co-ordinate their personal research agenda first (and foremost) with the priorities of the institution only confirms the importance of the institutional level.

3.7 Networking the European Research

A very useful definition of networks, not least by reason of its simplicity, is that of Wasserman and Faust (1994) who define a social network as a "set of actors

and the ties among them" (p.9). This definition points to two requirements for any concept of research networks. First, we have to define a set of relevant actors. Second, we have to define the types of relationships that link the actors with the network.

We can define the research actors as "all those persons actively involved in conducting, managing or facilitating research." Here, 'research' may mean the production of new scientific knowledge or the application of scientific knowledge to practical problems. Analogously, we can define the institutional actors as "all those institutions that conduct, manage and facilitate research." Research relations could be defined with reference to transactional flows, that is, flows of resources (personnel and funds), communication and flows of information/knowledge.

Research networks can then be defined as follows:

> *Research networks are those stable institutionalised or informal patterns of transactional flows between research actors that enable, facilitate, or manage the production and application of scientific knowledge.*

We can analyse these patterns of transactional flows along several dimensions: degree of openness – how open are research networks to new members? internal organisation; task-orientation; and membership.

The stability of research networks can be looked at from different perspectives:

- *temporally*, that is how long these patterns endure over time (which could be measured in projects or years),

- *in terms of output*, that is to say that the more stable a network, the more publications, etc. it would produce,

- *in terms of input,* that is to say that a stable network is more successful in acquiring funds than an unstable network,

- *in terms of efficiency,* whereby stable networks are more efficient (or inefficient) in the way they structure their flows,

- *in terms of the perception of network actors,* where emphasis is on the shared norms and practices.

This is the approach followed in the INNOCULT project for studying European research networks established in the framework of the Fourth Framework Programme

(Table 7.1). We have classified the topics with regard to time (static vs. dynamic analysis) and across the three dimensions of project/actors, relations and continuity (cf. Arnaud et al., 1987).

Table 7.1 Topics of the INNOCULT network survey

Features	Static analysis	Dynamic analysis
Project	Nature of activity (Specific Programme) Main features of actors and network	Role in the network Project and programme involvement
Relations	Motivation for involvement Typology related to interdisciplinarity Role of the co-ordinator Existence of core-group Type of network based on the cultural theory	Construction of partnership Production of publications Social contacts
Continuity	Attitudes on sustainability FP experience	Continuation of the network in the future

3.7.1 Features of Research Networks

As outlined in the methodological section of this chapter, the empirical data for studying European research networks derived from a survey among co-ordinators of projects of the TSER, ESPRIT, Environment and Transport programmes.

In terms of size of institution, the achieved sample of our survey was quite balanced, with small institutions (10 or less employees in full-time equivalent) represented with 39.1%, medium institutions (11 to 30 employees) with 31.6% and large institutions (more than 30 employees) with 29.3%.

Small institutions were dominant in the group of answers we received from the TSER and Environment programmes, whereas in ESPRIT and Transport, the answers came in nearly equal shares from small, medium-size and large institutions.

Universities were dominant in the TSER and Environment programmes, while in ESPRIT corporate actors were on the lead. This is not surprising given the nature and scope of these programmes. In Transport, the shares of all three types of organisations were nearly equal, with a slight dominance of private companies and research organisations over universities.

Altogether, responses arrived from 23 European countries, the largest single responses coming from the UK (17.5%), Germany (15.9%), France (9.4%) and Italy (8.5%). Large countries (that is UK, Germany and France) and Benelux countries more often than others provided co-ordinators to networks. The large countries were dominant in all four programmes (and most notably in the Environment programme).

The smallest network had only two partners (in five cases), and the largest 31. The median size was seven. There were altogether 181 small consortia (with up to five partners), 251 of medium size (with six, seven or eight partners) and 203 large consortia (with nine or more partners). The Transport programme displayed the largest consortia, the ESPRIT programme the smallest. The Environment and TSER consortium tended to be medium in size. These findings are in conformity with official data on the FP4 issued by the

Commission. The small consortia proved more likely to attract small institutions, while large consortia were more often assembled by medium-size and large institutions.

Out of 635 respondents, 308 were project co-ordinators and 327 partners. The over-representation of co-ordinators was expected, given the method of the survey. Out of these 327 consortium partners, 112 were major partners (with 24 or more person-months attributed to them in the project) and 215 minor partners. While co-ordinators came in nearly equal shares from small, medium-size and large institutions, partners (and especially minor partners) came mainly from small institutions.

Four out of ten individual respondents (39.5%) had only been involved in one project, six out of ten (60.5%) in more than one project. Every one out of ten (11.8%) had been involved in five or more projects. Looking at participation across programmes, we find that eight out of ten (82.2%) only operated within a single programme. Only two out of ten or one in five (17.8%) had experience with participation across programmes.

If the same type of reasoning is applied to the level of institutions, we see that three out of ten institutions (or 27%) had participated in European research across thematic programmes – a slightly higher share than at the individual level. Significantly higher, on the other hand, was the share of institutions involved in more than one project: four out of five institutions (or 77.8%) as compared to three out of five researchers (or 60.5%) were involved in more than one project.

With regard to co-ordination, we find the clear majority of both researchers and institutions to have co-ordinated only one project. On average, university researchers were less frequently co-ordinators than researchers from other types of organisations. The Portuguese and Spanish researchers were very seldom co-ordinators, while the Greeks were co-ordinators more often than researchers from any other small or southern European country.

3.7.2 How and Why to Create a Network

The most common way to enter a network is through previous personal contacts: 65.7% of researchers knew personally at least one project partner prior to the project. An equal number (64.7%) knew (a) project partner(s) by reputation, a smaller, yet still significant, number (57.6%) through previous collaboration, albeit not necessarily specific to the European Research Programmes. One third of respondents knew partners from previous Framework Programme collaboration.

Table 7.2 Motivations for networking

	... Knew partners before the project by ...			
No. partners	Reputation (n=636)	Personal contacts (n=636)	Collaboration (n=636)	FP collaboration (n=636)
More than half	35,3%	32,8%	24,7%	15,6%
Less than half	29,4%	33,0%	32,8%	18,6%
None	35,3%	34,3%	42,4%	65,8%

In Transport, more than in other Programmes, researchers seem not to have known their project partners in advance. Also researchers from private organisations appear to know less colleagues than others before entering a project consortium.

On the institutional level, there is however a different picture: 70.8% respondents knew partner institutions from previous collaboration. Interestingly, a high number of researchers, namely 57.3% reported having previously worked for a partner institution. This seems to be an important way of establishing networks (indeed more important than previous FP collaboration) and speaks for a relatively high level of mobility of researchers between institutions involved in FP research.

The relative majority took the initiative: almost every second researcher (46.9%) reported this. One third (30.2%) were approached by the project co-ordinator, 18.5 % said that they were approached by other colleagues from their department. Here it is very interesting to observe that the role of research-promoting agencies and national agencies in charge of research is extremely small: only six respondents reported having been mediated to projects through such agencies. An additional 21 respondents (3.4%) were approached by the European Commission officials to take part in the project – these were mainly researchers from Spain and Portugal and in Transport programme. Interestingly enough, there was not such a small number of co-ordinators who claimed to have entered a project by having been approached by another partner.

Figure 7.5 depicts the respondents' personal motivation for participating in a European research project:
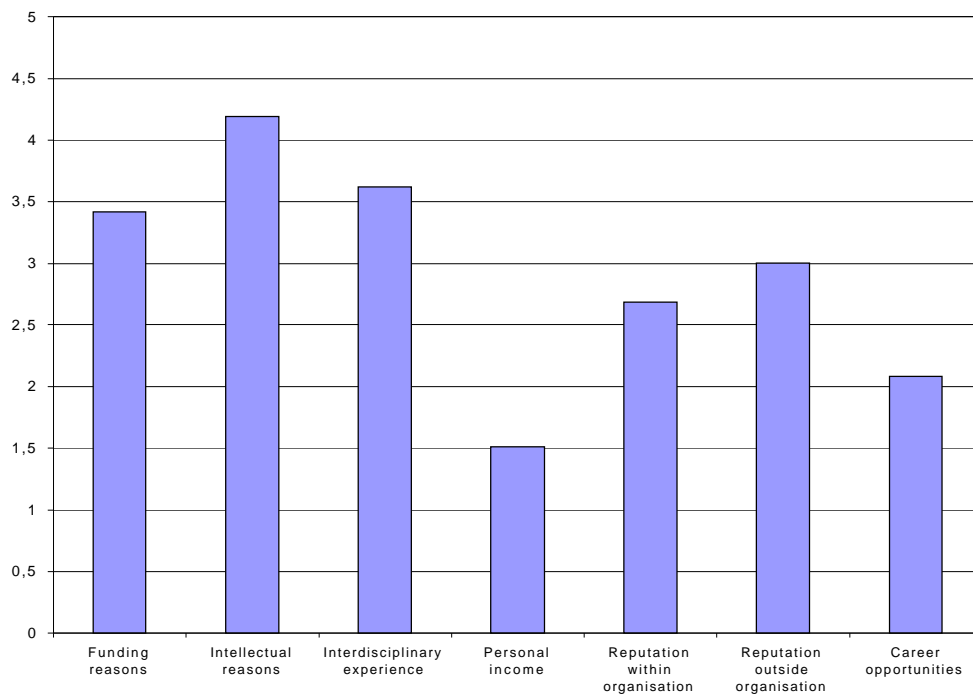
On a scale of one (irrelevant) to five (very important), intellectual reasons received the highest average grade (4.2), followed by opportunities for interdisciplinary experience (3.6). Funding reasons scored somewhat lower (3.4). All other motivations scored less than 3 (moderately important). Increase in personal income seems to be the least important motivation for entering an FP project (grade 1.5).

Funding reasons proved most important for researchers in Environment programme and those coming from universities, and least for those working in the Transport programme. At the country level, funding was most important for researchers from the UK and France.

Interdisciplinary experience was practically not important at all for researchers in ESPRIT, for whom reputations within the organisation was instead the most important motivation. Researchers of small consortia do likewise not attach high importance to interdisciplinarity.

The question as to the institutions' motivation to participate in a European research project produced the following results (Figure 7.6):
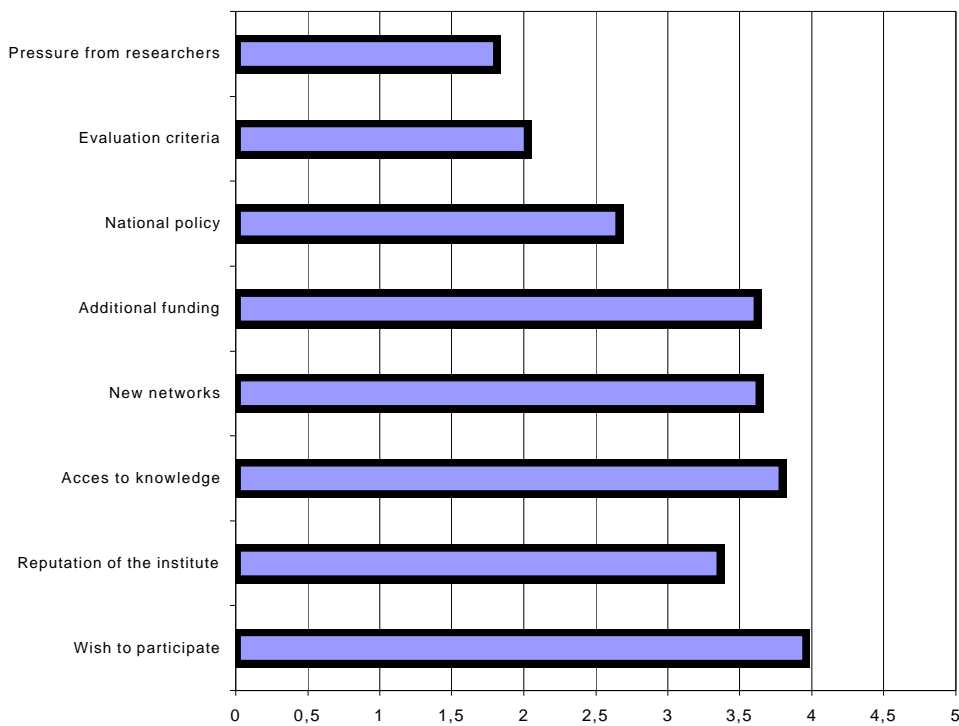
Five grounds were scored higher than 3: the researcher's own wish to participate (3.9), access to new knowledge (3.7), creating or entering new networks (3.6), access to additional funding for doctoral and post-doctoral students (3.6) and increasing the reputation of the institution (3.4). It is interesting that response to personal evaluation criteria was not considered as an important motivation to enter a project (2.0).

Access to new knowledge was most important for the Nordic and Southern countries as well as for co-ordinators and major partners.

3.7.3 Interaction within the networks

A good indicator of network relations over and beyond joint participation in a common European project is joint publications. Figure 7.7 shows whether the researchers from the consortium produced joint publications (aside from the project deliverables):

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

working papers   conference papers   journal papers   books
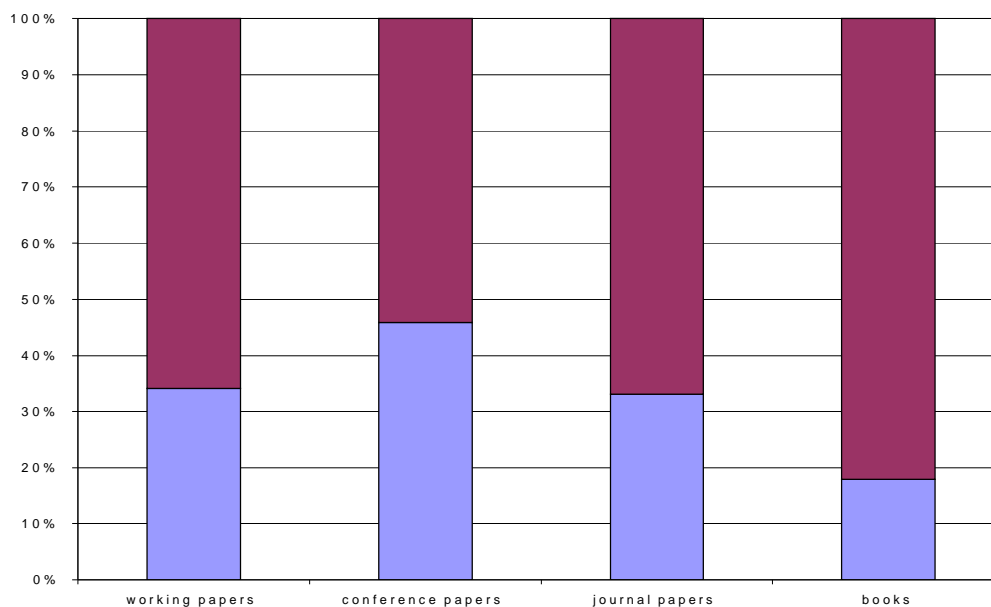
For none of the four types of publications considered by the questionnaire – working papers, conference presentations, journal articles, books – was the percentage of those who wrote a joint publication with at least one other consortium member higher than 50%. Only in the Environment programme did the number of researchers who had written a joint publication with another consortium member higher than those who had not. On the other hand, there was hardly any researcher of the ESPRIT and Transport programmes that had written a book together with his/her consortium partner. Researchers from private organisations were mostly involved in the publication of working papers, while university researchers cared most about papers in journals and books.

One other measure of communication flows within the consortium is also the level of communication between members aside from that strictly related to the project. 62.8% of the respondents had social contacts with less than a half of other consortium members, 37.2% with more than a half. Most sociable were researchers from Greece, Portugal and France, and co-ordinators more generally.

3.7.4   Networking Forms and Effects

In cultural theory terms, one could differentiate between 4 different types of networks, whereby three play an empirical role: individualist, hierarchical, communitarian networks.   Figure 7.8 shows the distribution of consortia accordingly:

Communitarian
28,9%

Other
5,4%

Hierarchists
15,8%

Individualists
49,9%
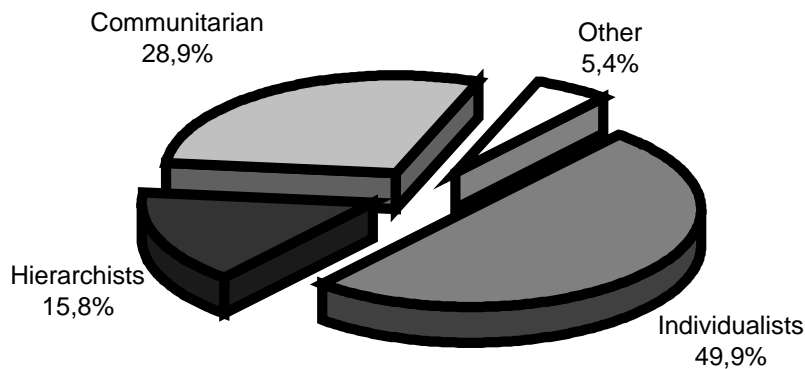
Individualism is the most frequent pattern of network organisation (49.9%), hierarchism the least (15.8%). Researchers working for private companies were less likely than researchers working at universities or research organisations to describe their consortia as individualist. The bigger consortia were also less likely to be organised in an individualist manner – communitarianism and hierarchy were here more common.

Communitarians showed more initiative in starting a project than individualists and hierarchists and, altogether, stronger motivation in nearly all aspects. Not surprisingly, individualists proved to be least interested in cultivating other than business relations with their partners, whereas hierarchists more than others preferred the co-ordinator to take a leading role in the consortium. Communitarians were more willing than others to continue co-operation with other partners after the end of the project.

Interestingly, the differences in organisational profiles of consortia had no impact on the intensity of production of publications and interdisciplinarity of consortia.

Figure 7.9 describes how researchers saw the role of the co-ordinator:
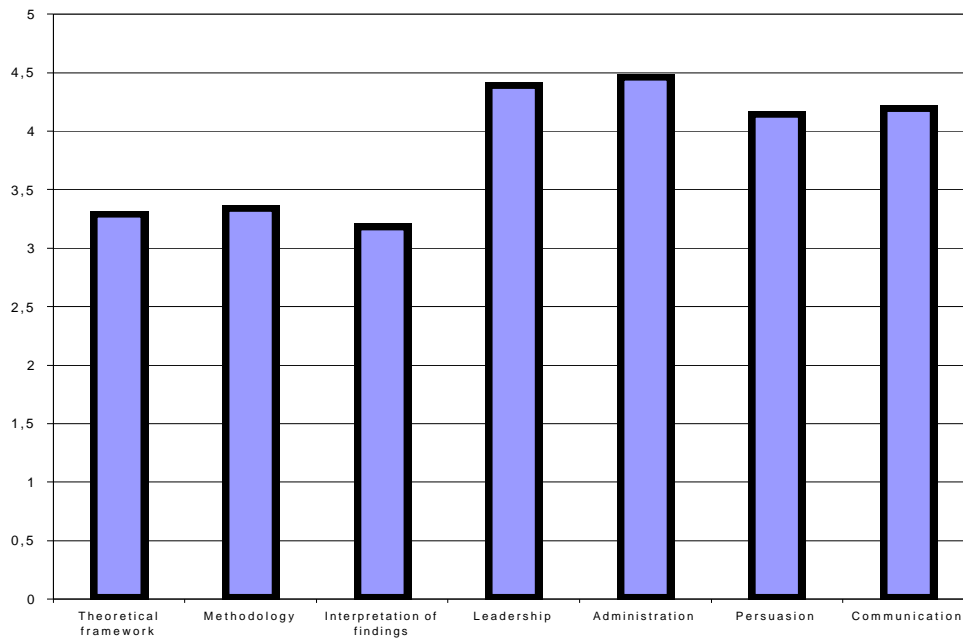
57% and 93.5% of the researchers were of the opinion that the co-ordinator should take the lead with regard to the scientific and administrative aspects of the work respectively.

Asked whether there was a core group in their consortium, and if so, whether they formed part of it, 57.3% of the researchers answered positively. Most sectarian were consortia in the TSER programme, least in the Environment programme. Most exclusive were TSER and Transport consortia, least ESPRIT networks. The existence of a core group was clearly related to the consortium size, with six representing the threshold.

There were hardly any respondents who reported not being interested in continuing collaboration with their consortium partners: four in five (79.2%) even answered they were interested in collaborating further with more than half of their partners.

Figure 7.10 shows the researchers' opinions as to the preconditions for network sustainability:
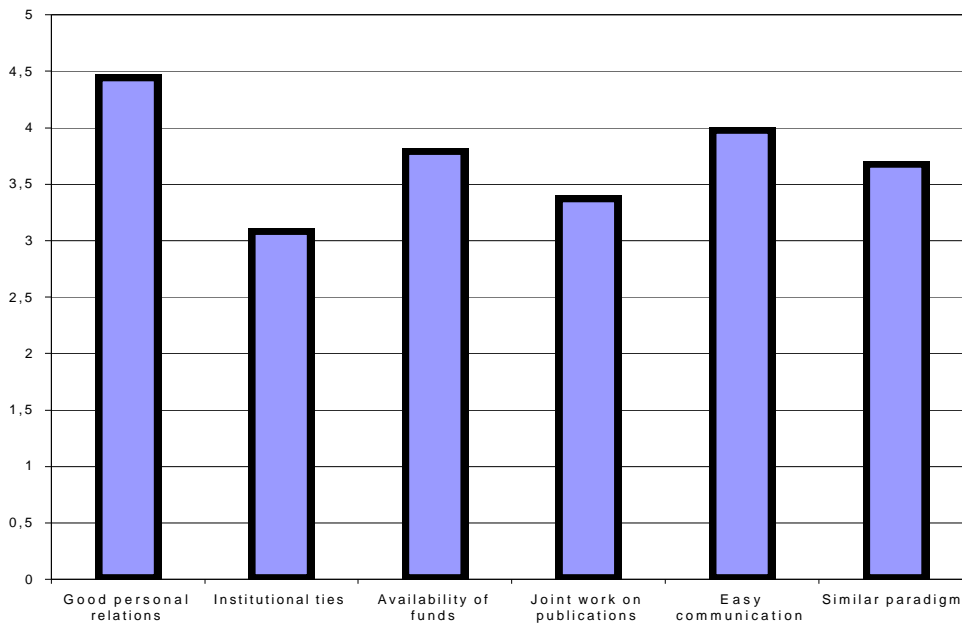
5

4,5

4

3,5

3

2,5

2

1,5

1

0,5

0

| Good personal relations | Institutional ties | Availability of funds | Joint work on publications | Easy communication | Similar paradigm |

Good personal relations, institutional ties, availability of funds, joint work on publications, easy communication and sharing a research paradigm, all turned out to promote further collaboration and thus network sustainability. Among these, good personal relations and easy communication were the most important. Availability of funds was most important for university researchers and least for researchers participating in the Transport Programme.

3.7.5 The Development of Research Networks - Is There Already a European Research Area?

There are strong indications that some research systems are more ready for the process of Europeanisation than others. The major players in the European research landscape are the UK, Germany and France; a further important role is played by the Nordic countries.

The direct comparison between the three major players shows the particular strength of the UK institutes in the social science programme (TSER) and in environmental research. Germany, on the other hand, is particularly strong in ESPRIT and the Transport programmes.

Table 7.5: Share of major European regions in thematic programmes

	TSER	**ESPRIT**	**ENVIRONMENT**	**TRANSPORT**
Large Countries	42,1%	47,3%	45,5%	37,3%
France	9,1%	12,2%	9,0%	9,7%
Germany	14,9%	20,3%	15,7%	15,7%
UK	18,2%	14,9%	20,7%	11,9%
Nordic countries	19,0%	4,1%	16,1%	22,4%
Southern Europe	13,2%	17,6%	12,4%	12,7%
Central Europe	13,2%	20,3%	15,1%	11,9%
Benelux	12,4%	10,8%	11,0%	15,7%

A comparison between the three major players in the European research shows that whilst the French system relies on small and medium-sized research organisations, the Germans have a balanced system, and the UK relies on the universities, and particularly on the larger units. Small research organisations and the private sector in the UK play a significantly less important role in European research.

Table 7.8: Type and size of participating institutions in three large countries

	France	**Germany**	**UK**
Small and medium RO	39,6%	25,5%	4,7%
Large RO	17,0%	14,3%	13,1%
Small and medium university unit	15,1%	29,6%	42,1%
Large university unit	5,7%	5,1%	26,2%
Small and medium private	13,2%	17,3%	8,4%
Large private	9,4%	8,2%	5,6%

Table 7.9: Type and size of participating institutions in all regions

	Large countries	**Nordic countries**	**Southern Europe**	**Central Europe**	**Benelux**
S&M RO	19,8%	27,7%	25,6%	27,6%	23,7%
L RO	14,3%	14,9%	3,7%	6,9%	13,2%
S&M Uni	31,8%	32,7%	36,6%	32,2%	40,8%
L Uni	14,0%	11,9%	8,5%	9,2%	5,3%
S&M Private	12,8%	9,9%	17,1%	17,2%	9,2%
L Private	7,4%	3,0%	8,5%	6,9%	7,9%

Small and medium-sized university institutes are the most important actors in the field of environmental research and in the social sciences. Private institutions have practically no involvement in these fields, whilst they are dominant in the ESPRIT programme and quite strong in Transport research. In Transport, research organisations play an important role, whilst in ESPRIT they seem to have a rather limited influence. Of the selected programmes ESPRIT is

the only programme in which large private research organisations play a major role.

Table 7.10: Type and size of institutions in different programmes

	TSER	ESPRIT	ENVIRONMENT	TRANSPORT
S&M RO	30,1%	7,1%	26,0%	22,7%
L RO	7,1%	2,9%	15,2%	12,1%
S&M Uni	46,9%	12,9%	39,5%	20,5%
L Uni	12,4%	7,1%	12,8%	7,6%
S&M Private	1,8%	45,7%	4,7%	24,2%
L Private	1,8%	24,3%	1,7%	12,9%

3.7.6 Support for Networks by National Agencies and the European Commission

The concept of national innovation systems is based on the idea of overcoming the traditional boundaries between the political and administrative system, potential users (be it industrial, be it political) and the research communities. This is even more true for a trans-national innovation system.

The data suggest that there is a high degree of satisfaction with the support provided by the European Commission. More than half of the respondents had good communication with and efficient support from the European Commission, but just one third did so from the national agencies. The best support came from the own department.

Table 7.15: Support for researchers from different institutions

Good communication with…	
...national agencies	30,8%
...European Commission	54,5%
Efficient support from...	
...own department	71,1%
...national agencies	33,0%
...European Commission	51,4%
...other	1,6%

There is a significant difference between countries: Southern European countries are particularly dependent on the Commission and particularly dissatisfied with their own national agencies. On the contrary, the Nordic countries are by far the most satisfied with their national institutions and enjoy less communication with and support from the Commission.

From the large countries, the French enjoy most support both from their national agencies and the European Commission. They feel, however, least supported by their own department.

Table 7.16: Geographic distribution of responses on support

	Nat. agencies	EC	Department
Large Countries	30,6%	50,6%	71,8%
France	37,0%	57,6%	65,0%
Germany	25,9%	48,4%	73,9%
UK	31,5%	48,6%	73,7%
Nordic countries	46,5%	40,2%	74,5%
Southern Europe	24,7%	63,7%	70,7%
Central Europe	33,8%	53,6%	65,1%
Benelux	26,9%	52,7%	70,2%

The degree of satisfaction with the Commission services varies quite significantly across the programmes: social scientists have to fight for their recognition both in the national context and on the European level. All other disciplines feel stronger supported, both on the national and the European level.

Table 7.17: Figures on support for different programmes

	Nat. agencies	EC	Department
TSER	29,0%	31,5%	64,9%
ESPRIT	28,8%	58,1%	72,0%
ENVIRONMENT	35,5%	56,4%	73,9%
TRANSPORT	33,8%	54,0%	69,8%

The support enjoyed from national authorities or the European Commission does not vary according to size or type of institution. Universities, research organisations and private ones feel the Commission is by far more efficient than national agencies.

Co-ordinators are more supported (and are more in touch with) the Commission. In this respect it is not surprising that co-ordinators express more satisfaction with the support of the Commission, whilst especially partners with a small participation in a project rather relate to their national agencies. It is, however, surprising, that the satisfaction of co-ordinators with their national agencies is so low. The data suggest that the Commission is particularly successful with co-ordinators. The support of the own department does not vary according to the role a researcher plays in a consortium.

Table 7.19: Role in the project and support

	Nat. agencies	EC	Department

Co-ordinator	29,1%	56,2%	72,5%
Major partner	36,4%	48,4%	69,7%
Minor partner	37,2%	43,2%	69,7%

3.7.7 The perception of the Framework Programme by the Research Communities

A European research system requires the close co-operation between the research communities and the policy makers not just on the day-to-day base of a research project but on the programme level as well. Are the research communities aware of their potential role in the agenda-setting of the European research policy? The data suggest a strong commitment from the researchers' side.

The commitment of the research communities was explored in an indirect way: the researchers were asked whether they think that the experiences gained in the FP4 were sufficiently considered in the programming of the FP5. As an option, the researchers could answer directly that they could not answer this question.

Remarkably, nearly three out of four felt enough informed to express an opinion. Of those who answered, about half were of the opinion that the experiences of FP4 were sufficiently taken into consideration, whilst the other half did not think so.

There are some differences in geopolitical terms: the large countries are apparently less interested in the programmatic development than the smaller ones; still, two third express an opinion. The Southern European countries, on the other hand, are the most explicit and the most satisfied.

Interestingly enough, this picture does not vary significantly according to programme. Social scientists are the group with the lowest readiness to voice an opinion and think the least that the experiences of the FP4 were reflected enough in the formulation of the FP5. Transport and ESPRIT participants seem to suggest a stronger support whilst Environment researchers are more critical in their appreciation. However, these differences are not statistically significant.

Table 7.22: Programming: geographic distribution of opinions

	No	Yes	Do not know
Large Countries	34,9%	31,6%	33,5%
Nordic countries	38,2%	46,1%	15,7%
Southern Europe	27,8%	63,9%	8,3%

	No	Yes	Do not know
Central Europe	48,8%	38,1%	13,1%
Benelux	36,8%	45,6%	17,6%

Table 7.23: Programming: distribution by programmes

	No	Yes	Do not know
TSER	31,4%	33,9%	34,7%
ESPRIT	33,3%	40,0%	26,7%
ENVIRONMENT	37,5%	37,2%	25,3%
TRANSPORT	28,9%	41,5%	29,6%

Large research organisations and large university units tend to be more informed about the programming of the European Framework Programmes than all other groups. The lowest rate of knowledge is shown by the small and medium university institutes: one out of three could not answer this question.

Table 7.24: Programming: distribution by type of institutions

	No	Yes	Do not know
S&M RO	30,1%	41,8%	28,1%
L RO	42,3%	38,0%	19,7%
S&M Uni	33,0%	33,0%	34,0%
L Uni	40,3%	43,3%	16,4%
S&M Private	33,8%	40,0%	26,3%
L Private	31,7%	41,5%	26,8%

The highest attention to the programming is given by those researchers who see their role in basic research. Four out of five express an opinion, and the majority hold that enough attention was given to the experiences made in FP4.

Table 7.25: Programming: distribution by type of research

	No	Yes	Do not know
Basic	35,4%	45,8%	18,8%
Applied	31,6%	38,6%	29,8%
New type	34,7%	33,3%	27,0%

3.7.8 Networking for Tomorrow: the Research Communities vis-à-vis the New Framework Programme

About two third of the institutions who participated in FP4 submitted new proposals to the Commission within the first year of FP5; about half of the respondents reported already an accepted proposal.

With respect to the country groups there is no significant difference to report, neither in the application nor in the success rate. A more detailed analysis, however, shows that those French institutions who participated in FP4 were particularly active in submitting new proposals to the Commission.

Table 7.27: Submission and success: distribution by regions

	Submitted	Newly accepted proposal
Large Countries	65,4%	60,1%
France	75,9%	64,7%
Germany	63,0%	59,6%
UK	61,8%	58,1%
Nordic countries	73,8%	50,7%
Southern Europe	71,6%	54,9%
Central Europe	63,6%	51,0%
Benelux	69,3%	41,5%

In terms of the programmes there are clear statistical differences, however not in terms of the submitted projects but in terms of approval: nearly two third applied for new projects, three out of four of those who submitted applications in the Transport programme were at least once already successful. Of the other programmes, around half of the respondents reported a successful submission. It is not possible to assess, however, whether this is related to higher competition in the other programmes or particularly efficient evaluation and contracting procedures of DG TREN.

The picture of the high sustainability of the networks can be further supported by the fact that the rate of submission of proposals does not differ according to the size or the type of the research institutions.

Regarding the submission of proposals and their success there is no significant difference according to type of research or of networks; co-ordinators are, however, more likely to submit proposals; their success ratio is only slightly higher than that of other institutions.

3.7.9 European Research Programmes - a Hint from the Networks of Excellence

In this section we explore on the basis of our data whether there already exists a European Research Area. It is not our aim to analyse research topics and propose key actions for the New FP; to identify topics of research, national and/or European research profiles requires a different study.

Topical to this study are two dimensions:

- In what ways do the European research communities reflect the general goals of European policies as reflected in the FP? In this respect topics like subsidiarity, social cohesion, and strengthening mobility play an important role.

- What procedural aspects do research communities consider as important for the development of the New FP? In this respect prioritisation of research areas, better co-ordination of research programmes, output orientation and the bottom-up programming are the relevant issues.

Table 7.31 shows the topics researchers would like to see improved in the development of New FP.

Table 7.31 Priorities for the new FP

Research Policy Related		General European Issues	
Output Orientation	36,2%	Implementing Subsidiarity	17,0%
Bottom-Up	58,3%	Supporting Mobility	25,2%
Increasing Prioritisation	22,4%	Overcome Social Cleavages	12,3%
Co-ordination with other Research Initiatives	43,8%		

The general framework in which European policy-making operates, e.g. subsidiarity, contribution to social cohesion and alike, rank quite low on the agenda of the research communities. Relevant topics to be taken care of are rather the procedural questions like the bottom-up decision making process of research programming, better co-ordination with other research programmes within and outside the European Commission or the stimulation of the output orientation of research.

Programming

The most often mentioned concern of the research communities is the bottom-up orientation followed by the need of more coherent co-ordination with other programmes. Clearly more than half of the researchers interviewed hold the former for a relevant issue, nearly half call for more co-ordination. Strengthening the output orientation is another relevant issue.

It is quite interesting to see that there are clear differences between the different programmes: whilst more than half of the Transport researchers find output-orientation a relevant issue to be discussed in view of the New FP, only one third of the social scientists and of those active in the environmental field consider this an important topic.

Table 7.32: Priorities for researchers from different programmes

	Bottom-Up	Output Orientation	Prioritisation	Co-ordination
TSER	61,8%	33,3%	25,5%	52,9%
ESPRIT	52,2%	43,9%	25,4%	43,3%
ENVIRONMENT	71,5%	35,3%	26,2%	43,1%
TRANSPORT	65,3%	58,9%	23,4%	64,5%

With respect to the *bottom-up approach* there are no regional differences according to the data; there exists widespread consensus across Europe that this is an important issue. This said, this issue is particularly important for research organisations and universities than it is for private organisations.

The large countries and the Nordic countries care less about the *output orientation* than the smaller countries of Central and Southern Europe and the Benelux. Half of the latter, as compared to one third of the former, is concerned with this issue. Within the group of the large countries there is no significant difference to be reported. The type of institutions matters as well with respect to the concern for output orientation: more than half of the private institutions are concerned with the improvement of the output, whilst just a mere one third of the universities and research organisations are likewise concerned.

The topic of *better co-ordination* with other programmes is least important for the UK and the Nordic countries. In the UK especially, just one third voice a stake. On the other hand, Southern and Central European researchers as much as French and German researchers mention the issue as relevant.

Prioritisation is the least important concern of European researchers – across geographical regions or types of institutions. (The data suggest that this might be a higher concern for large research organisations, the result is, however, not statistically significant). This would appear to be quite the opposite from the Commission agenda.

Table 7.33: Priorities as seen by researchers from different regions

	Bottom-Up	Output Orientation	Prioritisation	Co-ordination
Large Countries	66,7%	35,3%	22,2%	42,3%
France	61,5%	34,6%	15,4%	51,9%
Germany	67,4%	38,2%	25,8%	46,1%
UK	68,8%	32,3%	22,6%	33,3%
Nordic countries	62,6%	30,8%	26,4%	42,9%
Southern Europe	59,5%	51,4%	31,1%	63,5%
Central Europe	67,4%	48,8%	24,4%	59,3%
Benelux	73,9%	52,2%		56,4%

Table 7.34: Priorities for researchers from different institutions

	Bottom-Up	Output Orientation	Prioritisation	Co-ordination
S&M RO	66,4%	39,7%	26,7%	51,1%
L RO	70,8%	40,0%	38,5%	53,8%
S&M Uni	76,2%	35,9%	22,1%	44,2%
L Uni	66,1%	34,5%	20,3%	45,8%
S&M Private	44,9%	55,1%	30,4%	55,1%
L Private	44,1%	55,9%	11,8%	58,8%

Should FP6 take European issues into account?

In terms of contents, the only European issue which attracts attention from researchers is mobility. Yet also in this case no more than one in four consider this a priority. For both subsidiarity and social cleavages the approval levels are lower. There is a particular need of the European Commission to take here a clear stance – despite the explicit criteria in the guidelines for submission of proposals and the evaluation guidelines, researchers do not give enough attention to these quite relevant policy issues.

There are, however, some important national distinctions: it is particularly the large countries and the Benelux that show low interest in the European social agenda. Researchers from Central and Southern European show a higher interest. The differences are however statistically not significant.

Table 7.38: European issues as viewed in different regions

	Subsidiarity	Mobility	Cleavages
Large Countries	13,7%	24,4%	10,7%
France	21,2%	25,0%	15,4%
Germany	15,7%	23,6%	10,1%
UK	7,5%	24,7%	8,6%

Nordic countries	17,6%	34,1%	12,1%
Southern Europe	24,0%	31,8%	24,3%
Central Europe	28,2%	31,4%	19,8%
Benelux	23,2%	23,7%	10,1%

More significant are the differences with respect to the research areas. The social scientists and transport researchers show more understanding for the issue of social sustainability than their colleagues from other fields. Still, even the concern of social scientists remains quite low.

Table 7.39: European issues and programmes

	Subsidiarity	**Mobility**	**Cleavages**
TSER	20,6%	34,2%	25,5%
ESPRIT	18,2%	16,4%	13,4%
ENVIRONMENT	19,5%	28,1%	9,8%
TRANSPORT	18,7%	31,5%	13,7%

The mobility issue is particularly uninteresting for researchers from larger private organisations and particularly interesting for those who come from large university units. With regard to the task of contributing to overcome social cleavages there is a particular low commitment regardless the type of institution, the subsidiarity issue seems just to bother some researchers from small and medium research organisations. This low commitment of researchers to the goals of the European Commission and the European Union calls for action.

Table 7.40: European issues and type of organisation

	Subsidiarity	Mobility	Cleavages
S&M RO	26,7%	27,5%	15,3%
L RO	15,4%	21,5%	10,8%
S&M Uni	14,9%	26,5%	13,3%
L Uni	12,1%	40,7%	12,1%
S&M Private	18,8%	23,2%	15,9%
L Private	14,7%	5,9%	11,8%

Researchers engaged in applied research are the least interested in mobility issues. No significant differences could be observed for the other issues.

Table 7.41: European issues and type of research

	Subsidiarity	Mobility	Cleavages
Basic	25,3%	34,9%	13,3%
Applied	17,8%	22,9%	15,0%
New type	19,3%	34,9%	15,8%

4 Conclusions and Policy Implications

4.1 <u>National Research Policies</u>

At the research policy level, the following are the main empirical findings.

1. There is real evidence for a move towards governance.

2. This mainly reflects movement within the state. However, it is only possible to the extent that the research sector itself has at least a significant low-grid / low-group pole. In some countries, this has in any case always been true; in others it is a new tendency.

3. The trend stops well short of harmonization or convergence between European countries.

4. Internationalisation, while driven by a range of factors, some highly context-specific, is internally related to governance.

5. While a cultural perspective on policy is usefulness in structuring the analysis, culture as an explanatory variable (e.g. with respect to differences between countries) does not seem to have major significance.

   The main reasons for these conclusions derive from analysis of the kinds of changes that have occurred in R&D policy, which we can organise into three main categories.

First, changes related to demographics and career structures. The research sectors of the eight countries studied have been affected by the scarcity of job opportunities, which reflect major structural changes since the 60s. In the 1960s, traditional university systems were reformed in most countries. In the 70s, many jobs were created, including a large proportion of tenured positions. However, this mode of hiring has progressively been questioned and abandoned. During the 90s, access to academic careers has become more difficult in all countries, with growing numbers of fixed-term contracts and non-contract positions. As a result, differences within the academic professions have widened. In most cases, governments have seemed to react passively, allowing

the system built in the 70s to wither away without being formally challenged or replaced. (Even the UK is less of an exception in this respect than sometimes realised.) While this factor is primarily environmental, there is however also considerable evidence that policy-makers are conscious of the possible benefits in terms of reform by stealth, and are thus at least indirectly using employment patterns as a policy lever.

Second, changes in normative views of policy. There has been a change in the meaning of research as a policy issue, and in the objectives assigned to it. In particular, we have noted significant changes in priority setting, with the use of instruments that are either more "top-down", or (purport to) erode research autonomy by greater sensitivity to societal concerns. It is only a superficial paradox that these changes correlate with a move *away* from a planning or command approach to policy. For there have also been changes in characteristic policy levers, notably in funding (more competitive, more conditional, etc.) and in evaluation (in particular, in most of the countries studied, a real "evaluation system" has emerged). These imply, among other things, both a greater integration of the private sector into the public research system (something that INNOCULT has not studied directly) and, at least on paper, enhanced control of the research system generally. The fashion for interdisciplinarity has, in many ways, similar effects, since it erodes established disciplinary boundaries and internal hierarchies, thereby facilitating, in principle, the policy steering process.

Third, changes related to internationalisation. Traditionally, internationalisation was neither a priority, nor a problem; when it was endorsed by researchers, policy-makers endorsed it as well. This has shifted, partly as a direct consequence of internationalisation, partly as a consequence of changes in the way internationalisation is viewed by policy-makers. It can now be regarded as, in some respects, a policy lever.

4.2 Universities

There is a wide agreement among university policy makers and science policy researchers that research systems have gone through a transition since the eighties. Being a cornerstone of these research systems, universities played an important role in these changes. As part of national research systems and the object of national policies, universities have been confronted with new pressures and opportunities. As complex organisations with historically vested relationships and positions they tend to be resilient towards pressures for change, but as part of the world of science there are also internal struggles and conflicts that may induce institutional changes.

The results in general show that in relation to their environment, universities are facing changes in employment structures and funding patterns, and that part of their strategy to cope with these changes is to implement new institutional practices such as evaluation of research and priority setting. At the same time we find that these new institutional practices are still developing and are not as common and institutionalised as sometimes suggested. Not all research is evaluated, priorities are not set in all universities, or if they are set, they do not always guide actual research efforts. In addition the working practices of researchers display patterns which are not so different from traditional ones.

We expected to find the perceptions of institutional changes to vary by country, field of research, age of university and the latter's level of specialisation. Although we found differences in these respects, we could not find any systematic pattern in this direction. Several complementary explanations can account for this. The most obvious one is that although at the general policy level the transition of the research system points to a common direction (see previous section), differences grow at a more detailed level and instead of one dominant strategy pursued by universities to cope with the transitions, they apply a repertoire of responses, of which some are simply rhetorical, and others actually aim to achieve changes within their own organisations. The related explanation is that the transitions are still underway and new practices of funding, evaluation and priority setting have not yet really been institutionalised.

The latter part of the explanation is supported by another recurrent finding in the results: the difference in perception of change between research managers and researchers. The transition of the research system seems to be mainly a change in the relationships and rules of the game between actors at the level of the research system. Research managers act as representatives of their department, institute or university in such games and are thus confronted with the transition of the research system. Researchers do not act at this level and tend to have no explicit opinions on what is perceived as transition by their representatives.

With regard to Europeanisation, we expected the latter to depend on institutional innovation: researchers from universities that had indeed implemented research evaluation and priorities would be better prepared to act at the European level than researchers from traditional universities. We did not find any support for this hypothesis. We did however find that researchers who pursued traditional evaluation practices relying on peer review also valued European evaluation higher than researchers relying alone on their institution in terms of performance assessment.

4.3   Research Organisations

Research organisations tend towards greater involvement in international research co-operation than universities. However within differences are as important (with regard to different types of research organisations) as external comparisons.

> Where change in employment structures is concerned the following findings have emerged:

- Research organisations are less affected by the process of casualisation of research than universities and these employ a higher proportion of their researchers on a full-time permanent contract basis;

- Internationally active research organisations appear more able to guarantee permanent employment, however this findings necessitates further validation;

- There are today more possibilities for research employment (as compared to the mid-nineties) – however only in the framework of contract research.

- Research organisations have more freedom and enjoy more discretion with regard to employment strategies than universities.

A sharp relative decrease of institutional core funding has been experienced during the last five years. Core funding still constitutes on average the most significant part of research funding for research organisations, albeit we may delineate a descending tendency. The share of regional funds has on the other hand increased.

The two main changes in terms of funding are that the procedures for obtaining European funding have become more bureaucratic and time-consuming and that a higher proportion of national funding has become competitive. Five years ago the institutional mechanisms for applications for European funding were stricter than those for applications for national funding. Today, the procedures are equally strict, particularly for research organisations. Managers of research organisations are in particular concerned about the fairness of national evaluation mechanisms.

Research organisations are involved more often than universities in external evaluation of their performance and the results of such evaluations have more serious consequences. These external evaluations have necessitated the development of internal assessment procedures evaluating the performance of individual researchers. Research managers from institutions that are regularly evaluated also consider that the quality of research performed by the institution has increased.

It is not only that research organisations are more efficient when it comes to defining research priorities but they also have more flexibility and discretion in

promoting their priorities. Research managers from research organisations consider the institutional level to be leading in defining research priorities, followed by the European level. That researchers in research organisations should co-ordinate their personal research agenda first (and foremost) with the priorities of the institution only confirms the importance of the institutional level.

4.4   Research Networks

Networks are very effective and efficient ways of international collaboration in the field of research.

The Framework Programmes have had a remarkable influence on networking. Yet they have been relatively less effective in creating new research networks than in augmenting existing research networks.

There is high sustainability of the networks both in terms of institutions and of individual researchers. Most of the researchers and institutions are involved in more than one project – a comparatively high ratio is engaged even in different programmes of the European Framework Programme. This hints to the existence of cornerstones for the (further) development of the European research area.

Institutions participating in EU programmes have different features than national research institutions. Indeed one could almost venture that research actors are more likely to succeed on the transnational level, the less well connected they are at the national level. In market terms, the European and national research areas are quite distinct, representing core rather than competitive ones.

Some countries would appear more prepared than others to become integrated in the European research area. There are variations across programmes, yet in general the bigger countries – UK, France and Germany – as well as the Nordic countries are more active and more successful. On the other hand, those countries most successful appear also least interested in the research policy issues involved in the setting up and implementation of Framework Programmes as the main vehicles of the European Research Area.

Size is also an issue with regard to research institutions. Larger research organisations, universities or companies are more likely to be successful in the European Research Area. They are also not surprisingly more informed about the research policy programming of the European Union. Otherwise there would appear to exist a certain degree of specialisation, with the private sector being more interested in the output orientation of the programme, and research organisations and universities in the bottom-up more open co-ordination approach.

Problematic with regard to the further development of the European Research Area is the low knowledge and interest of European researchers in the European policy agenda, such as mobility, subsidiarity and social policy (including sustainability).

4.5   … With reference to original project objectives

Area 1: National science and technology potential

The conclusion that emerges from the research reported on here is that sharp differences remain between national traditions. These reflect historical paths of development that continue to be of relevance for contemporary analysis. However, it is important not to misunderstand the significance of "traditions", which refer not to vague ideas but to institutionally embedded cultural patterns. As a result, they are not necessarily national: indeed there is some evidence that differences between disciplines are of greater significance in understanding patterns of research activity than differences between countries. Furthermore, traditions, by their very nature, can evolve. There does indeed seem to be a tendency towards convergence between the countries studied. However, national traditions seem here to be as much a dependent as an independent variable. Far from offering evidence for cultural determinism, the INNOCULT research rather points to the dependence of cultural subsystems on environmental factors.

Internationalisation appears to be of considerable significance in ongoing changes in research and innovation systems. It seems, however, to be rather an environmental factor than an endogenous dynamic. Specific initiatives, whether at policy level or at the level of research institutions, tend to be instrumental to other purposes. In particular, the practical implications of internationalisation for research institutions (enhanced competition, evaluation, contractualisation, etc.) chime with the policy implications of the governance paradigm. On the other hand, we have found little evidence that Euro-peanisation, as distinct from internationalisation in general, is of *specific* significance in this respect.

This sheds some light on the final objective in Area 1, which the INNOCULT research has not directly addressed, i.e. the importance of the emergence of a European innovation system for European competitiveness. While we have no basis for a full answer, it is at least reasonable to suggest that the contribution of research to general economic competitiveness depends on the research sector itself being competitive in its own terms, which are, and are generally believed to be, global. This is no way downgrades specifically European institutions or procedures, but simply points to their necessary integration within a broader picture.

Area 2: Innovation in research institutions

> The cultural framework adopted here contributes in some respects to understanding of how innovations and transformations in research institutions can occur, although the picture is by no means complete. Four main factors in institutional change have been identified.

- Internal cultural patterns of hierarchy and closure may drive change when they are inconsistent with their environment. For example, as we have seen empirically, strong internal hierarchies may be eroded by confrontation with a market-driven environment. Only in unusual circumstances will such change count as innovation, since it will generally be passively undergone rather than actively promoted or managed.

- Similarly, since all institutions are part of systems, environmental factors may drive change, usually in passive rather than innovative ways. Among environmental factors pointed to in this research are the general balance of public finance, the demographics of the research community and the relation between public and private research profitability.

- Deliberate policy change is comparatively unusual, but it does occur. Its effectiveness, however, depends strongly on its compatibility with environmental dynamics. The influence of the governance paradigm of public policy even in countries where there is little explicit ideological commitment to it illustrates the fairly narrow boundaries of viable policy innovation in areas such as research.

- Finally, deliberate institution-specific change is possible, but depends on restrictive empirical conditions. In examples claimed or referred to during this research (this obviously does not mean that the explanation offered is necessarily correct), deliberate change in comparatively weakly structured institutions is judged to require something akin to a "conspiracy".

These indications do not suffice to dismiss the notion that internal factors ("such as level of cognitive development and institutional maturity") might explain the ability of institutions to evolve or to transform themselves. In particular, we have no evidence to support or to deny the hypothesis that certain cultural patterns (exemplified by specific institutions) offer greater adaptability in response to environmental change. This is primarily because the exclusive focus on research and higher education institutions has not made it possible, within the scope of the project, to compare across sectors or, except to a very limited extent, across time. On the other hand, subject to further research, we have at least established that it is not generally necessary to introduce internal institutional factors for explanatory purposes. Different patterns of change in the various countries seem to relate more to different starting points and to different policy climates than to specific features of certain university or research

institutions. And even the systems that do appear to behave untypically – notably, within the INNOCULT project, France – are amenable to explanation in systemic terms. It is, in other words, for structural sociological reasons rather than for cultural reasons that research dynamics and outcomes exhibit variations.

Area 3: Socio-cultural challenge

The conclusions sketched earlier suggest that it may be misleading to try to understand S&T systems in terms of the "public political culture". On the one hand, as we have seen, the empirical need for such an explanatory factor does not seem compelling. This is not a general judgement about the significance of causal cultural explanation. Rather it derives from features of the research system (a very powerful functional logic, comparatively weak institutionalisation and very weak politicisation) that should not be generalised across sectors. Even higher education shows considerably more institutional and cultural "thickness" and political salience, and therefore greater variation across countries, to say nothing of possible objects of study such as the welfare state. Broadly speaking, we might postulate that, the less institutional patterns are determined by functional requirements, the greater the scope for cultural explanation. Even here, however, one should be wary of introducing causal schemes, which tend, for strong theoretical reasons, to be disappointingly circular. Culture, properly understood, is not a "cause", but rather a certain way of organising analysis so as to show ways in which sociological processes are channelled through patterns of meaning accessible to ordinary knowledge, and not simply to social-science expertise. Cultural analysis lends itself better to reciprocal correlation than to causality.

For similar reasons, it may be unhelpful to approach "regulative and prescriptive processes within S&T systems" in terms of cultural differentiation, unless one could actually show empirically that subsystems are sufficiently closed for genuine cultural differentiation to occur. The hypothesis is not an absurd one, although there are many reasons to assume that the closure of civil-service and academic subsystems has tended to decrease over the long term. Certainly the

decline of the Weberian "vocation" (*Beruf*) in the face of managerial rationalisation seems here, as in the corporation, to dilute cultural differentiation at the institutional level in marketisation. This does not mean that culture ceases to be significant as a category of social analysis – rather that there is no *a priori* reason for the boundaries of culturally defined entities to coincide with institutional borders.

A possible interpretation of the points made in the previous paragraphs might be that, since all institutions are culturally permeable, only the national level of analysis is culturally significant. This, however, would be a mistake. There is no *a priori* reason to presume that national societies are culturally closed systems either – and reasons to assume precisely the opposite are easily available. Different responses of S&T systems to the process of internationalisation are perhaps best understood by focusing not on national systems, but rather on the range of differentiations that seem, empirically, to have explanatory significance. Some may, indeed, make sense in cultural terms. We have evidence, for instance, both for differences between disciplines (mathematics and the life sciences, for instance, are much more internationalised than political science or history) and for generational shifts: these undoubtedly reflect differing conceptions of the nature of scientific activity, and different patterns of institutional entrenchment that make certain conceptions "normal" within certain fields. In other cases, however, especially of differences between institutions, analysis may need to focus more on *sui generis* factors that are culturally random, and on structural factors that produce necessary adaptations, even though these may make little sense to participants, and may even be strongly resisted by them.

4.6   Policy Implications – The European Research Area

The European Research Area (ERA) is already an existing reality: the Framework Programme played a decisive role in making it sustainable. The data suggest, however, that it was built bottom-up, based upon ongoing scientific co-operation on the blateral and multilateral levels among research

communities as well as between research communities and industries. Those activities might have never led to fully developed research projects without the means allocated to the successfully bidding consortia. A relevant part of such consortia, however, were based upon networks which existed prior to the submission and funding of one or more project proposals to the European Commission.

The calls for proposals under the Framework Programme did in fact increase the research activities as much as the numbers of actors involved in the networks: successful bidding allowed aspirations to turn into reality and shaped the research activities. Unsuccessful bidding, however, did not stop the networks but rather seems to have inspired new activities, including - eventually - the successful re-submission of proposals. Research related networks build up their own core-groups. Those core-groups seem to prevail regardless of the concrete outcome of applications.

The typical profile of European research networks – their success as much as their shortcomings – have to be understood as the characteristic of the already existing European research area. In this light it would not be reasonable to re-invent an entirely new research structure, the less so after the completion of five Framework Programmes.

There is certainly a need for stability and long-term planning to increase the quality of research. There are two ways to stimulate such a stability, the **bottom-up** oriented competitive way in which the framework programmes have operated up until now and the "**Eurostat model**" based upon a central European research "factory" and national "centres of excellence".

The **first approach** is the typical approach of the framework programmes. It combines the traditional academic peer-reviewing procedures with the interest of the European societies, the Member States and the economy. The latter is ensured by the quite impressive consensus-building process underlying the development of the framework programmes.

The **second approach** seems to be favoured by some political actors, e.g. the JRC in Sevilla and some Member States. Combined with an increase of

outsourcing beyond proposal evaluation (e.g. project evaluation and auditing, etc.) this approach is expected to reduce the workload (and responsibility) of DG Research, enforce a more coherent research policy among the Member States, foster the steering and co-ordination capacity of the European Commission and thus implement a true understanding of the subsidiarity policy as laid out in the European Treaties.

There are, however, *major problems* with such an approach. Whilst this model might be appropriate for EUROSTAT given its mission (most of the relevant statistics are still nation-state based, thus EUROSTAT has a strict "comparing nations" mandate) such an approach does not reflect the reality of trans-national and international research in the European framework. The development of research within the Framework Programme shows the combination of different expertise across Europe in a truly interdisciplinary spirit rather than being strictly comparative. In this respect European research shows a commitment to excellence.

Furthermore, a lot of excellent European research is developed by institutions with a high international standing within the research communities but with lower national significance. On the other hand there are clearly national "Centres of Excellence" with no significance in international collaborative research which might be explained by their mission and/or the political influence of the Member States' governments.

The Framework Programmes have led to a new type of research beyond the traditional dichotomy "applied vs. basic". This research could be characterised as a multi-facious truly interdisciplinary and task-oriented research based upon excellent independent research units, often in collaboration with both public research organisations/universities and potential users. An interesting role can be assigned to the consulting companies as well; they often see their role somewhere between the users and the researchers and more often than not have an important influence in the management of the research networks. In the successful cases this seems to lead to excellent research which is efficiently

managed and – to a viable degree depending on the topic – applicable and/or policy-relevant.

This does not mean one should **neglect the mandate of the Commission in the co-ordination of the national research policies**, a function actively undertaken by the Commission supported by various on-going benchmarking exercises. This task has, however, to be understood as a **distinct function** from that of devising European and international research programmes like the Framework Programmes. European research programmes and research for Europe is in many ways distinct from national research policies and programmes.

The experiences made with the framework programmes allow, however, some insights for the improvement in terms of their implementation.

- To increase competition the Commission has already given a lot of infrastructural support for applications. Various information meetings have been organised related to the specific calls, and the information packages seem to be efficient and comprehensive. Given the amount of work related to the preparation of an application and the risk involved, the Commission might, however, consider financial support for those applications, e.g. in the form of lump sums. These could be awarded to projects which meet a certain threshold in the evaluation process. Another possible criteria could be a two-step procedure in which the Commission selects project ideas which could be funded for fully developed proposals.

- It is relevant to note here that some Member States have already developed such schemes. The problems with this are obvious: on the one hand, these uneven conditions disturb the competition between the research teams from different countries as there are unequal conditions between the Member States; on the other hand, there is a danger of political influence.

- Instead of "Centres of Excellence" the Commission should rather stimulate "Networks of Excellence". Such "networks" should be

allowed a combination of exchange programmes, research activities and dissemination routines on a long-term perspective, evaluated on the base of a programme proposal (rather than individual projects) and forgoing experience, attractivity for new partners and the understanding how to integrate them (to avoid closed shops), and monitored during the programme time. The timeframe here should be 5 tp 10 years.

- The interaction between the research communities and the administration of DG Research is in general quite satisfactory. This is based upon the rule that the evaluation of proposals and the assessment of the projects are carried out without any direct influence of DG Research, e.g. done by peer-reviewing. This clearly indicates that further outsourcing would not be appropriate.

- The general term – which is in part relevant to the evaluation of project proposals – is the "European Added Value". This term refers obviously to the subsidiarity principle and is a valid argument in favour of the development of the European Commission's Framework Programmes. However, there should be a specific research area developed for genuinely European research. This is valid for research undertaken for research tasks which are cross-boundary by mission (like environmental research, and sustainability, research on European governance, but also on social policy issues as much as economic ones with respect to the harmonisation debates). Another example are large-scale facilities which are in a sense not just an "Added Value", but "genuinely European" by their very nature.

- This brings up the question of the organisation of the Framework Programmes. Whilst the framework programmes cover a wide field of research topics which are quite relevant to support a wide range of excellent research activities within the institutional set-up there is not enough flexibility. The need to complement research activities by

different action lines was criticised by research groups who participated in FP4. The different application schemes for non-EU participants (at FP4 time INCO) was one of the problems; another one was the separation of mobility schemes for young researchers from the research studies as such. Another complaint is the way in which research projects are combined (by concerted actions and/or research networks); a more stable infrastructure based upon more flexibility in funding would be topical.

- Among the genuine European research tasks there is in the infrastructural perspective the question of the most beneficial use of the knowledge gained as much as of the tools and the databases.

- Dissemination should be stronger incorporated in the research plans and the Commission has here a specific role in making available good dissemination models. Dissemination in the past has just simply been either an add-on to a project or a specialised task tendered under separate calls. This sort of outsourcing does not provide the feed-back necessary for innovative research when dissemination is understood as a permanent interaction process between the researchers and the interested audience.

- Use of knowledge necessitates the public availability of the research results, the tools developed (which are sometimes the "results") and the data obtained. Up until now there is no enforcement of public availability of results; no database from which the results (e.g. deliverables) of the European research projects could be obtained; and it is up to the researchers to define whether a deliverable is public, restricted, or confidential and thus not available at all to the interested research communities. There is obviously an urgent task for clear rules to be set on this issue. As a general rule, deliverables should be open and accessible as public money was involved in the development of the knowledge, tools and data. In shared-cost actions this should be at least possible for a reasonable fee. And

there should be a central database from which information on the projects and its deliverables is available.

- With respect to the databases there is a need for further activities. In addition to the datasets available at EUROSTAT, sometimes however at debatable costs, a lot of data-sets have been created for specific projects. As the data covers quite often relevant information for other projects this is clearly a sub-optimal use. On the other hand, the project specific data need often some extra-work to prepare in a format which is ready for general use and supported by a user-friendly documentation.

To *summarise* the findings of a research carried out among researchers participating in four relevant programmes of FP4: ***there exists already a European research area with a commitment for excellence***. Its participants are quite well connected internationally, quite often even beyond the EU-15 research communities. The functioning of the framework programmes has been rather supportive to its sustainability and the research communities are quite aware about the changes ongoing and voice opinions in how far the experiences have been taking into account when devising new programmes.

There is a scope for incremental changes, and there is some innovation necessary to support "networks of excellence". However, the principles of the Framework Programmes so far are heavily supported by the research communities.

These can be summarised as

- ***bridging the gaps between the scientific approaches and the societies' needs*** by public tenders, but run and evaluated by scientific principles (peer-reviewing, independence of the research work as such from non-scientific influences),

- ensuring the ***quality of research and its efficient organisation*** by inviting a pluralistic and interdisciplinary research community and providing the framework for fair and efficient competition,

- thus ***opening the research markets in a regional and institutional perspective*** and keeping the market open for all qualified participants in order to make social cohesion work.

5   Dissemination of Results

5.1.1   Completed Dissemination Activities

- The 4th Semmering S&T Forum for researchers and policy-makers from the EU and the Accession Countries was organised by the ICCR and the European Association for Advancement of the Social Sciences (EA) on 3-5 December 1999 in Vienna. These meetings are designed for exchange of view between the two communities on issues pertaining to S&T policy. Several members of the consortium attended this Forum and presented, both formally and informally, preliminary findings from the project.

- The co-operation of the co-ordinator with the Six Countries Programme was successfully continued. The co-ordinator attended the meeting of the Steering Committee in Utrecht on 14 May 2000 and discussed the findings of the project.

- On 23 May 2000, a conference was held in the premises of the European Centre for Comparative Government and Public Policy in Berlin, organised by the Zentrum für Technik und Gesellschaft of the TU Berlin, with around 30 participants from various European countries. The objectives and methodology of the INNOCULT project were presented to the participants, together with national reports from all eight countries covered by the project. Considerable and important input was provided by the participants outside the project consortium.

- Steven Ney from the ICCR took part in the Interdisciplinary Marie-Curie Workshop at the Austrian Ministry of Education, Science and Culture on 30. May 2000, and held a presentation on Austrian S&T Policy-Makers' Definition of Inter-, Trans- and Multidisciplinary Research.

- Special session "Institutional Innovation and Europeanisation of Research" at the annual congress of the European Association for

Social Studies of Science (EASST) and American Society for Social Studies of Science (4S) was organised in Vienna, 27-30 September 2000. Within the four sub-sessions, preliminary results of the project were presented and juxtaposed with results of other projects addressing the subject of the Europeanisation of research.

- A conference entitled "Shaping the European Research Area: Internationalisation of Research, Institutional Innovation, Culture and Agency in the Framework of Competition and Co-operation", was organised in Brussels on 28 March 2001 in the presence of 50 policy-makers, researchers and experts from around Europe. The findings of the INNOCULT project were presented by consortium members and commented by renowned European experts in the field.

- A seminar on the French research policy and the position of France in the European research landscape was organised by CERI and CIR in Paris on 30 March 2001. Consortium members from France presented the study and discussed the particularities of the French research scene with other French experts.

- KG Hammarlund presented the paper "Scientific Society and the Outside World" at the conference 'HSS 2001', Halmstad 6–10 May, 2001

- Ronald Pohoryles took part in the Seminar on Governance, Entrepreneurship and Academic Values, OECD-IMHE, Prague, 20-22 May 2001 and provided the participants with the information on the project.

- Sasa Cvijetic took part in the conference on including Accession countries into EU Research Schemes, organised by the Swedish EU Presidency, Linköping, 23-24 May, 2001, and informed the participants on the project.

- Project findings were quoted in: De Bernardy, Michel; Lawton Smith, Helen *"From Pipeline Technology Transfer to More Co-operation between Knowledge Institutions and Business Firms – a challenge to Master Urgently"*, Les Cahiers de l'Innovation, 2001

- Together with the Research Policy Institute of the University of Lund, Workshop "Policies for European Research: Patterns of Change" was organised in Lund, Sweden on 15 June 2001.

5.1.2 Dissemination Plans for the Future

- John Crowley, Elise Feron and Ronald Pohoryles will present the paper "Governance and the Internationalisation of Research" which summarises the project's main findings at the Congress of the European Sociological Association in Helsinki, August 2001.

- NATO Advanced Workshop on the European Research Policies: abstract for application in preparation

- Presentation of the study to the Austrian audience: „Europäische Forschungslandschaft – Wissen für Europa? Is scheduled to take place at the Volkshochschule Brigittenau on 11th October 2001

- "Research Policy: Trans-European Perspectives" will be the title of the 6th Semmering Forum which will be held from the 6th to the 8th of December 2001 at the Institut d' Etudes Politiques de Lille, where a special session will be devoted to the study's presentation.

5.1.3   Publications Past

Hans-Luidger Dienel: "Bilateral Scientific and Technical Collaboration between Hostile Countries in Europe: France and Germany 1860-1950", *Innovation – the European Journal of Social Sciences*, Vol. 12, No. 4, December 1999

Martin Peterson: "Collaboration and Competition", *Innovation – the European Journal of Social Sciences*, Vol. 12, No. 4, December 1999

KG Hammarlund: "Det dubla arvet: internationalism och nationalism i det europeiska forskarsamhället", *Forskning om Europafrågor*, Göteborgs universitet, 1999

5.1.4   Future Publication Plans

A book publication based on the project's Synthesis Report (Deliverable 7) has been contracted with the Ashgate Publishers, under the title ***European Research Cultures – Myth, Vision or Reality?*** (editors: Ronald J. Pohoryles and Sasa Cvietij). The book will include contributions from all INNOCULT consortium partners and is expected to appear in the market in the Fall of 2002.

Under consideration are the following book projects:

- ***Organisational governance of knowledge production. How new is new?*** (Editor: Maria Nedeva and John Crowley). The book brings together the analyses for universities and research organisations. The aim of the book is to examine and in part challenge the empirical and normative claims of the literature on the new forms of knowledge production on the basis of the INNOCULT empirical material.

- ***The culture of research systems*** (Editor: John Crowley and Barend van der Meulen). The aim of this book is to exploit the idea of a cultural perspective on research systems. This idea remains largely unexplored in the literature and the INNOCULT project can make a contribution in this regard. The book should explore the possibilities for a cultural analysis, drawing for instance on Cultural Theory, but also other approaches are possible, for instance on how

certain 'concepts' like Europe, or the idea of a 'priority' guide interactions within research systems, or parts of it.

- ***National Research Systems***. An edited volume with country reports on research systems drawing from the INNOCULT research and other contributors.

A special issue of the journal *Innovation; The European Journal of Social Science Research* (Volume 15, Number 2 or 3) will likewise seek to publicise the project's results.

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7   Annex – List of INNOCULT Deliverables

All public deliverables listed below may be downloaded at the Project's Web Page, www.iccr-international.org/innocult or be ordered at the ICCR, Schottenfeldgasse 69/1, A-1070 Vienna (Contact person: Project Co-ordinator, Ronald J. Pohoryles, r.pohoryles@iccr-international.org)

The project's Synthesis Report (Deliverable 7) which also provided the basis for this final report is currently being re-worked for publication in book format. The book will appear in 2002 with Ashgate Publishers, under the title ***European Research Cultures – Myth, Vision or Reality?*** (editors Ronald J. Pohoryles and Sasa Cvietij) with contributions from all INNOCULT project participants.

For other publications resulting from the project (past or forthcoming) consult chapter 5 of this Final Report.

Deliverable 1

Inception Report

Internationalisation of Research: Institutional Innovation, Culture and Agency in the Framework of Competition and Innovation

January 1999

Status: Public

Deliverable 2

European National Research Systems: An Overview

October 1999

Status: Public

Deliverable 3

Database of Actors of European National Research Systems

Updated throughout 1999-2000

Status: Internal (Restricted)

Deliverable 4

Methodological Guidelines

November 1999

Status: Internal (Restricted)

Deliverable 5

Literature Review

Analysing National Research Systems, Culture and Innovation

June 1999

Status: Internal (Restricted)

Deliverable 6
Working Papers
National Research Systems
Research Organisations
Reports on Expert Interviews
September 2000
Status: Internal (Restricted)

Deliverable 7
INNOCULT Synthesis Report
June 2001
Status: Public

Deliverable 8
INNOCULT Executive Report
June 2001
Status: Public

Deliverable 9
INNOCULT Policy Report
June 2001
Status: Public