

ELECTRONIC PAPERS FROM THE RESEARCH LANDSCAPE PROJECT

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**The University and the New Research Landscape
A Research Programme**

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THE UNIVERSITY AND THE NEW RESEARCH LANDSCAPE: A RESEARCH PROGRAMME

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This proposal will describe an empirical research programme, developed in co-operation between researchers in Linköping, Lund and Umeå. The aim of the programme is to study – theoretically and empirically – changes in the organisation of, and conditions for university research within a new system for steering and financing research.

UNIVERSITY, RESEARCH AND SOCIETY – TOWARDS A BROADER PERSPECTIVE

As a general ambition, this research programme will analyse the relationship between the university and society. This relationship can be conceptualised as a *contract*, specifying the obligations and powers of the university system (Fridjónsdóttir 1983, Odén 1989). It has been claimed that this contract has been undergoing substantial revisions during the last decade (Guston & Keniston 1994). One important aspect of this seems to be decreased academic freedom and organisational autonomy of university researchers (in decision-making and research priorities and even the determination of epistemic criteria). The steering, but also the evaluation, of research tends instead to be based on its social and economic utility (Elzinga 1993). At the same time, politicians, state officials and policy analysts increasingly stress the impact of research on economic growth and social development.

Like other institutions in society, the university system is exposed to both internal and external pressure. The pressure for organisational renewal comes partly from the cognitive dynamics of research (an internal aspect), but also from political and economic influences (external aspects). As an example covering all of these aspects, technological development (in biotechnology, materials science, etc.) is increasingly interconnected with academic research (Narin & Noma 1985, Grupp 1992, Reger & Schmoch 1996). This development has been supported by research policy interven-

tion aimed at reinforcing the connections between academic research and industrial development (Slaughter & Rhoades 1996). Contemporary university research thus evolves in a context of comprehensive political steering and with close contacts with other institutional settings, for instance the corporate, with, arguably, somewhat dissimilar norms and organisational targets than those of the university. This change in the political and economic regulation of university research has been conceptualised as part of its "third transformation" (Wittrock 1993) or as "the second academic revolution" (Etzkowitz 1990). Such typologies tend, however, to be based on scattered observations rather than comprehensive and systemic studies of, for instance, funding routines, research practice and the external contacts of university researchers.

Research collaboration, organised in more or less formalised networks has become a phenomenon of crucial importance for scientific practice. It is important to state that even though there has always been collaboration in science, we are now witnessing a significant change. Today, in medicine, the natural sciences and engineering, single individuals hardly ever produce scientific results. Instead, it is the teams and the networks of scientists that are the relevant producers of scientific knowledge (Gibbons et al. 1994, Ziman 1994). A number of recent empirical studies have shown the magnitude of the collaborative activities, on several levels of analysis: between countries, between universities, between departments at different locations and between the researchers within the same department (Melin 1995, Persson & Melin 1996, Melin & Persson 1997, Melin 1997). The perspective has to be wide and range from micro to macro, in order to fully understand the dynamics and the implications of this complex socio-cognitive organisation.

In the traditional mode of knowledge production the disciplinary order is clear, the way of communicating the information is formal and the management of the work characterised by hierarchy and a division of labour. The emerging research practice has been assumed to be characterised by transdisciplinarity, increased interaction between universities and other knowledge-producing units, validation of research based on its applicability, and a less formally structured way of organising research work. These hypotheses need to be examined empirically if we are to draw any conclusions about changes in research practice.

The societal interface with university research is perhaps most obvious in the form of research policy. Swedish research policy since the late 1960s has, perhaps more than in any other country, emphasised the applicability of state-funded research, and this has been a major topic within the Swedish research policy debate for at least 10-15 years (two early scholarly examples are Elzinga 1985 and Gibbons & Wittrock 1985). From an emphasis on applications in industry and public authorities during the 1970s, Swedish research policy stressed the conditions for basic research during the 1980s and has returned to the issues of applications and utility in the 1990s. The targets for university research that contemporary Swedish research policy identifies are industrial competitiveness, a more efficient public administration, regional development and gender equality. As many observers have noted (e.g. Ruivo 1994), there is a general tendency in contemporary research policy to emphasise the practical utility of state-funded research. However, the mechanisms and routines of research policy priorities and decision-making has not been the object of many investigations.

The university and university research have been forced into coalitions with other socio-economic forces throughout the post-war period: the military- and health coalitions in the 1950s and 1960s, and the coalition of industrial competitiveness during

the 1980s and 1990s are two such forces (Slaughter & Rhoades 1996). With these coalitions has followed a more instrumental approach to university research, exemplified by the emergence of new professional groups of "R&D managers" and "hybrid researchers". Similarly, systems of intra-organisational management within the universities have developed to strengthen the socio-economic relevance of research (Slaughter 1993). This means that the traditional notion of academic autonomy has been marginalised and that the contribution of university research to socio-economic development is instead the main criterion for the assessment of research, in *ex ante* resource priorities as well as *ex post* evaluations (Hackett 1990; Ziman 1994).

In this connection, some claim that the organisational and cognitive conditions of university research and industrial R&D have converged (e.g. Randle 1997). Established concepts such as basic and disciplinary research, peer review, etc. have lost their significance. The term quality tends to denote practical utility, and it is believed that knowledge is advanced in transdisciplinary, multiorganisational forms. As a result of this, university research is organised in the same structured form as industrial R&D (Gibbons et al 1994). No doubt, tendencies towards problem-orientation and knowledge production exist, even in Sweden, but to what extent they have crowded out the traditional disciplinary organisation of knowledge production is uncertain. If the description offered by Gibbons et al is correct (which Hicks & Katz [1996] claim), many issues still require closer study anyway – for instance, what consequences this development will have on the mechanisms of quality assessment, recruitment's, resource allocation etc. within the university system. The "contract" between the university and society can be expected to be dynamic, and we would therefore expect that strategies will be developed within the university system to adapt to the organisational and cognitive changes. Ziman (1994), for instance, emphasises that the universities have been forced to develop their own internal strategies for resource priorities as a result of the growing expectations of the socio-economic utility of research. As another example, the structure of the university system has been altered, with multidisciplinary and problem-oriented research centres as common forms of research organisation (Etzkowitz 1990).

To further develop the study of the (supposed) transformation of the university system, we should, we argue, be moving beyond the programmatic and impressionistic stage ("third transformation", "second academic revolution", "a decay of traditional values"). Instead, the procedures of academic research must be studied in more detail. Which regulating mechanisms develop on a state level (research policy)? How is research funded and how are the research funding agencies organised?

These issues refer to the macro-level structuring of university research. Research is, however, also structured at the meso- and micro-levels: the university (central, faculty and department levels), the research group and the actions of the individual researcher. Some important issues here include: How do the universities try to structure research (budgetary steering, the development of liaison offices, departmental restructuring, etc.)? How is research organised at group level and what role does academic leadership (management) play? How do researchers pursue their research activities – in which networks do they develop their research, how do they publish and how are they promoted?

We believe that it is only by investigating issues such as these that we can resolve the question as to whether or not the university system is undergoing a transition towards new norms and a new praxis, a new university. As we will argue below, these issues

are all related to the development of a theoretical framework of university research – a system marked by internal regulation but also external dependencies.

This is one major objective of the research programme: to develop an empirical knowledge based on the operations of the public research system – the relationship between funding, research practice and research outputs (publications, external contacts, degrees, etc.). To do this it is also necessary to develop a theoretical framework as a set of guidelines for the empirical studies.

THE ANALYTICAL LANDSCAPE OF THIS PROGRAMME

In the following discussion we tentatively will identify four ideal-typical positions that have been influential in the study of the university system – its research, organisation and steering. They are logically organised according to their position in two dimensions. The first dimension focuses on the well-known *autonomy-heteronomy* distinction (Gustavsson 1971). It poses the question of whether the university is an institution with distinct operational criteria of its own or whether its organisational procedures are similar to those of other social institutions. In the second case university and society are impossible to separate. The other dimension has its origin in two different views of what it is that is changing the system or where the "threat" or the stress has its origin. Are the change agents and/or mechanisms located within or outside the university research system? The *exogenous* position would answer that external pressures on the university are the actual forces of change, while the *endogenous* position would answer that mechanism of change mainly are located inside the academic system. To delineate the four positions, the four quadrants in our analytical scheme, we will try to conceptualise them according to their recommended "foreign policy". With this we mean how the different positions would like to organise the relation between the two continents University and Society. The four policy positions are the federalists, the internationalists, the sovereigntists and the isolationists.

1) **The federalist position** states that the university is integrated with the rest of society, and that the interface between university and society constantly enforces a restructuring of the system. Most students of the innovation process, who analyse the linkages between academic research and industrial innovations, embrace this position. This tradition can be exemplified by journals as *Technology Analysis & Strategic Management*, *R&D Management* and to some extent *Research Policy*. From this perspective, university research is seen as but one of many components of socio-economic development, and it should be organised, managed and evaluated to increase its societal utility and its societal accountability. External penetration and control of the university system is therefore – implicitly – seen as necessary to bring about changes and modifications of university research in relation to broader socio-economic processes. We can summarise this position as the management or bureaucratic perspective on the university system. The recommendation would be a *federalist* policy. Academics and industry should take a seat in the board and solve their relations through a number of bridging organisations. An economist typically holds this position.

2) **The internationalist position** underlines that the university is assimilated with the rest of society. The development of research is organised by the researchers in an absolute interface with societal processes. In this tradition, academic research is viewed as one of many cultural practices in contemporary society. There is nothing that distinguishes university research from other forms of knowledge production. Social interests influence and determine not only problem choice but also the methods and validation of science. This tradition can be exemplified by the journals *Science, Technology & Human Values* and *Social Studies of Science*). Despite the supposed social determination of science, university researchers have been successful in claiming to produce "irrefutable" knowledge, superior to all other forms of knowledge production in society (Gieryn 1995, Latour 1987; for a critique, see Cole 1992). Thus, the further development of science is therefore based on power relations and social strategies of the researchers and it would be analytically incorrect to distinguish between society and university. Processes are neither internal nor external, but they produce change in the system and as boundaries are social constructions these changes might be seen as endogenous. This is the power perspective on the university system and the internationalists would recommend some kind of *integration* policy. This position is typically held by a sociologist.

3) **The sovereigntist position** argues that the university is a unique institution and a social system of collegiality. The change agents are mainly internal and the threat to the system comes from anti-science and relativism. From this perspective, the progressive development of university research is dependent on autonomy from social, political and economic steering. Disciplinary research is developed on the basis of intra-scientific procedures, which cannot and should not be blurred with targets of practical utility (Ezrahi 1990). Considering this, the internal self-organising mechanisms of the university – in particular quality control – must be maintained to preserve the university's claims to autonomy (Björklund 1996, Merton 1973 [1942], Price 1965, Shils 1993). Otherwise, there is a great risk that the system will be undermined from within, by declining quality measures and a nihilist approach to the standards of reputational control, attempts to satisfy socio-political interests, i.e. relativism or political correctness. Thus, changes in university research emanate from within the university system, as a result of erosion of the internal system of quality control. This is the collegial perspective of the university system and the recommended policy would probably be *self-governance* with respect for "national borders". This is the typical argument from a political scientist.

4) **The isolationist position** states that the university is a unique knowledge-producing institution. The change agents of managers and industry commercialisation are a real threat to the university. From this perspective, the societal autonomy of the university and of university research must be maintained to secure the conditions for scientific practice and knowledge production. The famous journal *Minerva* is the typical fora for discussions on aspects of academic freedom. The threat to this autonomy is seen as coming from external steering (social, political and economic), eroding the traditional mechanisms for organisation and validation of research, and exposing university research to demands for social utility and accountability (Russell 1993). On the other hand, if research is organised and evaluated by the "scientific community", this will ensure the reproduction of the university research system. In tentative terms this is the intellectual perspective on the university system and the recommendation would be *isolationistic*. Typically historians hold this position, but that is clearly a

From our point of view, each of these four perspectives and the research produced from these perspectives provides interesting insights, but taken individually they are too narrow in their approaches. Instead of using, as we would claim that these perspectives do, a singular focus on university research – i.e. viewing it either as a sub-system of the economic system or as an autonomous and self-organising system – we will use a *relational* and *institutional* approach. We aim to contextualise the evolution of university research by studying the interaction between steering and research practice, the development of steering practices (research policy, administrative routines of research funding), the development of research organisation and research practice at the university department level.

THE THEORETICAL FOUNDATION OF THE RESEARCH PROGRAMME

We suggest an institutional and relational approach to the study of the university system. Within institutionalist approaches, the emphasis is on the borders between social institutions (for instance, the university system and the market) and how macro-institutional arrangements are related to micro-institutional practices (Ahrne 1990, Ostrom 1990, Pedersen et al 1992, Scharpf 1993). The attempts by the state to steer university research into given directions has led to (the risk of) a confrontation between, on the one hand, the institutional orders of the political system and the market and, on the other hand, the structure of the academic system (Hansen 1988). Institutional orders are subject to constant changes because of their external dependencies (cf. Mouzelis 1991, Benner 1997). This means that the internal mechanisms of the university system – however stable they may be – are affected by the changes in the political and economic environment of research. Similar arguments have been presented by sociologists of science, arguing that the research group is a self-organising system, which develops in a dialectical relationship with its environment (Krohn et al 1990). Our approach is also connected with policy research that conceptualises the policy process as being multi-organisational, where the actors involved form networks or coalitions to bring about institutional change (Jenkins & Sabatier 1993).

The subjects of this study – the steering, organisation and practice of university research – fit such an approach quite well. The university research system – historically seen as an autonomous and self-organising institution – has been integrated into the political as well as economic systems of contemporary societies. The contemporary university system is relatively open – through external relations with companies, authorities, research funders, politicians and social movements of different kinds, and through research policy steering – but at the same time, the system has retained its self-organising mechanisms, such as the disciplinary structure, the “scientific community’s” control of quality assessment, the lingering significance of the research councils in research funding, etc. (cf. Clark 1983 & 1993, Elzinga 1997). A theoretically challenging area is therefore to characterise the tensions between external dependency and internal self-organisation. Several of the areas of the research programme illustrate such a tension, for instance the funding mechanisms, the strategies of the universities and the university researchers, the relationship between university research and social practice, etc.

This programme is also intended to contribute to the analysis of how institutions develop and change. As we have argued, the system of academic norms is one important institution in the university research system. This institution is expressed in the system for reputational control, quality assessment, etc. However, the system of academic norms is, it could be argued, as all institutional orders, subject to changes because of internal and external processes. The relativism of constructivist studies of science is an example of the internal processes (Björklund 1996), whereas the growing expectations that the university research system will contribute to corporate competitiveness is an example of the external processes (Slaughter & Rhoades 1996). By analysing the development of research practices in connection with changes in the regulation and steering of research, we should therefore be able not only to analyse how institutions are reproduced, but also how they change.

One of the theoretical approaches that will be used to study institutional change is based on neo-institutional theorists. As a starting point we define institutions as the rules of the game, that is norms, procedures, rules, etc., that shapes actors behaviour (North 1990). As pointed out by DiMaggio & Powell (1989) institutions can be described as "the very criteria" by which people discover their preferences". Elzinga (1994) points out that the criteria of epistemic quality control and societal relevance can be seen in this way as manifestations of institutions. Theories of institutional change are therefore relevant for our research programme.

One central aspect of institutional change is according to DiMaggio & Powell (1991), what they call institutional isomorphism, that is a force within a population that compels other members of the same environment to come to resemble one another. The force can, for example, be coercive or mimetic (organisations pattern themselves on successful competitors). According to Hackett (1990) both of these tendencies can be observed in how the universities, and the departments within them change their organisation. But, in this case, how easily are the norms of science changed? Theorists such as Douglass North have pointed out the distinction between formal and informal institutions. Informal institutions, such as basic norms, are often harder to change by introducing formal institutions such as regulations. As shown in several studies, institutional changes imposed from above (for example regulation or administrative reforms initiated by the Government) are dependent for their success on the existing norms (March & Olsen 1989, Ostrom 1990, Putnam 1993).

Academic science has been interpreted as a distinct culture, with its own peculiar practices, rules and conventions. Merton (1973 [1942]) suggested that these practices were governed by a set of unwritten social norms. Even if this type of analysis of social behaviour is questionable it is obvious that Merton summed up many familiar social characteristics of academic science. The norm "communalism" requires that research should be regarded as "public knowledge". "Universality" requires that contributions to science should not be excluded because of nationality, social status or other irrelevant criteria. The idea of academics as "disinterested" says that scientists will have to discount any material interest that might prejudice their findings and instead adopt a humble, neutral, impersonal stance. "Originality" stresses that academics are expected to be autonomous in their choice of research problems and techniques. "Scepticism" is the basis for many academic practices, such as critical controversy and peer review.

What happens when the organisational boundaries change? The interface between academic institutions and industry has been opened up, and researchers in industrial

companies, government laboratories and universities can work together in the same team. What happens then? Research that before would have been published immediately now become intellectual property, which may be kept secret for commercial reasons.

This programme then focuses on the relations between university research and other social organisations, and how these relations affect academic knowledge production. Have the social and cognitive norms – (what we institutionalist tradition conceptually will describe as "institutions" or in terms of normative structures – "rules of the game") – of the scientific community been changed? How do different modes of research funding and the organisational interventions of companies and public agencies affect university research? In which ways is university research related to social actors like governmental bodies, innovation firms, professional agencies or regional actors and bridging organisations? How does the "social role" of the university system affect research conditions?

In concentrated form these are the research questions that motivate the overall programme activities. The realist theory of science (Harré 1990 and Bhaskar 1989) is a general point of departure, which, in turn, will direct our research efforts towards the collegiate (self-governance) and managerial (federalist) positions in the analytical landscape above. Our theoretical discussions will deal mainly with the tensions that are created by the everyday encounters and collisions between those two perspectives and their related practices. We would argue that it is that axis that is most likely to produce interesting research, while the other axis, the tension between the isolationists and the internationalists, is much more explored in contemporary academic discussions. The former position is to a large extent a problem-avoiding strategy and the latter a strategy where the problem is transcended or disappears by definition.

OBJECTIVES AND RESEARCH QUESTIONS

Most studies of research steering and development in Sweden have concentrated on the formulation of policy goals or the specific strategies of individual agencies (e.g. Fridjónsdóttir 1983, Premfors 1986, Sandström 1994, Stevrin 1978). The university department and the research practice that is developed there have, however, not been studied to the same extent. One central issue here is how the "inputs" in the form of research funding, research staff, competence, etc. are transformed into "outputs" such as publications, degrees, external contacts, etc. How can the connection between "inputs" and "outputs" be analysed? How is research steering from the research funders pursued? Which strategies for research practice and external contacts do the researchers themselves develop? How is research steered and organised at the university level? These issues are all related to the organisation and structuration of research – involving both the *internal* regulation of research (research organisation, quality control, publication, etc.) and the *external* steering of research (research funding, research targeting, etc.).

If the first target is to develop a new empirical programme for research on research, then the second target of the programme is to develop an approach to the university

system which can account for both its internal constitution and its external dependencies in a historical and dynamic perspective. To be able to understand this, it is necessary to investigate these issues in studies that are both theoretically and empirically focused on different levels of the research system. We suggest a number of investigations where the micro level (the university department) will be analysed through a research strategy, which is both quantitative and qualitative. These investigations will, in turn, be complemented by investigations at the macro and meso levels. (The methodological strategy of the programme is developed in a later paragraph.)

So far, we can summarise our research questions as follows:

- How external steering influences the patterns of university research, how the external steering of university research (public funding, private funding and cooperation) is organised and how these processes are transformed and adjusted to within the university system;
- How the university research system is internally organised (academic leadership at group level, top- and medium-level steering within the university) and how the evolution of the norms guiding research practice are reproduced and changed within patterns of communication, scientific careers, external interaction, publications, seminars, faculty positions etc.

Together, these issues will illuminate the dynamic interrelation between the university system (and university research) and other social institutions – how the norms and actions of university researchers are affected by new regulatory mechanisms for science. To understand this dynamic process, we will investigate how the university system is organised internally and how the organisation and content of university research is connected with other institutions in society, such as the state and the market. The longitudinal approach of the programme will make it possible to understand how the interaction between research practice and research steering (by the state or the market) develops historically. These historical and dynamic perspectives will, we claim, make this a unique study in its focus on both steering and practice, on external as well as internal processes in the development of research.

METHODOLOGICAL ASPECTS

The different case studies of the research programme are integrated by a methodological consideration: namely to conduct *comparative* studies of universities, faculties, departments and research areas. Science-based technologies will be compared with traditional disciplines; natural science areas with social science and medicine; interdisciplinary and/or transdisciplinary areas with mono-disciplinary. Because of the differentiation of the university research system, such comparisons are necessary to understand the different conditions that apply within the system (cf. Becher 1989). The ambition is also to include international comparisons.

In terms of methodology, a number of case studies will be organised. These case studies will be chosen on the basis of bibliometric indicators and other quantitative measures. The case studies aim at investigating intra-organisational and inter-organisational forms of knowledge production. In more concrete terms, this means that we will investigate the development of research practice regarding categories such as basic research, applied research, consulting etc. during a twenty year-period. Eriksson (1996)

has done an important work to operationalise these concepts into categories that can be studied empirically (see also Eriksson & Sandström 1997). On the basis of such an operationalisation, it should be possible to analyse one major aspect of the new landscape of research: if and how new forms of research steering influence the direction and content of research.

The categories must be connected with research funding and publication patterns. In such a study, it is essential to analyse in which organisational forms university research is pursued: within or between academic departments, within or between disciplines, individually or in groups, etc. We will also analyse whether there are differences in conditions for female and male researchers, for researchers in different faculties, and in different types of university organisations (universities and university colleges). We also intend to analyse the system of quality assessment and reputational control. This will be done by studies of recruitment, the allocation of resources, the patterns of publication, the mobility of researchers within the universities and between the university and other social institutions (cf. Engwall 1992).

The intention behind the research programme is to study the changes of the university system on the basis of a number of distinct case studies. These studies will be organised to facilitate comparisons between different disciplines and research areas influenced by the new forms of research steering. The methodological consequence of such an approach is to construct case studies that illustrate the new forms of research steering and funding. Areas with a stable funding from the research councils should be compared with those financed by the sectoral agencies, the new research foundations, the EU, etc. Research areas, which are supported because of the applicability of the research conducted, should be compared with areas that are not. Thus, we take the research group and its perspective as our starting-points for the study of the "new research landscape".

THE ORGANISATION OF THE RESEARCH PROGRAMME

The research programme is organised in the following way. During the first year, preparatory studies will be done. These studies will include a report on the development of Swedish research policy, an elaborated version of the theoretical assumptions of the research programme, and finally, an exploration of the quantitative and qualitative methods and data sources that the programme will use. We will also start collecting longitudinal data on a micro-level (the university department). These data will include such issues as publication patterns, funding profiles, mobility, etc. The longitudinal approach of the programme will make it possible to understand the dynamic interaction between research practice and research steering (by the state or the market).

During the second year, the theoretical and empirical studies on a macro, meso and micro-level (described below) will be effected. We will study the macro-level regulation of the research practice, the organisational interfaces between the macro-level and the micro-level, and finally the daily routines of research performance on a micro-level (publications, collaboration, mobility, etc.). The third and the fourth years will be devoted to finalising the theoretical and empirical studies, reporting the results in confer-

ences, and international, refereed journals. A synthesis of the studies will be presented in an edited monograph.

The programme participants: a new network team

Within the research programme, the ambition is to combine macro-studies of policy changes with micro-studies of research practice at the level of the university department and the research group. To achieve this combination of perspectives, the group is composed to include both qualitative and quantitative approaches. The Linköping researchers (Sandström, B. Persson) have an established co-operation with Lund (Benner), and the co-operation with Umeå (O. Persson) has been established with this programme to handle the quantitative studies. These quantitative studies are both independent research efforts and complements to the comparative analyses of research practice. Among other things, this material (e.g. HRST – Human Resources in Science and Technology) indicates the growth and flow of human capital in science and technology.

Earlier co-operation within the network has been focused on how science-based technologies evolves in networks of researchers in academia, in governmental institutes and in industry laboratories. Several comparative case studies are being executed in each country in two different areas of research: conductive polymers and auto-immune diseases. The connection with the Umeå group has already been instrumental in creating a mapping of the research areas. Sandström has recently joined a EU-project that is co-ordinated by Senker. The project title is European Comparison of Public Research Systems. Among the collaborators are Larédo (Ecole des mines de Paris) and Schimank (Fern Universität).

The Umeå group (Olle Persson et al) is specialised in the quantitative study of research development. The group is internationally renowned for its development and use of bibliometric methods, and have published extensively on research collaboration, publication patterns, international collaboration, etc. (Melin 1996, Melin 1997, Melin & Persson 1996, Persson & Melin 1996). The group is devoted both to methodological development and to substantive sociological studies of scientific practice.

The participant from Lund, Mats Benner, was trained as a sociologists of science at the Research Policy Institute in Lund. After having studied the development of applied research in the academic system, he has recently finalised a PhD thesis on the public regulation of the economy based on the tradition of institutionalist studies (Benner 1997). Together with Sandström has Benner established a co-operation in several research projects: 1) On processes of relevance in research organised in public laboratories and institutes; 2) On the monitoring of networking activities and research organisation in diabetes research in Sweden; 3) Co-ordination and organisation of research in engineering research and technical development in Sweden (c.f. Benner & Sandström 1996); 4) Fusion as a large research and technical system (together with Martin Meyer, SPRU).

The Linköping group works within a larger research group that is well-established within the area of innovation studies especially systems of innovation (cf. Edquist 1997). This research is oriented towards the institutional underpinnings of economic growth and industrial innovations, and will represent an important reference to the re-

interaction between universities and industry are areas that will be expanded and further developed within the proposed research programme.

During the past couple of years, the Linköping group (Sandström, B. Persson et al), together with M. Benner (Lund) and J. Eriksson (KTH), has concentrated on developing an empirically grounded knowledge of research funding: how the research funding agencies structure their research grants and which institutional factors that can explain the conditions of the grants. This research is summarised in Sandström (1997), and represents an analysis of research grants to analyse the differentiation of research funding in the Swedish R&D system. The research is founded on a theoretical programme based on the concept of principal-agent relations to analyse the connections between the state, the research funding agencies and the researchers.

This work has progressed to include studies on the Swedish research councils. Sandström and his associates have already studied the Research Council for Engineering Sciences (TFR), analysing the allocation of research grants over time and between different areas (Sandström, Persson et al 1997). A questionnaire sent to research leaders applying for grants from TFR has also been distributed. Finally, a study of the decision-making process of TFR has been done. The intention is to pursue similar studies of the procedures of the Medical Research Council (MFR) and the Natural Sciences Research Council (NFR), and, if these studies are successful, also other agencies for the financing of research.

Jan Eriksson and Ulf Sandström (1997) have recently finalised an in-depth study of the Building Research Council's (BFR) support to actors outside the university system (companies, consultants, research institutes, municipalities, etc.). This report outlines a qualitative analysis of knowledge production, disciplinary belonging, methods and areas of application of the projects supported. In this report the authors also present a quantitative analysis of research funding based on the project database of BFR.

These experiences, and the co-ordination between the different research groups, make possible a number of new efforts and combinations for the study of University and Research. The team of researchers in the programme can now take the step from studies of funding practices or bibliometric indicators to an extensive and interdisciplinary study of the conditions for university research within a "new landscape for research". Growing out of the network discussions and the theoretical framework are a series of related research projects that will contextualise and advance our understanding of what is going on in the university sector. As mentioned above we have organised them according to simple logistics: we will have to develop our framework and refine the rationale for the empirical studies. This will be done during the first year of preparatory work. Later on, during year 2, 3 and 4 will follow the specific research projects.

BRIEF DESCRIPTION OF PROPOSED RESEARCH PROJECTS

Preparatory studies

The research programme is designed to analyse the dynamic development of norms and actions in university research. To achieve this, we will emphasise both the internal constitution of the university research system (research practice, quality assessment, reputational control, etc.) and the regulation of university research through research policy, research funding and research administration. To build a solid analytical and methodological basis for the research programme, our work will begin (during year 1) by exploratory (preparatory) studies of research steering and research practice. These, therefore, will be the main tasks during the first year. These studies will lay the basis for the empirical projects, which will be planned and designed during the first year and carried out during the second year.

1. Swedish research steering in transition

An important objective for the programme is to analyse the steering mechanisms of research policy developed during the last decade. Studies on Swedish research policy cover either the period until the mid 1980s only or focus on the historical evolution of research steering (Premfors 1986, Svensson 1987, Nybom forthcoming). As a complement to these studies, and as a background to our empirical investigations of research practice, we will analyse Swedish research policy during the past decade. In this analysis, we will emphasise the development and institutionalisation of new targets for research policy (industrial competitiveness, regional development, gender equality, European co-operation etc.) and new institutional forms (industry-academic R&D collaboration, interdisciplinary programmes, research foundations etc.). In our analysis, we will study the interests and actors that have developed research policy ideology and practice and the process of research policy implementation. This study will be presented as a monograph, finished in 1998, which will also contain a further elaboration of the theoretical framework of the research programme.

(Responsible researchers: Ulf Sandström, Mats Benner, Olle Persson)

2. Developing the empirical framework of the research programme

In science policy research there is, in general, a lack of empirical data that can be used to evaluate science policies. There are some available databases that can be used to retrieve data that can partly describe the national research system at a macro level. However, there is a great need to refine such data as well as to collect new data covering other aspects and levels of analysis. It will be one of the main tasks during the first years of the programme to develop empirical methods and data resources that can be used in the various studies.

A. Gathering data at departmental level

The main empirical focus of this research programme is the academic department, in which the actual research is being done. For the various studies suggested, there is a need to co-ordinate the data collection on this level. First of all, a set of academic departments must be selected. This sample will have to cover several relevant theoretical dimensions such as basic versus applied research, hard and soft disciplines, new ver-

sus traditional forms of financing, external versus internal funding etc. It is not possible at this stage to determine exactly which, or the number of, departments that will be selected for empirical study. However, considering the multitude of observations that are needed, the number of departments has to be limited to about ten.

Secondly, it has to be decided which types of basic data that must be collected for each selected department and the time window needed to allow for an analysis of the dynamics of the system. We estimate that the time frame needs to be some 20 years, from 1975 and onwards. For each department there is a need to collect data for individuals on a yearly basis, covering, among other things, and their research positions, student-supervisor relationships, funding from various sources, their research outputs in the form of publications. Then, depending on the actual research problem, additional data will be gathered, for example describing attitudes to various issues, internal and external interactions, formation of research groups, and activities such as seminars, workshops etc. The idea is that the research network of this programme has much to gain in co-ordinating the collection of some basic data, while allowing for collection of specific quantitative and qualitative data needed in each separate study. (Estimated cost for collecting basic data is 2 man-years/research assistant: 300,000 SEK.)

(Ulf Sandström and Olle Persson; Prof. A. Elzinga has accepted to act as a scientific consultant in this sub-project.)

B. Gathering data on the macro level

There are a number of activities in Sweden and abroad aiming at compiling science indicators from available databases. Members of this programme are already taking active part in these developments, which will be beneficial for the research programme as a whole. Three main classes of indicators can be identified: the amount and flow of financial and human resources and bibliometric indicators.

Financial resources

Some aspects of the flow of research funds within the Swedish research system can be studied on a macro level using data collected by the SCB. The National Agency for Higher Education is also producing a database (NU-databasen) that contains aggregate data at university and faculty levels on personnel, doctoral students and funding. However, these sources do not contain data at the departmental level. Still, some of the theoretical statements on the changes in academic research can be tested at university level.

Another source of financial data is the project databases compiled by the various research councils. Sandström and his colleagues have started to analyse these registers with a number of new statistical methods and with research questions that differs from the common administrative use of databases, i.e. as accountability indicators. This has already been implemented on the project databases at the Swedish Council for Building Research (see Eriksson & Sandström 1997) and the Swedish Council for Engineering Research (see Sandström et al 1997). During the preparatory year the programme will survey other councils and financiers for their project databases and try to import these to statistical programs.

Human resources

Human resources in science and technology (HRST) is a new line of development in R&D statistics. It concentrates on the stock and flow of human capital in national research systems. In Sweden there are exceptionally good opportunities to design databases for HRST-data by combining the various databases of Statistics Sweden (SCB). There is an ongoing discussion and co-operation between our research network, the SCB, and NUTEK Analys the aim of which is to make these kinds of data available for science policy studies. The database will enable us to follow research careers since 1975 and onwards. The exact time increments, the kind and quality of the data that can be added to each individual have yet to be determined, but it is clear that sex, age, place of study and work, family status, income and position can be retrieved from the various registers available. Again, it is hard to get reliable data from these registers on the departmental level.

Bibliometric indicators

In principal a scientific publication contains information on who has produced, or co-produced, a document, when and where it was published, what the reported research is about and what other documents it relates to. In short, a publication gives detailed information in terms of which people and ideas are involved but also how people and ideas interact. Although publications do not reflect all aspects of research work – everything is simply not reported – we can use them as indicators of research work and its organisation. If a scientist reports results on a given phenomenon in a given year, we have good reasons to believe that the report indicates real events that have taken place in a given research setting. If the scientist has co-authored a publication with another scientist at the same or another location, this is an indicator of interaction and collaboration. Similarly, if the publication cites or is cited by other publications that also reflects the interaction of ideas.

On a national level bibliometric indicators can be constructed from the databases produced by the Institute for Scientific Information in Philadelphia (ISI). ISI produces three main data databases: the Science Citation Index (SCI) for medicine, natural sciences and technology, the Social Sciences Citation Index (SCI) for social and behavioural sciences and the Arts & Humanities Citation Index (A&HCI) for arts and humanities. The ISI-databases have relatively good coverage of scientific journals published in English. These databases should be looked upon as segments, the most important ones, of the international journal market. By using these databases we can generate indicators of publication activity in various sub fields, countries and universities or other main organisations within a national research system. All author addresses are also registered in the ISI-databases, which can be used to study co-authorships as an indicator of scientific collaboration.

Since these databases do not cover all scientific publication activity the data that can be retrieved from them give a rough picture of the research system, especially if a dynamic study is called for. Since the journals covered by ISI include the most influential ones, changes in publication activity and collaboration in large units such as countries and major universities will probably be reflected in these databases. But, when analysing the activities at departmental level, there is a need for collecting bibliometric data based on the whole set of publications produced. Sandström, Elzinga et al (1995), has discussed how these whole sets of publications might be analysed.

Summing up, there are a number of available databases of various quality and content that are relevant for this project. Members of this research network have already used some of these data sources and are well aware of their potentials and limitations. One experience is that standardising and matching data from the various sources can enhance the reliability of these data. During the first two years of the programme one of the main tasks will be to start to build a database for science indicators that focuses primarily on the Swedish academic system, by combining data from the research councils, the SCB, HSV and bibliographic databases. In short, such a database will permit a dynamic study of the flow of scientific manpower, funds and publications at a macro level. We believe that such an effort will have benefits in the long run which will also serve the needs of other science policy studies besides ours. (Estimated cost for these types of data during 4 years: 200.000 SEK).

(Olle Persson, Jan Eriksson and Ulf Sandström)

THEORETICAL AND EMPIRICAL PROJECTS

The empirical projects of the research programme are organised into three separate, but interrelated, categories: macro-, meso- and micro-level studies. Studies of research steering must, as has been argued, be related to studies of research practice in order to understand the interplay between steering and practice, and vice versa: the dynamics of university research must be analysed in connection with the development of research steering. The meso-level actors are the organisational bridges between research steering and research practice: The projects described below will all be conducted within an analytical framework consisting of the changing norms of academic research (research practice on a micro-level) within a new system of research steering and organisation (on a macro-level). The meso-level actors (research managers, university leadership, etc.) function, we assume, as intermediaries between the micro- and macro-level actors, structuring the actions of the research performers but also acting in relation to the macro-level actors.

It should be emphasised that the three analytical levels (macro, meso and micro) identified above will be used as conceptual tools rather than as theoretical categories to be filled with empirical content. We *assume* that the norms and actions of the research practice are structured on these three separated but interrelated levels, but whether that is the case will be the subject of further theoretical and empirical analysis.

Macro-aspects of the research programme

The projects of this theme are concerned with the overarching structuration of the university research practice. This structuration process is expressed in the formulation of research policy on a political level (and in Sweden most visibly in the form of tri-annual research policy bills), but also in the form of the research policy practice of the funding agencies (research councils and sectoral agencies and other more or less new organisational forms of research financing), such as project organisation, selection criteria, evaluation practices, etc.

The projects described below will therefore study various aspects of how general and overarching targets for university research are developed, which social, political, economic and professional interests are articulated, and how the political steering is expressed in administrative practice.

The development of doctrines and coalitions in Swedish Research Policy

How is the Swedish Research Policy made in a network of different interests, ideas, and institutions? There are many indications that in Western countries policy coalitions supporting a closer university-industry connection have developed. Slaughter and Rhoades (1996) have, for example, claimed that the US Science and Technology policy is changing based on the development of a new bipartisan coalition stressing commercialisation as the criterion for R&D. During the first half of the 1990s there have also been indications that the Swedish research policy is developing towards a more industry oriented policy. What are the policy coalitions behind the formulation of Swedish research policy, and how are they developing over time? During the last 25 years a co-ordinated governmental research policy has slowly developed in Sweden (Premfors 1986). How can we understand changes in the direction and content of this policy?

The purpose of this project is to study the development of the Swedish research policy doctrine and policy coalitions underlying this doctrine from 1975 to 1996. To be able to identify the relevant actors important in this process, the focus of the study will be on the governmental ministries, which are considered as the central nodes where ideas and interests meet in the research policy making process. The project will be carried out as a case study, and will primarily use qualitative methods for analysing data. The project will use written material, interviews, and information from a questionnaire as data sources.

The problems and questions in the project are founded in theories about the policy process and policy change. These theories are emphasising the multi-organisational character of the policy process, the importance of learning, and path dependency. The project will initially use a specific model of the policy process as the theoretical framework to carry out the study: the Advocacy Coalition Framework (ACF) developed by Sabatier and Jenkins-Smith (1993). (Ulf Sandström and Bo Persson)

The Political Economy of Research Funding

The reset system can, as pointed out above, be defined as a set of institutional arrangements for the production of knowledge. The basic elements of any research system are people and ideas, which together with material resources constitute the major inputs to the system. As output we consider publications and new competencies. Money for research is one of the fundamental aspects, and the transformation of funding into research results is the main activity of the system.

Research on the political economy of research funding will have to consider the institutional set up of organisations for financing of research, their different procedures for allocation of resources, and their different uses of collegial and managerial strategies. The purpose of this sub-project is to contribute in some measure to the analysis of resource allocation policies among research councils and other granting bodies, especially

new granting agencies and forms of funding that has been created during the 90s. In particular it is of interest investigate whether the implemented policy for R&D financing is adequate for long-term motivated knowledge production.

The specific focus on R&D allocation procedures and policies in as far as these are reflected in funding patterns in a flow from financiers to departments and sections at Universities, as well as different accounting procedures on the donor and receiver ends has not been explored by many students of research policy. Canadian researchers like Chapman & Farina (1983) and Dalpé & Anderson (1995) are exceptional cases. Using existing databases it is nowadays possible to analyse large quantities of granting decisions regarding several crucial aspects of research policy. (Sandström 1997, Sandström et al 1997 and Eriksson & Sandström 1997).

One aspect is amount of time awarded for research projects. Another aspect is amount of money awarded per project. There seem to be huge differences between councils which grant almost the same types of research, e.g. compare the Swedish Natural Science Research Council (NFR) and the Medical Research Council (MFR), on the one hand, with the Engineering Science Research Council (TFR), on the other hand. How can we explain these differences?

In order to place these patterns in context it is also necessary to conduct interviews with researchers who participate in the evaluation procedures and the deciding bodies of these councils. If the range of granting bodies also includes sectoral agencies it will be necessary to interview officers and managerial staff. Through interviews it is possible to receive a good picture of accounting procedures and relevant preconditions for the financing of research as well as concomitant policy measures relating to R&D grant allocations. This is shown by the TFR-evaluation conducted by Sandström and his colleagues (1997) and the study by Eriksson and Sandström (1997) on the research funding policy of the Swedish Building Research Council (BFR), a typical sectoral research agency.

The investigations reveal that funding portfolios in BFR and some other sectoral granting agencies is split up into a large number of relatively small and short-sighted grants, so that the quality and long-term horizons are difficult to maintain. The support to long-term motivated knowledge productions only constitute a small proportion of the overall support to research and development, e.g. it counts for no more than 15 % of the total BFR budget for R&D.

The current processes of internationalisation and globalisation in the industrial, economic and political arenas will rapidly prompt a reorientation both of the structure of research and the funding procedures. In other words, there is a growing pressure for Swedish research to be more competitive and to do so with an eye on achieving and maintaining parity with the best on international levels. Therewith the question of quality is indisputably pushed into the foreground and new questions must be raised with regard to priority setting and a concentration of resources on a Swedish national arena of R&D funding and research performance.

The distinction between foundational knowledge core research and cutting-edge research in an international arena is reflected in the current policy deliberations on institutional restructuring as well as in quality enhancement discussions going on within the various universities and technological institutes across the country. These discussions tend to be articulated in terms of references to profiling and quality, as well as teaching and internationalisation. It follows from this that there will also be a definite

need for a non-normative research on research, which is more interested in the underlying mechanisms and their institutional explanations.

(Sandström and Eriksson)

The Research Community and Their Response to Changes

During the 90s a whole set of new forms and modes for financing of research has emerged and been incorporated in the institutional set up of Swedish research policy. This has not happened without controversies and debate. Some researchers of good reputation decided to leave their positions in research councils and the Government Research Advisory Board. But in all, the reaction has been surprisingly weak and few researchers have voiced their possible criticism. What are the actual attitudes on these issues within the research community?

The question addressed in this sub-project is how contemporary Swedish academics assess and respond to various institutional transfer-oriented policy alternatives. Of certain interest is where they would draw the boundaries of university-industry collaboration. What kind of division of labour between academia and industry would researchers want to have if they had a choice? One informed guess would be that researchers tend to strive also for strong connections with external actors and that validation strategies often involves contexts of application. If we look at actual practice and do not listen to dinner speeches we might get quite another picture of research activities. But, then again, this is hard to catch with survey methods.

Not only the external penetration should be considered when asking researchers these questions. What are their attitudes regarding the functions of the research system when it comes to internal aspects regarding the council procedures, council granting policies and peer review in different instances.

Faculty attitudes in these respects has not been an exploited area of policy research, although it should be mentioned that NSF and NIH in the US have both conducted surveys which are very interesting (Gillespie et al 1985, NSF 1986 and McCullough 1989, see also Lee 1996). It is probably taken for granted that due to high levels of integration in the research community the need for investigations of this kind is not apparent. Scholars of the collegial position (in our analytical landscape above) though, have pointed out that there are a lot of tensions inside the research community. The impending debates between male and female researchers are but one example of this. The division between researchers who accept the collegial system and researchers who consider this to be a game for senior power professors is another one.

Also, the level of integration inside the research community might have changed. With an expanding community, and a lot of new research areas between the traditional disciplines, there could be room for processes, which will have the effect of disintegration. This was one of the major findings in the Sandström evaluation (1997) of the Swedish Engineering Science Research Council (TFR).

In the TFR evaluation attitudes were examined by a national mail survey implemented in the beginning of 1997. The same type of survey is now distributed to researchers who have sent in proposals to the NFR and MFR. Using this method it will also be of importance to include researchers who mainly work within policy-driven areas of re-

search. As this is a fairly new line of research within the Linköping group it has to be both theoretically and methodologically refined during the first year of research.

(Ulf Sandström, bibliometrician and Jan Eriksson)

Meso-aspects of the research programme

The projects of this theme focus what we identify as the intermediary level of the university research system. The actors on the intermediary level – such as university administration and academic leadership – operates in relation to the macro-level actors, for instance through applications for research grants, budget appropriations, etc. and also in relation to the activities of the research performers through the development of the organisational infrastructure for research (funding, recruitment's, future planning, etc.). This level, thus, represents an important, if neglected, dimension of the steering of university research and the reproduction and change of the academic norms.

The role of "academic entrepreneurs"

The analysis of the steering of university research has often focused on the role of research policy or the strategies that the researchers' funders have developed. We believe that another important factor in the organisation of contemporary research – connected with the dependence on "external funding", the demands for social, political and economic accountability of research, the increasing scale of research operations, the growth of international research co-operation etc. – is the group of "research managers". This group, which we call the "academic entrepreneurs", functions as an intermediary between the research funders and the research performers (PhD students, post-docs, etc.).

Studies on this group of researchers – who primarily organise rather than perform research – either emphasise their social motivations (Bourdieu 1984) or their instrumental role in increasing research output (Stankiewicz 1980). Our intention, instead, is to search for the role that these actors play in structuring research. The academic entrepreneurs are responsible for arranging economic support, recruiting manpower, developing and monitoring research programmes, etc. In short, they structure the internal as well as the external relations of the research group. We will analyse how these key persons translate social, political and economic expectations into research practice – how they negotiate with research funders, recruit personnel, develop the intellectual programmes, and ensure that the expected results are reached. The method for this will be the identification of a number (about 20) such "academic entrepreneurs", who will be interviewed, and whose organisational networks – within as well as outside the university system – will be studied.

(Mats Benner and Olle Persson)

Research steering at the university level

This project will analyse the strategies of university administration within the "new landscape of research". University administration (vice-chancellors and university boards) is affected by both the steering strategies of the state and the research funders

(central regulation), and, on the other hand, the practice of the university researchers and the "academic entrepreneurs" (local regulation). Studies on the rhetoric of U.S. university leadership indicate the ambition to portray the universities as responsive to external interests – both political and industrial (Slaughter 1993). Important questions for studies of the Swedish university system that follow from these preliminary findings are: How does the university administration try to influence research practice at department level? How do they organise and structure the external relations of the university (with companies, regional interests, organisations, public authorities, etc.)?

This project will be pursued by collecting material on the university administrations' strategic policy formulations as well as their more concrete measures to influence research organisation and practice, including departmental reorganisations, the creation of new forms for research performance, budgetary steering, regulation of external contacts, etc. Interviews with leading university administrators will also be pursued. The study will include a selection including the old universities (Lund, Uppsala, etc.), newer universities (Umeå, Linköping), university colleges (Växjö, Västerås, etc.) and technical universities (Chalmers, KTH). By such a study, it will be possible to characterise the role of university leadership in the structuration of contemporary research as well as to compare the strategies of different types of universities/university colleges.

(Mats Benner)

The organisation of university-society contacts

The importance of the interaction between the university system and other organisations has been stressed during the last decades (cf. Stankiewicz 1986). The university should, from such a perspective, contribute to local entrepreneurship, industrial renewal, further education of professional groups, etc. In order to accomplish this function – in Sweden labelled the "third objective" (tredje uppgiften) of the university system – the universities have set up a number of intermediary organisations, functioning as bridges between university research and societal practice. Among these organisations, science parks, contract research organisations and technology transfer agencies could be mentioned. It has been argued that these organisations represent not only a bridge between different organisations but also between different institutional orders/norms systems (Webster 1994). Our intention is to analyse how these organisations function, how they translate societal demand for knowledge and information into programmes for research practice, and if and how they translate the corporate norms of competitiveness and profits into programmes for knowledge production within the university system. In such a study, it will be possible to analyse the role of these intermediary organisations in the reproduction and change of the institutional order (norms system) of academic research. This study will be based on qualitative studies of a number of such organisations, the structuration of their activities and their relations with university researchers.

(Benner and Sandström)

Micro-aspects of the research programme

The everyday activities of an academic department can be looked upon as a highly dynamic set of activities. At the centre of these activities are the researchers, their preferences and ideas. The outcome of the activities are to a large extent dependent on the actual research practice, the sequence of events and decisions made during the course of a research process. Few, if any, research policies have tried to steer or control this kind of everyday activity. But research policies could, to a substantial degree, affect the initial set-up of these activities.

Below, we list four projects that address questions related to the transformation of research as a socio-cognitive practice.

Norms as institutions in academia

In what ways are the forms of academic production of knowledge changing and how are these changes related to the institutional set up of new modes of financing? As pointed out in the introduction of this proposal several scholars have claimed that changes of that type are pervasive in the research system. Gibbons et al (1994) have argued that the production of knowledge is increasingly characterised by interdisciplinarity and applied orientation. Leydesdorff & Etzkowitz (1997) on their hand argues that university research, private industry and public policy are increasingly interacting with each other, which, by itself, changes the organisation of research. Are traditional norms of science, expressed by Merton, changing due to these new conditions? Hackett (1990), basing his hypothesis on the neo-institutionalists DiMaggio & Powell (1991) has claimed that increased dependence on resources from the private sector will cause universities to resemble the private sector. As Elzinga (1997) has pointed out, this implies an institutional change in the academic community, for example shifting criteria of evaluation of research from peer review to commercial or management oriented criteria.

It should be possible to find empirical traces of these processes at university departmental level. What is really happening at the university department, the black box where the production of university knowledge is carried out? Is the Hackett thesis correct? Are the norms of academic research changing? Does different organisation of departments, universities, and the national organisation of research, matter in this respect? Webster (1994) argues that in Germany, the system of bridging institutes between industry and academia has discouraged universities from developing in a commercially oriented way. There are, in fact, few empirical studies about the effects of an increase in external influence of university research. Furthermore it has not been systematically shown what is the actual content in, for example, funding and personnel of these claimed changes. So what are the changes in funding and personnel, and is it possible to observe changes in institutional structure, such as formal organisation, criteria of evaluation and seminar procedures, at the University departments?

The purpose of this sub-project, which is connected to the preparatory study during the first year, is to study changes in funding, faculty positions (e.g. extent of marginal positions) and institutions (such as norms and procedures) of university departments. Opening this black box will make it possible to see the exchanges in external funding and steering, but also through interviews and observation, the institutional changes (in, for example, norms and procedures) at the departments. One proposed project in this

programme, which will be central to the research questions, is to carry out a number of comparative case studies at a selected number of departments in for example three Swedish Technical universities: KTH, CTH, and LiTH¹. These universities are chosen because they have departments that represent three different modes of organisation. At KTH applied research is often organised through institutes connected to, but separated from, the university departments. At CTH departments are small and organised around one professor. At LiTH the departments are large, including different orientations of research. The development of the departments will be studied from 1975 to 1995, which will make it possible to observe and analyse changes over a long of time.

The project will be based both on written material, interviews and data bases. In the first phase of the project written sources from the departments (such as publications, annual reports, and financial reports) and from external funding agencies (such as project data bases) will be used to analyse the character of the funding, as regards amount of funding and time for projects. The categorisation of the material will be carried out with a method based on a theory of funding policy and institutional characteristics developed by Sandström (see Sandström 1997 Ch. 4). The institutional conditions at the departments are more difficult to capture, but here both written material and interviews will be used. We are here interested in the practices of appointments of staffs, seminar procedures, how the system of quality assurance works, etc. Emphasis will be placed on patterns of publication analysed with methods developed by Sandström based on a theory of refinement operationalized into categories of "publication friction" (see Sandström, Elzinga et al 1995, Ch. 5).

To examine the possibilities of this comparative project a pilot study will be carried out during the first year of preparatory studies. A "big department", IFM (Institutionen för fysik och mätteknik), at the University of Linköping is proposed as object of study. The object for the pilot study has been chosen based on the criteria that IFM is a crucial case since it includes both basic oriented and applied oriented research, and receives funding from a variety of funding sources.

(Ulf Sandström, Mats Benner and Olle Persson)

Gender socialisation in academia

One major aspect when studying the change of modes in scientific production concerns the composition, mobility and flow of academic staff. The number of female researchers has increased over the years, primarily in the lower ranks, and today the share of females starting doctoral studies in Sweden has reached 40%. This dramatic increase of female researchers brings the gender issue into focus and it is becoming increasingly urgent to learn more about the integration of female researchers into the male-dominated research system.

Studies of gender differences in scientists' careers are important from at least two aspects. In the first place it concerns the matter of equality, how the norms of universalism work in the scientific reward system. Secondly, it has an economic aspect, namely how the system of knowledge deals with its human resources. Universalism indicates that the allocation of rewards should be based on a scientist's merits and contribution to scientific knowledge. In contrast, particularism involves the considera-

tion of irrelevant characteristics such as race and gender in the distribution of rewards and resources (Long et al 1995). A number of studies have focused on the differences in career achievements for female and male researchers (Long et al 1993, Wold et al 1996). The inequalities are well documented; however, the mechanisms behind the results need to be further elaborated.

If Gibbons et al are right about a development towards more network-oriented research, it motivates empirical studies of the social organisation of research. Access to scientific networks can be looked upon as a kind of social and intellectual capital of increasing importance for knowledge production and scientific careers. As a consequence, the understanding of processes of inclusion and exclusion becomes central for the study of modern academic research. One central question is to what extent gender affects network integration, mobility and flow of academic staff. Since earlier studies have shown that positions in the informal scientific network as well as access to information and collaboration is crucial for career output (Crane 1972), one might assume that such factors also explain career differences between male and female researchers.

The answering of these questions requires empirical case studies focusing on departmental environments as well as individuals. By means of bibliometric techniques, register data and interviews with scientists, a fair mapping should be obtained. Bibliometrics will tell us about collaboration, research orientation and intellectual linkages, register data gives us information on positions and career paths, salaries, student supervisor relationships etc., and interviews will provide a basis for validation and deeper understanding of the processes and structures at hand. Using the data on HRST prepared by the SCB and NUTEK, we are also able to follow research careers for various cohorts as they move in a geographical and social space.

(Olle Persson and Mats Benner)

Mind and Institution

One part of the overall study concerns the academic department and its role as an organiser of social and cognitive elements in research. Gibbons et al (1994) have assumed that the university department is gradually losing its influence on, and control of, the social as well the intellectual life of the department. There are, however, circumstances pointing in a different direction. The organisational structure, as well as the job structure, of university research in Sweden is more or less the same as it was twenty years ago, and the academic department is still the location where the socialisation, that is the education and training, of researchers takes place. Considering the stability indicated by such instances, the academic department would still be of major importance, both socially and intellectually.

Empirical evidence, nevertheless, indicates that research is increasingly being organised in networks that cross institutional borders (Melin & Persson, 1997). The question, then, is to what extent the prevalent organisation of university-based research in Sweden corresponds and reacts to these new circumstances. Can the nodes of the networks, constituted by individual researchers situated in a specific department, be considered as forming a cognitive and not a merely social unit? How is the socialisation of researchers to be described? How, and to what extent is the individual researcher influenced by the social and cognitive climate of the department in her/his choice of re-

search direction, and in what way is the department affected by this socialisation in the longer run? The answering of this kind of questions requires and motivates empirical case studies focusing on specific departmental environments where individual factors as well as factors related to the department are considered. By means of bibliometric techniques, register data and interviews with researchers, a fair representation of the relevant aspects can be accomplished.

(Olle Persson, Melin and Sandström)

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