

# The Changing Landscape Debate – Where is Research Going?

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Profound changes have taken place in the Swedish research system during the 1990's. The financing and steering of research have become more and more directed and rationalised by economic means. This is an international phenomenon. In his book *Prometheus Unbound* (1994) John Ziman points out that there is now a pressure on "for the introduction of a new regime, supposedly more responsive to the needs of industry and commerce, and more in line with current belief in the power of market competition to ensure efficiency and excellence" (p. 74).

To understand these changes we have to examine closely the triad of University-Industry-Government relations. The American sociologist Henry Etzkowitz has coined the term "a Second Academic Revolution" to describe these new relations, which involve a reconfiguration of institutional boundaries and the introduction of an economic mission into the university system:

"A second academic revolution currently underway is making economic development a function of the university in addition to teaching and research. The internal impetus for the changing role of the university include:

- the industrial activities of individual academics in forming firms, these take on a collective force as they become increasingly commonplace;
- the organisational initiatives of academic administrators in establishing procedures and administrative offices for university-industry relations and;
- conflict of interest controversies over linkages with industry, these often lead to the formulation of explicit policies regulating and legitimating such ties."

(Etzkowitz 1994)

In this context a number of scholars have proposed new concepts for interpretation and debate, e.g. Triple Helix (Etzkowitz & Leydesdorff 1997), post-normal science

(Funtowicz & Ravetz 1993)) and, of course, the most famous of them all, the so called mode 1 and mode 2 concept (Gibbons et al 1994). What are these concepts all about?

### *University and Society*

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 intervention 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). 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, scientific results are hardly ever produced by single individuals. 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; in order to fully understand the dynamics and the implications of this complex socio-cognitive organisation it has to range from micro to macro.

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 is 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.

### *Changes in Research Policy*

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. 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 moved to stressing the conditions for basic research during the 1980s and seems to have 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 as runner up during the 1980s and as overall policy during the 1990s are two such examples (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 lost in importance 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. Even if the description offered by Gibbons et al is correct (which Hicks & Katz [1996] claim), many issues still require closer study— for instance, what consequences this development will have on the mechanisms of quality assessment, recruitment, resource allocation etc., within the university system.

The "contract" between the university and society can be expected to be dynamic, and we should 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). Are these new forms to be interpreted as ways for handling added mandates for university research?

To see and acknowledge what happens at the level of university policy we will need concepts for dividing between different types of policy measures. In the following I am going to rely on an analysis that identify three different forms of financing modes of university research: (1) the interventionist model, (2) the autonomy model and (3) the transinstitutional model.<sup>1</sup> While I go on illustrating these models I get the opportunity commenting also on the debate concerning changes in the research landscape.

#### *Four positions in the debate on academia and society*

In the following, I propose four ideal-typical positions in the debate on how to analytically describe the relation between university and society. They are logically organised according to their position in two dimensions.<sup>2</sup>

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

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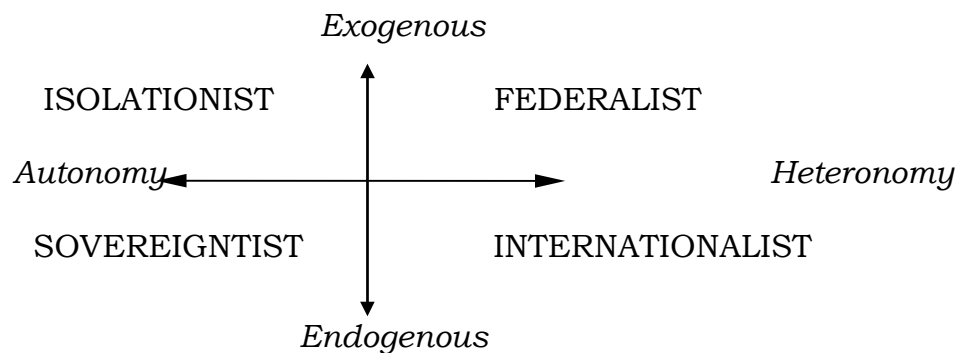
<sup>1</sup> The proposed classification emanates from a paper written by Benner and Sandström (1998), in which Benner's contribution should be underlined. He gave the first ideas on this topic. Here they are summarised and not dwelled upon.

<sup>2</sup> I am indebted to Leif Hommen for comments and suggestions to this analysis.

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 where to locate the forces that change 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 mechanisms of change are mainly located inside the academic system. To delineate the four positions, the four quadrants in our analytical scheme, I will try to conceptualise them according to their recommended "foreign policy". With this is meant 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.

*Fig. 1. Positions in the Research Landscape Debate*



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. This position is embraced by most students of the innovation process who analyse the linkages between academic research and industrial innovations. 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 both take a seat in the board and solve their differences through a number of bridging organisations. The position is typically held by an economist.

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 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 or 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, both related to 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 an erosion of the internal system of quality control. This is the collegial perspective on 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 forum 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 this position might be held by historians, but that is clearly a caricature.

Each of these four perspectives and the research produced from these perspectives provides interesting insights, but taken individually they are, from my point of view, too narrow in their approaches. Instead of using 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 – I propose a *relational* and *institutional* approach. Studies of the evolution of the university system have to take a multitude of factors into consideration: 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.

### ***Looking backwards***

In Sweden we can observe that certain arenas of knowledge production have been reorganised during the past years. Before going into details on the reconfigurations occurring in Sweden today, let me call attention to experiences from not more than three decades ago. This historical background might be relevant for the current discussion and theoretical reflections on new modes of knowledge production. What I have in mind is the 1970s and the very strong and enduring external penetration of the university that took place during the "sectorial period" of research policy in Sweden. At that time Government, with a little help from its friends at the University, tried to solve all types of problems by organising new agencies for research support.

The belief in large research programmes and rational politics was at the forefront of the political arena. Sectorial research in Sweden was organised as a system for deputy contracting, since there were no genuine contractors for the type of problems that were focused on. These included, for example, problems in housing,

the search for new energy sources, and so on. Deputy contracting is a system whereby a state agency acts as a deputy for needs that can't find their way to the "research market". Needs are identified by the programme officers, or at the political level, and transformed to research contracts with the university sector. The energy research programme, launched in 1975 and finished in 1984, is possibly the example of the failures of this policy, especially concerning conditions for steering of university based research.

The policy was built on some doubtful assumptions: 1) that the contractors had a rational understanding of what type of knowledge they needed; 2) that inside of the contracting bodies there resided a conclusive "will" and comprehension of the energy problem; 3) that the university system consisted of a number of conveyors who could readily supply the demanded knowledge; and 4) that knowledge ordered would also be used by the contractors (c.f. Wittrock & Lindström 1984).

These assumptions can be challenged in several ways. Let me mention one important dimension: The policy viewed universities as instrumental players in the contractual relation. Research were organised and directed. At the same time, there existed no strategy, or only a rudimentary strategy, for how to build a new field of knowledge. For example: How much of time and resources should be devoted to fundamental, basic, research, and how much for applied research? No one knew in what alternative ways it might have been possible to organise capacities for strategic problem solving and long-term problem solving. Instead, it was taken for granted in very simple forms of directed research.

Science is, as many social scientists has shown since then, deeply rooted and not detached from social, economic and political realities. Because of this, science is most often capable of providing different interpretations of problem constellations and legitimation for different policy proposals in a given situation. Different organisations – NGO:s, the authorities, as well as specific groups within the authorities – can easily, through inclusive or exclusive strategies find ways for using "science" in public debates on energy problems. From this it follows that it

was difficult to rationalise knowledge utilisation during the energy programme. The nuclear debate is just one illustration (see Brante, Fuller & Lynch [Eds.] 1993).

Bearing this in mind and with hindsight, there is room for a lot of scepticism towards research that derives its epistemological justification first and foremost from political bodies. But many researchers were comfortable with the situation during the so called sectorial period. Indeed, we could argue that it agreed with the political preferences in the scientific community, which was very open to external penetration. The money offered provided employment and the scientific community benefited by becoming larger and larger.

The paradigm for research policy has changed since the 1970s, largely due to the drawbacks of the rationalistic paradigm. Formerly, it was political problems and politically organised arenas that dominated the research agenda. We might describe this historical pattern in terms of a military and social engineering paradigm. Nowadays, the main problems are more economic in nature and they are associated with industry-based arenas. The competitiveness paradigm, in Slaughter's (1996) words, dominate, both actions and discussions about the future of research. Today, there is no need for deputy contractors and this might why we now witness the closing-down of several sectorial bodies. A governmental investigator has, for example, recently proposed that the Swedish Building Research Council (BFR) should be discontinued (SOU 1997:182, for comments, see Sandstrom & Eriksson 1998).

To describe and analyse the current situation, I will concentrate on funding agencies for technical and engineering research. This area of research policy will function as an illustration, showing that there are a number of problems inherent in the new paradigm for research policy. These problems, e.g., the difference in ethics and the difference in value structures between the sectors – academia and industry – have to be regarded as important. They have such a fundamental character that we always, in our normative discussions, have to come back to the issues involved

In Sweden, considerable funding has been (and still is) allocated through sectorial bodies reporting to other ministries than the Ministry of Education and Science. The National Board for Technical Development (formely STU, now NUTEK) has distributed a great deal of support for technical research and industrial development (and energy research). NUTEK was started in 1968, when the sectorial policy came into its take-off period. The university sector is the main recipient of money for applied research and development. That is due to the fact that the research institutes (governmental labs) are few and of little importance in Sweden. Let us keep in mind that R&D in Sweden focuses heavily on certain key industries. Between them, the five biggest R&D areas account for more than 80 % of all research and development in industry. And these resources are concentrated among a few companies. Pharmaceuticals are the most R&D intensive industry, of course, (42 % of value added) and it is closely followed by telecommunications 40 % (value added). Two companies alone, Astra (pharmaceuticals) and Ericsson (telecommunications), accounts for a large part of the stock market in Sweden. I will come back to this problem later.

University research in Sweden is supported from a distinctively pluralistic funding system (Benner & Sandström 1996). NUTEK is not alone on the market aiding research in science and technology. In engineering science and technology there are a couple of more traditional research councils as well. We know them in Sweden under the acronyms NFR (The Natural Science Research Council) and TFR (The Engineering Science Research Council).

Besides these agencies, we have a couple of new research Foundations. In particular, the SSF (the Strategic Research Foundation) is devoted to science and engineering, but to be comprehensive it should be mentioned that there is at least one more Foundation that directs money to this area – the Knowledge and Competence Foundation (KK Foundation). These Foundations are more or less under governmental control and their establishment has produced a substantial amount of new money for research at the university, even if the phasing in of

foundation money has had the effect that the councils and NUTEK have had some cut-backs on their respective budgets. NUTEK, especially, has lost at least 40% of their budget for university research.

In view of the current discussion about new modes of knowledge production, these reallocations are interesting facts. NUTEK has had a Mode 2 policy ever since the beginning of the 1980s. The agency is, as I mentioned earlier, rooted in political attempts to regulate the Swedish economy. It has had a proactivist and interventionist rationale. NUTEK tends to view itself as the "voice of industry" within the academic system. Research officials aim at channeling university research into lines that are relevant to industrial R&D. Thus, NUTEK aims at connecting and integrating academic research and the dominant Swedish industries.

During the 1970s, NUTEK (which at that time was named STU) worked more as a deputy contractor. Their ambition was to orient academic research towards new areas and new problems. This was expressed in attempts to foster new sectors and new products on the basis of academic research. Later, NUTEK has set the objective of translating industry's interests into programmes for funding: programmes that are designed to meet industry's needs in the medium-term perspective.

Since the early 1980s, NUTEK has taken the approach of operating as a network entrepreneur fostering coalitions between industry and academia. Their style of operation is still what I would define as an *interventionist model*. The type of networks that NUTEK has developed reflects its self-imposed mission. An elaborate system of steering committees is connected to its support programme. Industrial representatives dominate the committees. They have 60 % of the representation and academics have only 20 %. NUTEK seems to have developed strong connections to the traditional strongholds of Swedish industry, since it is these sectors are most well represented in the committees. Inside of the organisation, the routines emphasise the role of the research officials. Quick decisions that are

responsive to industrial needs are highly valued. Selection criteria in use stress the relevance of research to Swedish industry. In framework committees, this relevance is guaranteed through meetings between the officials and societal and industrial interests. Is not this a typical so-called mode 2 operation?

### *The Interventionist Model Illustrated*

Now, remember that research officials are bureaucrats as well. This can be illustrated from an empirical example of how the administration acted when industry and academics applied for support to develop a new area of research (c.f. Sandström et al 1997). In 1977 it was discovered that polymers could function as conductors. This would have a tremendous importance with regard to applications. Batteries could be better and lighter. In Sweden, though, there were no industries that could take on research of that kind. It would be a type of fundamental research with certain applications in mind. But, as in many other scientific fields, there were no short cuts to finding and realising these applications.

The large family of conjugated polymers are materials capable of being doped, through chemical oxidation or reduction, to states of high electricity. Three other types of doping methods have been developed over time:

- electrochemical,
- photo-doping and
- doping by charge injection at a metal-insulator-semiconductor.

Following the analysis of Heeger (1993), these methods can be interpreted as four different trajectories within the ECP-paradigm. Each of these trajectories utilises doping and undoping for specific types of applications, e.g. lightweight batteries, lightweight electrical conductors, energy conversion devices, electro-optical devices and different products in the area of electronics (field effect transistors).

During the 1980s many of the chemists and physicists in the USA, Japan and Europe concentrated their efforts on raising conductivity and on solving the

problems with stability and processability, principally for polyacetylene.

Polyacetylene was the polymer for which the researchers managed to reach the highest conductivity – in fact almost as high as copper.

To produce polyacetylene you need access to synthesis chemistry. As a consequence several physicists started to produce and experiment with the conductivity of other polymers. Because of problems concerning the stability of the polymers, conductivity decreases quickly in air or normal temperatures. When the researchers did not find a solution to this problem in polyacetylene, their interest turned to other conjugated polymers, mostly polythiophenes. A marked move towards several other substances occurred after 1984-1986. Stability increased, but the ability to process the material was not solved.

Because of the problems described above the focus of the research turned *from* the conducting properties at the doped state *to* the undoped. This happened at the end of the 1980s. Undoped polymers are semiconductors and, within this line of research, the optical properties in particular have attracted a wide interest. New ranges of possible devices have arisen, for example light-emitting diodes, photodiodes, solar cells and lasers. In summary, we can say that in a few years of time the whole rationale for the area of research changed.

If we go back to the beginning of the 1980s we will find that there were a number of young and ECP-interested researchers at Swedish universities. Many of them were underfinanced or had a hard time raising money from the Natural Science Research Council. They started to send in proposals to STU (NUTEK). The agency initiated a discussion about launching a "framework programme" for the new area of research. But this was hindered by the simple fact that the agency could not find industrial money and representatives to put into the steering committees. The area was not of immediate relevance to Swedish industry, as it was structured in the 1980s – even if there were people at Ericsson who showed interest and pleaded STU to take an initiative. After a long delay of two-to-three years, the agency solved the problem by inviting ABB, the power transmission company, to participate. Why?

Did ABB have any type of commercial interest in polymers as conductors? Yes, they had, but in a rather odd route of research – polymers could be used as fibers in textile, and this was of interest for the company. Mainly they were interested in polymers as insulators, i.e. the reverse of the original research interest. Also, the research official responsible for the programme appointed his former chemistry professor to the committee, since the professor had had contacts with ABB before.

The STU policy for the framework programmes was that grants for university-based research should be on a long-term basis. The other forms of grants were called projects. The long-term contracts were supposed to have both quality and relevance and STU themselves saw no conflict of interest between those two goals. From the STU perspective, the agency was responsible for identifying areas of interest for the future industry in Sweden. That was why they wanted to support university research. "Quickly", if needed, they should have resources for an intensified establishment of new competence in specific areas of research. At the same time, the industrial relevance was of crucial importance for STU involvement in a framework programme. During 1982-83 they evaluated the industrial "anchorage" of six framework programmes by asking whether the industrial representatives in the committees had the ability and competence to diffuse results from the programmes. The consultant who investigated these questions came up with positive answers, and the STU decided to go on with further developments of the industrial anchorage and more precise expectations of the representatives.

This policy was controversial within the scientific community. Researchers came up with criticisms of this policy because of the risk that relevance would direct the funding away from areas where research was of high quality, but industrial interest and competence was low. Because of that, a discussion started on establishing a research council function inside or outside of the STU. After a short time a new organisation (STUF) was established within the STU. The F stood for "scientific research" and depicted a research council function.

The STU policy had effects on the management of the ECP area. To start a framework programme the agency had to have industrial representatives who were dedicated and interested. Ericsson's engagement by this time was low and soon they got tired of the slowness and left this area. Unfortunately, there were no other supporters of the field. This made it difficult to establish a framework programme. To achieve a more dedicated industrial co-operation, the programme officers at STU turned to the ASEA company, which seemed to have an economic interest in the area. It is said that the company needed a reorganisation of their research division. A new proposal for a framework programme was written rapidly and, surprisingly, a new area was included in the programme. It was called "Polymer Electric Properties" and was directed towards polymers as insulators, especially polymer degradation in electric fields and chemical changes in polymers used as electrical insulating materials. This new direction was fully in line with ASEA's company profile; there was already a research group at ASEA RESEARCH (twelve persons) within that field. Now the company needed contacts with universities to get a broader knowledge base, especially in chemistry.

In the new programme proposal the authors could not avoid expressing their own doubts about the possibilities. They wrote: "It might be the case that research on conducting and insulation polymers, in part, can be co-ordinated."<sup>3</sup> The proposal did not come to an implementation in the usual STU forms. Instead the agency continued its co-operation with ASEA and started a new type of grant, which was called a "project package". This package consisted of six different projects for the year 1984/85, four of which were co-financed by ASEA.

In total ASEA managed to get SEK 925,000 from STU for their insulators projects, and the research on conducting polymers was confined to SEK 600,000. ASEA's Arne Hjortsberg also became chairman of the informal steering group.<sup>4</sup>

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<sup>3</sup> From STU Archive Ragnarsson 1984-03-05, p. II, 2. For further information see Sandström & Tisell (1998)

<sup>4</sup> STU archive dnr 84-3777.

The STU "initiative" in 1983 had, after three years of informal networking, resulted in a Pyrrhic victory. The research field ECP had not been institutionalised during the process. There were no dedicated industrial interests and without these it was almost impossible to receive long-term funding. In the project package grant there were no implicit obligations in terms of time for funding. In this respect there was an insecure period during 1985–86. The field was not approved as a strategically interesting area from the point of view of Swedish industry. Even if the number of researchers was growing, it was questionable whether there would ever be enough money for these new young researchers.

How to explain why the STU programme officers chose to go along the ASEA line? At that time STU had an ambitious plan for framework programmes in basic engineering and generic technologies. This was an orientation away from the short-term project grants and with the more coherent programmes they wanted to raise the performance of research groups. "Partners from industry" was not a compulsory condition, but was indeed a significant argument if a programme officer wanted to start a new framework programme. The conclusion is simple: Firstly, the programme officer in charge of this specific field of research had not enough strength to convince the agency of the need for a programme in this field. Secondly, the implementation of the policy for framework programmes was done in a mechanistic manner. One of the means of getting higher performance (industrial contacts and networks) became the main goal of the whole operation.

The initiative became a failure, of course. Maybe it was not a complete disaster: Nevertheless, this example provides an illustration of how hard it is to overcome the barriers of university-industry relations when there are no real interests on the part of industry. The challenges of new, first-class academic research did not match with the interests of industry. One conclusion is that too much programming along lines that are drawn from how the economy is structured at present is a dangerous activity for the research community – and the economy. Keep in mind that spin-off companies and start-up companies, owned from Sweden or abroad, will be set up if

universities keep on the track of excellence in research. What happened with the polymer research? After hard times during the 1980s, several of the researchers got new financing from research councils (and other NUTEK programmes). Today, with Norwegian capital, they have started a research company with fifteen researchers in one of the Swedish science parks.

A lesson to be learned from this example is that too many networks and too many policy-driven imposed relations with industry might have negative consequences for the excellence of research – and researchers. If we are to make policy out of Mode 2, we should be careful and with prudence take notice of the fact that the university should, in the first place, produce the best training in problem-solving. This, in turn, requires further development of world-class academic research. Trained researchers are what the industry of the future will need – that is almost all we know for certain. How to organise for this training is the main problem for the university, and this is precisely why a mode 1 logic might be more efficient if the universities are to produce knowledge that gives people and collectives a capacity to transcend the economic and social structures of the present.

### *The Autonomy Model*

Fortunately for the Swedish research community, the interventionist model does not represent the only funding principles for technical and engineering research. There are others, for whom "excellence" stands out as a more serious concern. This can be shown also in the area of polymers, but I shall now change to other aspects of the research landscape.

Partly because of the critique against the sectorial research, especially the confused criteria for project selection, and partly because of political changes, a new research council for engineering science research was set up during the 1980s. At first it was organised inside of NUTEK but later, 1990, it was established as a separate agency. The TFR (The Swedish Engineering Science Research Council) operates in a typically peer-reviewed manner and in a responsive mode, which gives the

academic community the type of autonomy it has usually striven for. In brief, TFR represents the *autonomy model* of funding.

I would say that TFR is an example of trends that point in another direction than what is proposed in the mode 2 scheme. It should be underlined that researchers are very positive towards the TFR. The peer review system has a very high credibility among Swedish researchers. This is illustrated by the results from surveys that we have conducted during the year 1997. We asked principal investigators funded by the TFR, and later their counterparts funded by NFR (Natural Science Research Council) and MFR (the Medical Research Council) about their opinions on several topics, including attitudes about procedures and selection criteria. The results from the TFR survey are published in the book *Peers on Peers* (1997). Let me summarise what we found.

Only a small group was dissatisfied with the peer review system as such. A specific analysis of these respondents – approximately less than 5 % – shows that this group includes few women and that the group is overrepresented by researchers who graduated during the 70s and haven't been very successful in their scientific careers. Many of them have had only a few articles published in scientific journals. They have strong attitudes on the review system and on research policy, i.e., they want changes in favour of networks and relevance-driven initiatives. This group's members are the "real mode 2" researchers. They would be well integrated in the transdisciplinary and network-oriented university. If we look at the majority groups, they still have the "perfect mode 1" attitudes and that accounts for the younger scientists as well. Some of them, though, are uninformed about the operations of the council system and, consequently, they are not so well integrated in the community of university research.

What we find is more or less a re-academisation of research in Sweden. This might be explained by the fact that Sweden can be regarded as an exceptional case, since the budget for research is still expanding. Due to the newly established Foundations, such as SSF, the system will grow by considerable figures, especially

compared to other nations in Europe. That is why the Foundations are important players in the future.

*A new model – the third way?*

But what is the rationale for the SSF as a financier? It is said that the distribution of funding is marked by highly international standards. Besides this, it is quite clear that the SSF is based on a mode 2 logic, whereby university researchers and industrial interests together will design the support to research combining scientific and industrial targets. The expectation is that the programme will improve Swedish competitiveness on the international markets.

The programmes are headed by academics, and each of them has a steering committee composed of university researchers. The foundation aims at establishing *trans-institutional* networks of university researchers. The ambition is to foster common interest among academics and corporate researchers. When the programmes are being organised, relevant researchers and industrial interests are identified. In structuring research support, industry's need for qualified researchers is a central target, whereas the programmes are implemented within the academic system. Industry's competitiveness should be enhanced through the increasing supply of PhDs.

Programmes must be designed for a long period, and they have to involve participants from several universities and disciplines. That is why it is justified to call SSF a *transinstitutional* body. This generates a rather complex research organisation and most of the implementation is pushed on to the departmental level of the universities. This could be interpreted as leading to an *entrepreneurial* or maybe *managerial* revolution in the university.

At the same time, the networks have to consider that the main *ex post* evaluation of the programmes sponsored by the SSF will focus on the numbers of PhDs that become employed by industry. This makes it necessary for the research managers at the university to have close relations with industry. Beside all their duties at

home as co-ordinators, they will have to develop friendly relations with people who are responsible for manpower in companies.

From this short description it should be clear that the SSF represents a new model, but how to analyse the features of this organisation? Is it to be understood as an interventionist model? Or, is it more of an autonomy model? Of course, the question is in its essence empirical and should therefore be answered from empirical research. In the meantime, while waiting for research of that type, we can discuss the possibilities for interpretation. On the one hand, the SSF can be seen as strategically linked to the interventionist model and a mode 2 operation. On the other hand, it is possible to stress the autonomy given to universities in the administrative handling of programmes and the non-negotiable stress on peer review as the main selection mechanism. Maybe it is necessary to understand the new model as a typically Swedish "middle way" in which the power of the large firms is the basic mechanism for co-ordination and steering of strategic resources.

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As social scientists with a dedicated interest in research policy we are now witnessing a very turbulent period of changes. What types of new relations will grow because of new networks and transinstitutional initiatives? Will academic norms be penetrated and epistemic drift takes over? Or, will strong academic actors continue academic autonomy? These are empirical questions, which it is possible to answer with enhanced research efforts. Personally, I am convinced that it is time to address empirical questions with empirical research in the mode 1 and 2 debate. From experience with cases like conducting polymers we might find arguments that can challenge some of the fast policy conclusions that always come together with new concepts and new modes à la mode of understanding.

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