Changes in Funding University Research: Consequences for Problem Choice and Research Output of Academic Staff

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1. Introduction

In the post-World War II period until the late 1970s, university research in most Western European countries was generally funded by general government grants via the state budget. Research councils for basic research constituted an additional funding source, while the extent of contract research was relatively modest. The scale of university research increased more or less as a function of growth in student numbers and the subsequent increase in academic staff. As a general rule, individual staff members did not have to pay much attention to funding matters and had considerable freedom to choose research topics on the basis of scientific interest rather than external demands. The relationship between the government and the universities was relatively harmonic and based on the belief that it was the academic community that could best formulate research problems and undertake the necessary priorities. In return, academic staff would produce new knowledge that in the short or long run would prove useful to society.

However, this relationship was to change. In most Western European countries, the large growth in student and staff numbers in the 1970s became an increasing burden on state budgets, and the economic crisis towards the end of the decade added to this strain considerably. Simultaneously, a fundamental shift in public policy towards universities took place. Governments expected universities to become more responsive to

societal needs and contribute more directly to the economic growth and improvement of public services through cooperation with industry and the public sector.

These changing demands on universities were more or less the same in most OECD countries (Goedegebuure et al. 1994). However, there were differences between countries in the extent to which the state actively governed universities and with regard to the means used to obtain these objectives. In this respect, funding and funding mechanisms are the most important measures for steering and influencing universities; consequently, funding principles and patterns changed substantially in most countries during the 1980s. A set of financial incentives was introduced to affect university research indirectly (Geuna 1999). General government funds decreased relatively, forcing universities and staff into the market to seek supplementary research funding. Through the competition for funds, universities were expected to adjust their research practice to changing societal needs for practical knowledge.

This article examines the effects of increasing external funding for problem choice and research output of academic staff at Norwegian universities. As in other countries, the government implemented policies to steer university research in more strategic and applied directions. Two main changes were the outcome of this process: an increase in 'contract funding' and an increase in 'programme funding'. The article shows how the funding principles of Norwegian university research changed during the 1980s and 1990s, and how these changes affected funding patterns. Second, the effects of increased external funding on the content of research in terms of the extent of basic versus applied research as reported by academic staff are examined. Third, the effects of contract funding on the content and outcome of research are discussed, and fourth, the paper examines the effects of programme funding on problem choice and publishing patterns in academic research. First, we briefly review relevant theoretical and empirical contributions in this field.

2. Theoretical and empirical contributions on the effects of increased external funding research

During the last two decades we have witnessed a flow of statements and theoretical speculations from universities and scholars in the science studies community on the detrimental effects of increased external funding on university research. There has been a general concern that involvement in contract research for industry and public agencies and par-

ticipation in strategic programmes organised by research councils, the European Union etc., will lead to a decline in basic research and a radical change in the universities' mission. The effects of this process have been described in various ways, and the influence of some of the concepts coined has been pronounced, including "academic capitalism" (Slaughter and Leslie 1997) and "the drift of epistemic criteria" (Elzinga 1985). The latter term means that increased pressure for external funding may constrain academic staff to become more concerned with the relevance of research instead of pursuing basic problems. This process of the "the drift of epistemic criteria" means that traditional scientific internalist criteria might be eroded by the enhancement of applied research within a university context through the internalisation of external norms on problem choice.

The most influential notion however, is the transformation of the paradigm of knowledge production from "mode 1" to "mode 2" (Gibbons et al. 1994). In contrast to "mode 1" research, which is more or less synonymous with disciplinary basic research, "mode 2" research is generated within a context of application; not only in the natural and social sciences, but also in the humanities. The creators of these concepts have argued that the process of knowledge production is being radically transformed, and that "…the research that is variously described as 'pure', 'blue-skies', fundamental, or disinterested, is now a minority preoccupation – even in universities" (Nowotny et al. 2003, p. 184). This conclusion, which on the surface may sound convincing and in accordance with much of the critique voiced by university leaders and representatives of academic staff is however, weakly founded in empirical studies. It builds on the assumption that universities have been previously engaged mostly in basic research, and that applied research is an activity enhanced by new demands in society. There is ample historical evidence that research within the context of universities has always been shifting between the fundamental and the applied spheres. Godin (1998) maintains that no empirical data allows us to conclude that "mode 2" is really a new phenomenon. Martin (2003) similarly argues that in a long-term historical perspective, what we are witnessing appears to be not so much the appearance of a new phenomenon, but more a shift back towards research practices prior to World War II.

On the other hand, there is no doubt that the position of universities has changed over the last two decades. Governments have other expectations of universities today than they had in the 1970s, and the amount of externally funded research has increased quite considerably. Within such a short time-period, the conclusions drawn by Nowotny et al. (2003) might therefore be verified through empirical research.

A general problem in parts of the science studies literature and in internal university debates is the tendency to equate increased external funding and market-orientation with non-scientific influence on problem choice and research practice. A deconstruction of the notion of market orientation indicates however, that we should distinguish between at least four different financial markets with their own rules and regulations for market transactions. First, we may speak of an *academic financial market*, where funds are distributed by research councils for basic research and private foundations, and where peer review of applications for research support is the dominant allocation mechanism. Research priorities are made by the academic community itself. Second, there is a *public sector financial market* where government ministries and other public agencies distribute funds for research, either through open competition between applicants or direct contact with specific institutions or individual researchers. As we show, the academic community itself often has a large influence on problem choice in such projects. Third, there is an *industrial financial market*, which similarly to the public sector market, employs various transaction strategies. And fourth, in a European context we may speak of a *European Union financial market*, since this institution now has become an important actor in funding university research. In this market, academic peer-review also constitutes the dominant procedure in the selection of competing research projects, although the major research topics have been negotiated in a political and administrative context.

Empirical studies of the consequences of changing funding principles for the content and output of university research have been in relatively short supply compared to theoretical analyses and speculations. Reasons for this discrepancy are that empirical research is time-consuming and that a certain period of time has to pass after the change is initiated before meaningful observations can be made. Two relevant studies will be briefly addressed as a starting point for our analysis. One of the most important contributions is the study of academic identities in British universities (Henkel 2000). The British university system has been exposed to the largest changes in funding principles of research in Western Europe, and should be of particular interest in analysing the effects of changes in government expectations and funding schemes on the research practice of university staff. Henkel's study documents how scientists were increasingly under pressure to generate more external resources, partly to sustain their own research agendas and partly to satisfy institutional needs and objectives. Based on interviews with academics in seven disciplines at 11 universities, Henkel describes how academic staff responded to new expectations and demands in a variety of ways.

She concludes that in spite of a much closer relationship with industry and other sectors of society, identities of staff in terms of academic values and integration with disciplinary communities seems to have remained relatively stable, if not reinforced. Henkel's conclusion does not fit very well with the hypotheses put forward by Gibbons et al. (1994), and may be rather surprising considering the strong changes that have taken place in the funding structure of British university research.

A similar interview study among university staff in Finland supports Henkel's findings (Ylijoki 2003). It concludes that increasing market-orientation and external funding does not displace traditional academic norms, values, and practices. Intellectual contributions to one's field through publications in highly ranked journals are as important as before, if not more important. This does not mean that increasing external research funding is easy for academic staff; there are several kinds of tensions between market and academic orientation that require constant balancing and a lot of extra energy.

These two studies are convincing evidence that university staff maintain academic values and identities as their primary sources of motivation and guidelines for research. It is nevertheless hard to believe that the strong increase in external funding of university research would not have changed research practices in important ways. A pertinent question is whether these interview studies, basing their conclusions on attitudes and impressions on a selection of (primarily) senior professors, might have overlooked important trends not easily detectable through conversations with individuals.

This paper complements these two studies in four respects. First, it examines the effects of changing funding principles by using another university system – Norway – as a case. Second, it bases its analyses mainly on quantitative data. Third, it is more specific with regard to studying the effects of various funding sources where the increase in contract research and programme research are the most important. Fourth, rather than being primarily occupied with academic identities, this paper focuses on research practice and output.

3. The data

The data applied in this paper are mainly drawn from national R&D statistics and from three postal surveys among all academic staff of the rank of assistant professor and higher in 1982, 1992, and 2001. The staff come from five fields of learning; the natural and social sciences, the humanities, medicine, and technology. The latter field was only included

in the 1992 and 2001 surveys. This field classification follows the guidelines for research statistics suggested by UNESCO (1978).

The response rate has declined over time, from 79 percent in 1982 to 69 percent in 1992 and 60 percent in 2001. This tendency probably reflects the general increase in the number of surveys and forms of different kinds to which staff are requested to respond. Nevertheless, a 60 percent response rate in the last survey is acceptable, and higher than most comparable surveys undertaken in other countries.

In addition, we refer to other Norwegian studies relevant for the enlightenment of changes in funding patterns and their effects on research practices of university staff and the content of their research.

4. Changes in funding principles and funding patterns

The shift in public policy in Norway towards universities took place in the late 1970s and 1980s. State authorities criticised the universities, arguing that academic staff showed little understanding of the need for (new) knowledge by industry and the public sector. Criticism was levelled at university researchers' unwillingness to become engaged in important practical problems, and the universities' lack of ability to tackle problems which required coordinated scientific efforts directed towards well-defined goals. The government subsequently implemented policies to steer university research in more strategic directions with a stronger emphasis on applied research. The following measures were undertaken:

- An increasing proportion of the university budget was expected to be generated from sources other than general appropriations over the state budget;
- The government initiated research priority areas and major research programmes;
- The research councils were given a more prominent role in the allocation of research funds. The councils were also encouraged to become more strategic in their evaluation and shift focus from project funding to programme funding;
- Universities were encouraged to seek research funding from industry;
- The government expected that universities should actively apply for funding within the European framework programmes.

4.1 Relative decrease in general government funding

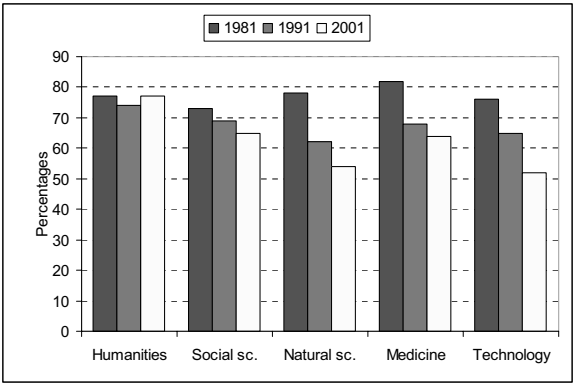
Table 1 displays the relative size of various funding sources for university research and changes in funding patterns over time. A major trend is the strong relative decline in general government funds from 80 percent in 1981 to 62 percent in 2001, with the largest decrease in the 1980s. This means that in the latter decade, close to 40 percent of the research funding came from external sources, having almost doubled over a twenty-year period.

The decrease in general government grants has been particularly strong in the natural sciences and technology, while there has been no decrease in the humanities and only a small decrease in the social sciences (Figure 1). Data from the 2001 survey show that in the preceding five-year period, 75 percent of academic staff received financial support for their research from sources outside the university. The funding pattern differs notably between the various fields of science. Between 80 and 90 percent of staff in the natural sciences, medicine, and technology reported external funding as the main source, in contrast to 75 percent in the social sciences and 55 percent in the humanities.

Table 1: R&D expenditure in Norwegian universities 1981, 1991, and 2001, by source of funding (in %)

	1981	**1991**	**2001**
General government grants	79.5	66.7	61.6
National research councils	10.3	18.3	18.9
Public agencies	4.3	4.0	5.0
Industry	2.8	5.5	6.0
Private foundations/organisations	2.6	4.6	5.3
Funds from abroad	0.5	0.9	3.2
Total	100	100	100

Figure 1: Percentage of university R&D expenditure funded by general government appropriations in 1981, 1991, and 2001, by field of science



4.2 The introduction of government-initiated research priority areas

In the mid 1980s, in accordance with changes in science policy measures internationally, the government initiated research priority areas which were an innovation in the traditional funding structure of university research. The priority areas were to concentrate and focus research efforts in subject areas where the extent and quality of research was not in accordance with the knowledge needs of society. The government became directly involved in establishing research priorities; something which was previously determined by the university, research councils, or the individual ministries. The primary objective was to support research which could stimulate technological development and economic growth, but social and cultural aspects were also included. In part this was done by channelling extra funds via the research councils to target areas, and in part by coordinating and restructuring already existing research initiatives. Eight priority areas were identified: information technology; biotechnology; oil and gas production; management, organisation, and administrative systems; dissemination of research on culture and tradition; health, environment, and living conditions; materials technology; and aquaculture. The government-initiated programmes soon became significant to the funding of university research. In 1990, designated priority areas received some 15 percent of the government funding for research and development. In practice, these funds were now allocated to

researchers through major research programmes organised and coordinated by the research councils (Mathisen 1996).

The introduction of research priority areas was seen by some actors as a way of reforming the universities. Research was to be increasingly focussed on more coordinated scientific efforts which would be to the direct benefit of society, and away from traditional academic individualism and fragmented research practice. Inside the universities, the reception of this new funding policy differed. Many regarded the creation of programmes as important additional funding sources, and did not fear that external interests would create problems for the continuation of their research practice. An important reason for this attitude was that senior professors were influential members of councils and programme committees responsible for research priorities determined at government level. But many academic staff members also regarded the introduction of priority areas and research programmes as science policy instruments aiming at providing external control of academic research, placing priorities in the hands of politicians and bureaucrats (Mathisen 1996).

4.3 Governmental contract research – from Rothschild Principle to Langslet Doctrine

In most countries various public agencies have the opportunity to fund research projects aimed at improving their work. Probably the best example of policies for direct research funding by public agencies is the Rothschild principle in Great Britain, introduced in 1972:

"… applied research and development (R&D), that is R&D with a practical application as its objective, must be done on a customer-contractor basis. The customer says what he wants; the contractor does it (if he can); and the customer pays." (Rothschild Report 1971)

According to this policy, all applied research funded by government ministries should be organised on this principle (Kogan and Henkel 1983).

In Norway, a large number of public agencies, not only governmental ministries, allocate funds for targeted research projects. Funds from government ministries have however, been particularly important. At the end of the 1960s and the early 1970s, earmarked resources for 'research, development, experiment, etc.' were introduced to cover the ministries' own need for research-based knowledge. Soon, this government initiative resulted in a considerable number of projects. But ministerial use of contract research gradually came to be criticised by the research com-

munity as well as by politicians. Questions were raised about the quality of such research. Procedures for assessing the academic standards of research projects were often absent. In addition, it was maintained that splitting up funds into many small and short-term projects was disadvantageous, and that projects frequently did not have a critical enough distance from the policy of the ministries.

This criticism led to an emphasis on stronger quality control of contract research. In 1983, the government decided that the research councils were to be more involved in the allocation of ministerial funds for research projects. This decree was later referred to as the 'Langslet Doctrine' after the minister who initiated the reform (Skoie 1985). In practice this meant that the ministries should transfer large parts of funds for research projects to applied research programmes under the auspices of the research councils. The ministries themselves should influence the profile of the programmes to maintain relevant criteria. In this way, the government attempted to unify principles of research quality (the scientific standard of the research undertaken), and relevance (the applicability of the research for ministerial policy purposes).

With the shift from the 'Rothschild Principle' to the 'Langslet Doctrine' as a funding principle for ministerial research in the mid 1980s, a future decline in university research funding from public agencies could be expected. However, only a small decrease can be traced from 1981 to 1991. From 1991 to 2001 direct funding of university research by public agencies in fact increased from 4 to 5 percent of the total R&D expenditure in the universities. An evaluation of ministerial funding policy in the wake of the implementation of the 'Langslet Doctrine' showed that the ministries generally followed the policy concerning increased programme involvement (Larsen et al. 1991). In 1989 the ministries allocated funds to 85 research programmes under the auspices of the research councils, compared to 15 programmes in 1983. However, this growth in programme funding was not followed by an equivalent decrease in the number of projects supported. On the contrary, the ministries continued to fund R&D projects to the same extent as before. The reason for this policy seems to be a belief in targeted projects over which the ministries have greater control, and as a more instrumental means for their own work than the more general programmes. The governmental policy to change funding strategy from projects to programmes thus led to a strong increase in R&D funding by the individual ministries.

4.4 Research council funding – from individual projects to large programmes

In most western countries, national research councils have been important for funding university research since World War II. For most faculty members these councils have constituted a major source of additional funding for basic research. Broadly speaking, research councils may be divided into two groups: university or disciplinary councils strongly influenced by representatives of the scientific community at universities, and mission-oriented sectoral councils that essentially support applied R&D in close contact with user representatives and in accordance with government policies (Skoie 1996). University-oriented research councils have traditionally based most of their allocations on a peer review of individual research proposals. However, in the 1980s and 1990s these councils were increasingly encouraged by governments to become more strategic. They were expected to be proactive and not only respond to individual grant applications. The development of large strategic R&D programmes was given priority in order to strengthen the strategic and applied side of university research. Subsequently, research council funding not only aimed at strengthening the quality of research, but to an increasing extent also enhancing its relevance.

Since 1993 there has been only one research council in Norway which covers the spectrum from basic research to technological development. Of the external funding sources for research at Norwegian universities, national research council funding is the most important, and increased from 10 to nearly 20 percent over the two decades. In 2001, 55 percent of academic staff received funding from the Research Council of Norway. About 70 percent of the staff in the natural sciences and technology received such funding in contrast to 50 percent in medicine and the social sciences and approximately 30 percent in the humanities.

The question of how large a role the research councils should play in funding university research has been discussed from time to time. In Norway, where resources for the research councils increased strongly during the 1980s while general university funds decreased relatively, the government clearly prioritised the research councils (Kyvik 1997). The argument was that the research councils would be in a better position than the universities to discriminate between good and mediocre research, and that it would be easier for them to change priorities between fields. Moreover, the increase in research council funding was to a large extent attributed to the establishment of government-initiated research priority areas. The more important role of the research councils can also be explained by the fact that during the last half of the 1980s they re-

ceived resources from several ministries in addition to the particular ministry under which they were placed. These funds were primarily earmarked for specific research programmes. In 1995, programme funding thus constituted a larger share of the total grants from the research councils to the universities than the funding of individual research projects.

4.5 Increased emphasis on industrial and private funding

An increasing degree of industrial and private funding of university research is an international trend (Geuna 1999). Belief in the importance of universities for innovation and economic growth appears to be widely accepted in most countries. This is expressed in government policies for universities and in the initiatives by industry and business to develop collaboration with universities. The expectations are above all connected to the development of a science-based industrial sector.

In Norway, the role of industry as a funding source for university research is relatively modest in relation to the expectations for this form of funding. The share of industrial funds of the total university R&D expenditure amounted to 6 percent in 2001 – a doubling from 1981. But most of this increase took place in the 1980s, mainly due to generous grants from oil companies to support the development of research competence related to the extraction of oil and gas in the North Sea. Industrial funding of university research is first and foremost of importance in technology and accounted for 22 percent of R&D expenditure in 2001. In this field, two out of three researchers reported receiving finance from this source in 2001.

Funding of university research by private foundations and non-profit organisations also doubled over the two decades and constituted more than 5 percent of the research expenditure in 2001. Some in fact, function more or less in the same way as the traditional disciplinary research councils, using peer-review procedures as a basis for their allocation of research grants to individual projects. Private foundations and organisations are of particular importance in medical research where more than 50 percent of the university staff in 2001 reported such funding in the preceding five-year period.

4.6 Increased emphasis on funding from European Union research programmes

As from the mid-1980s, the government has been an active agent for increased international research co-operation. This direct approach is

manifest in several public documents in the latter part of the decade (Skoie 1997). The background for this policy change was the enhanced emphasis on technology and innovation as important driving forces for economic growth in the European Union. Even though Norway was only an associated member of the European Union in 1989, the government recommended that Norway should strengthen its involvement in the EU programmes. The government noted that the advantages Norway might gain would outweigh the membership costs, emphasising that the benefit would be easier access to new knowledge and technology. Since the beginning of the 1990s, Norway has participated virtually as a full member in the EU framework programmes. Considering the large membership fee, the government expects that universities and their academic staff should actively apply for participation in and funding from the EU framework programmes.

Funds from abroad have been of relatively little importance for funding university research in Norway, but there was a dramatic increase in the 1990s, from 0.5 to 3.2 percent of R&D expenditure – first and foremost due to funding over the European Union framework programmes. In 2001, EU funding constituted two thirds of the total funds from abroad; 31 percent of the academic staff had received such funding in the preceding five-year period. In contrast, only 17 percent of the respondents in the 1992-survey reported such funding. Such sources are of particular importance in the natural sciences. In 2001, funding from abroad constituted 6.7 percent of the R&D expenditure in this field in contrast to only 0.8 percent in 1991.

4.7 Changes in funding principles and funding patterns – Summary

In the 1980s and 1990s, the mode of funding university research changed substantially in Western Europe – and in Norway. The greater emphasis on a national research strategy led to the establishment of a large number of research programmes, and needs in industry and the public sector for innovation and practical knowledge resulted in the enhancement of contract research. As a result of these policy changes, external funding of university research increased and the universities gradually became more dependent on such funding. A strong growth in external research funding took place in the 1980s – from 20 percent in 1981 to 33 percent in 1991 – and a slower increase in the 1990s to 38 percent in 2001. If we look more closely at these figures, half of this growth is related to the large increase in research council funding of university research primarily through participation in programmes. In

addition, the growth in funding by private foundations and non-profit organisations is to a large extent a contribution to academic research. Thus, it is the academic financial market that has expanded the most, where research priorities are made by the academic community itself to a very large extent. The industrial financial market has been of relatively limited although increasing importance, being mainly restricted to the field of technology.

5. Effects on the extent of basic versus applied research

To what extent have changes in funding patterns of university research affected the content of research? One indicator is the relationship over time between basic research, applied research, and experimental development. Universities have traditionally been regarded as the sites of basic scientific research, or research initiated by the evolution of problems internal to the scientific discipline itself. Other similar terms for this activity are fundamental research, pure research, free research, non-directed research, and curiosity-driven research (Skoie 1996). It is to be expected that the increase in external programme funding and contract research may have led to an increase in the share of applied research and experimental development.

In the 1982- and 2001-surveys, academic staff were asked whether their R&D activities in the preceding year were mainly basic research, applied research, or experimental development. The definitions of these three categories were given in the questionnaire, and are identical to those formulated by the OECD in 1963 and published in "Proposed Standard Practice for Surveys of Research and Development", better known as the "Frascati Manual" (OECD 2002). The manual states that there are many conceptual and operational problems with these categories. They seem to imply a separation which rarely exists in reality, and the three types of R&D may sometimes be carried out in the same department by essentially the same staff. It is obvious that the distinctions between these three categories are often blurred, and in the questionnaire the staff were informed that if their research could be classified in different ways, they should indicate this by writing in 1, 2, or 3 in each of the three boxes instead of an 'x' in one of them, depending on which of the three categories they considered most applicable to their research; 1 applied most, 3 applied least.

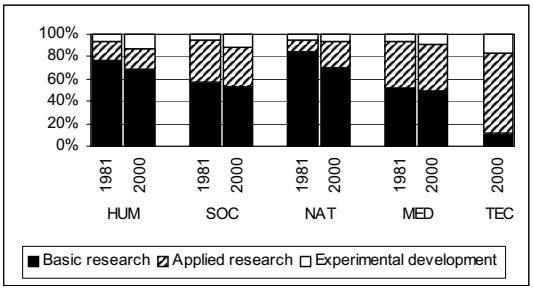
In the 2001 survey, 57 percent of the academic staff classified their R&D-activities in the preceding year as mostly basic research, while 32

percent characterised it as predominantly applied, and 11 percent as experimental development. There are significant differences between fields of learning in this respect. The proportion of faculty who defined their work as primarily basic research varied between approximately 70 percent in the humanities and natural sciences, about 50 percent in the social sciences and medicine, and only 10 percent in technology. By and large, the variation in applied research between fields followed this pattern, as there were relatively small differences in the percentage of experimental development between the various fields.

A comparison with the 1982 survey is only possible in four of the fields because technology was not included. Figure 1 displays how academic staff classified their research at the two points in time. There has only been a small decline in the proportion of staff in the humanities, social sciences, and medicine who reported that their research was mostly basic; and a somewhat larger decline in the natural sciences. These results are consistent with changes in the percentages of university research expenditure funded by general government appropriations over these two decades for the humanities, social sciences, and natural sciences; but not for medicine, which experienced a significant drop in basic funding of research.

The decline in basic research from 1981 to 2000 however, is much smaller than might have been expected considering the very large decline in general government grants for research in the same period (Table 1). These results may indicate that type of funding is of relatively little importance for the character of the research undertaken. A test of this relationship was done by examining how academic staff in the 2001 survey classified their research when controlled for various funding sources. Of those who did not receive financial support from sources other than their university, 57 percent reported that they primarily undertook basic research, 27 percent applied research, and 16 percent experimental development. Of those who received grants from national research councils, foundations, and European Union programmes; 60 percent answered basic research as the most important activity, 30 percent applied research, and 10 percent experimental development. The equivalent figures for those who undertook contract research were 55, 37, and 8 percent. The relationship between type of funding and how academic staff characterised their research is thus very weak or insignificant.

Figure 2: Percentage of academic staff that characterised their research in 1981 and 2000 as mostly basic research, applied research, or experimental development; by field of science



6. Effects – of contract research

We have shown that a substantial increase in contract research took place from 1980 to 2000, and that such research funding constituted an estimated 13-15 percent of the total R&D expenditure by the universities in 2001. One third of the academic staff in 2001 reported that they had obtained funding from industry or public agencies in the preceding five-year period. We have also shown that the science policy debate in the 1970s and 1980s was dominated by those critical to contract research. But what are the attitudes towards this type of research among ordinary academic staff members?

Table 2 shows the percentages of academic staff in 1992 and 2001 who agreed and disagreed with the statement that contract research often introduces new and interesting topics in research at their department. On both occasions between 20 and 25 percent of the staff agreed with this statement. In 2001, about 40 percent partly agreed, and 20 percent disagreed. A substantially smaller percentage answered 'don't know' or 'not relevant' in 2001 than ten years earlier; indicating that the great majority at the latter point in time had some experience with contract research, either through their own research or through observations of their colleagues with funding from industry or public agencies. Of those who actually had undertaken contract research, about 40 percent in both surveys agreed that this activity often introduces new and interesting topics in research at their department, in contrast to 15 percent of those who did not engage in this type of research. Academic staff members in the field of technology have substantially more positive attitudes towards contract research than other staff members. On both occasions 60

percent of the staff in technology agreed with the statement, and 5 percent disagreed.

Table 2: Percentage of academic staff in 1992 and 2001 that agreed and disagreed with the statement that contract research often introduces new and interesting topics in the research at their department

	Agree	**Partly agree**	**Disagree**	**Don't know**	**Total**
1992	24	31	14	31	100
2001	22	42	20	16	100

Table 3 shows that only 15 percent of the staff in 1992 and 2001 respectively agreed with the statement that 'the extent and character of contract research is problematic in relation to the autonomy of research and the independence of their department' while close to 40 percent disagreed. At both points in time there was no difference in the percentage who agreed with this statement among those who had undertaken contract research, and those who had not. Of those who had undertaken contract research close to 50 percent disagreed, in contrast to 30-35 percent of those who had not. This difference in opinion applies to both surveys. The field of technology again deviates from the other fields of learning. In 1992, 40 percent of those who had engaged in contract research in the preceding five-year period disagreed with the statement that this activity is problematic for the autonomy of research. In 2001, this proportion increased to 60 percent. This indicates that attitudes towards contract research are considerably more positive in the field where such funding is the most common, and also that during the last decade attitudes have become substantially more positive among those staff members who actually undertake this type of research.

Table 3: Percentage of academic staff in 1992 and 2001 that agreed and disagreed with the statement that the extent and character of contract research is problematic with regard to the autonomy and independence of research at their department

	Agree	**Partly agree**	**Disagree**	**Don't know**	**Total**
1992	14	20	36	30	100
2001	15	29	39	17	100

The reason why close to 50 percent of those who had undertaken contract research did not agree with the statement that such funding endangered autonomy of research is probably to be found in the character of this type of research. Industry and public agencies do not always announce project funds for R&D, but despite this lack of public announcement receive applications from researchers and research institutions for support for R&D projects. An examination of research projects funded by governmental ministries revealed that more than half of the projects in 1989 were initiated by researchers, while ministries took the initiative in less than one third of the projects (Larsen et al. 1991). The objectives of each of the about 580 projects funded that year were examined in a survey addressed to the ministries. The questionnaire distinguished four categories, with the open-ended possibility to check more than one optional answer. The need to increase or update knowledge within a specific field was indicated as the motive behind 67 percent of the projects. The need for a general establishment of expertise was the basis for 47 percent of the projects. 'Problem-solving' was the aim of 24 percent of the projects, and the need for 'mission-oriented' contributions in relation to specific legislative measures, evaluations etc. was the background for 20 percent of the projects. Generally-formulated objectives thus dominated specific and mission-oriented demands in the ministries. Moreover, ministerial involvement in a project was often limited to being informed by the researchers about its progression and results. For only half of the projects, the ministries themselves reported that they had contributed to restricting thematic objectives.

At a general level these results are supported by an analysis of publication data. No significant differences were found in publication practice between academic staff who had undertaken contract research and those who had not. Moreover, staff who had received industry funding published more journal articles than staff without such funding.

7. Effects of programme research

The introduction of governmental research priority areas and the development of research programmes in the research councils in the mid-1980s were met with ambiguous attitudes by the universities. While some professors emphasised the extension of their funding base, other representatives argued that the programmes would lead to more applied research at the expense of basic research, and that governmental demands would place excessive influence on research priorities. Others claimed that involvement in research programmes would result in re-

search of a less scientific value than that of individual projects initiated by scientists.

There is no doubt that the research programmes have constituted important additional funding sources for university research. A total of 55 percent of academic staff in 1992 agreed that the programmes had brought in funds to the department that otherwise would probably not have been provided (Table 4). As much as 36 percent of the staff obtained funding through programmes organised by a national research council in the preceding five-year period, varying between 18 percent in the humanities and 58 percent in technology. A majority of the staff agreed with the statement that the programmes had contributed to vitalising research in their department. One of the reasons for this positive attitude may be that the programmes not only tempted researchers with financial support and material resources, but the opportunity to collaborate with and get inspiration from researchers at other locations.

But to what extent have these programmes actually affected research undertaken in the universities? Is it true that the scientific autonomy of university research has been eroded by the introduction of research programmes? Has involvement in these programmes resulted in research of questionable quality? Have the conditions for producing good research been undermined by these new mechanisms for financing and setting priorities in research?

The 1992 survey did not provide much evidence for a change in internalist scientific criteria (Table 4). Only 14 percent of the academic staff agreed with the statement that individuals other than researchers in their department had too much influence on scientific priorities and problem choices of their specific projects. Furthermore, only 9 percent of the staff agreed with the statement that the research programmes had resulted in research of less scientific value than usual in their department.

Table 4: Percentage of academic staff in 1992 that agreed and disagreed with the following statements on the participation in research programmes organised by the research councils

	Agree	Partly agree	Dis-agree	Don't know	Total
Brought in funds to the department that otherwise would probably not have been provided	55	19	8	18	100
Contributed to vitalising the research in the department	29	31	16	24	100
Contributed to making the research in the department more applied and user-oriented	20	30	24	26	100
People other than staff in the department have got too much influence on scientific priorities and problem choices	14	17	40	29	100
Resulted in research of less scientific value than usual in the department	9	16	48	27	100

Against the background of strong criticism of research programmes, these results may be surprising. It seems that the criticism does not reflect the experiences of the majority of the involved researchers. What could explain this discrepancy? Interviews undertaken among academic staff involved in research programmes revealed that to a large extent they used the research programmes to obtain access to extra resources without changing their priorities beyond the label of their research projects (Mathisen 1996). Traditional academic research was virtually unaffected by the objectives of the programmes. Most informants said that their programme-financed research was very similar to what they had done earlier, or that it built upon their former research. The overwhelming tendency was that the involved researchers had undertaken only minor if any, changes in the research theme to obtain funding through the programmes.

These effects should be seen in connection with the decision-making processes preceding the establishment of the research programmes. Senior scientists from relevant disciplines were very active and influential in the formulation of research priorities and the academic community itself was given the main responsibility for the selection of research groups and distribution of funds to specific projects. Mathisen (1996) has argued that the priority areas and the research programmes developed by the government and the research councils was a form of 'mild steering' of problem choice in science through funding mechanisms. These initiatives, influenced by the concept 'strategic research', were effective in targeting areas for increased research efforts and should be regarded as strengthening rather than weakening university research.

In general, these results are supported by an analysis of publication data. There is no evidence that academic staff who took part in programme research around 1990 performed worse scientifically than those who did not have such funding. There were no significant differences in publication practice between those who had programme funding or only university funding.

Data pertaining to the participation of university staff in national research programmes was not available in the 2001 survey, but there is no reason to believe that the extent of programme research was reduced. In addition, there has been an increase in the number of academic staff participating in research programmes organised by the European Commission. In 2001, 16 percent of staff members reported that they had received funding from EU-programmes in the preceding five-year period. These funds were particularly important in the natural sciences and technology, where 25-30 percent of staff members were involved in these programmes. In contrast to the national research programmes, university staffs have had very little influence on EU research priorities. Nevertheless, they might have had considerable influence on problem choice in some of the projects in which they have participated. An analysis of publishing practices in the various fields of science indicates that researchers with EU funding were significantly more productive than other staff members, and published as many articles in international journals as their colleagues without such funding.

8. Conclusion

The strong relative decline in general government grants for university research and the enhancement of research programmes and contract research, has been strongly criticised by many university researchers.

These science policy measures were regarded as attempts by government and bureaucrats to acquire stronger control over university research, linking it more closely to societal interests and political priorities (Mathisen 1996). This critique has been largely supported by scholars in the science studies community, claiming that the social conditions of creative research as well as scientific progress itself are endangered. Traditional scientific internalist criteria might be eroded through the internalisation of external norms on problem choice among academic staff.

These claims do not find much support in the data presented in this paper. The strong increase in contract and programme research in the 1980s and 1990s led to only a relatively small decline in the percentage of academic staff who reported that their research was mostly basic. On a general level, these results are corroborated by publication data. In the course of the same period, the scientific article in an international (English-language) journal enhanced its position as the dominating type of publication, while reports declined in importance (Kyvik 2003). No significant differences were found in publication practice between academic staff who had undertaken contract research or programme research and those who had not been involved in such activities.

These findings seem consistent with those reported by Henkel (2000) and Ylijoki (2003). A recent review of scientific research at American universities had similar conclusions. Bok (2003) states that research priorities have hardly shifted in any substantial way to favour applied research at the expense of more fundamental inquiry. He points out that the percentage of US university R&D devoted to basic research has remained fairly constant since the late 1970s. While industrial funding has increased, this accounts for less than 10 percent of all university research financing, and hence does not significantly affect the overall balance of priorities. An interview study among American and British scientists also supports these findings. The scientists consistently denied that the nature of their research was being changed substantially (Calvert 2000).

There are probably two main reasons for the discrepancy between theoretical speculations of the consequences of increased market orientation and the measured effects of increased external funding on research practices; (a) an uncritical use of data on funding of university research, and (b) an incomplete understanding of the social mechanisms that come into play to sustain the position of academic research in universities.

First, there has been a tendency to equate increased market orientation with increased non-academic influence on problem choice in scientific research. Even though the percentage of R&D expenditure in Norwegian universities drawn from competition in the market increased

from 20 to 38 percent over the two decades, this does not mean that private corporations and public agencies directed the use of these funds. It is the academic financial market that is by far the largest and expanded the most in this period, encompassing close to 25 percent of total R&D expenditure at the universities (Table 1). The public sector financial market transacts five percent of the total research funding, the industrial about six percent, and the EU-market between two and three percent. The mechanisms for selection of externally funded research projects are subsequently dominated by traditional academic peer-review procedures.

Second, to the extent that university staffs seek funding in non-academic markets, they do not necessarily restrict their research to applied problem-solving and experimental development. The large relative decrease in general government funds and the subsequent increase in programme and contract research so far seem to have had surprisingly small effects on problem choice and research output of academic staff. The reason is that university staffs are very reluctant to become involved in programmes or contract research if the results are not also expected to contribute to basic research. As there are strong norms in the scientific community against external influence on research, and because recognition and prestige are still linked to the quality of research, scientists normally have strong personal interest and motivation in combining applied and basic research. It is thus not necessarily a conflict between contributing to problem-solving in industry and public agencies and science-internal knowledge production.

References

Bok, D. (2003). *Universities in the Marketplace. The Commercialization of Higher Education*. Princeton: Princeton University Press.

Calvert, J. (2000). 'Is there a role for basic research in Mode 2?', *Vest*, 13, 35-51.

Elzinga, A. (1985). 'Research, bureaucracy and the drift of epistemic criteria', in Wittrock, B. and Elzinga, A. (eds.), *The University Research System*. Stockholm: Almqvist and Wicksell, pp. 191-220.

Geuna, A. (1999). *The Economics of Knowledge Production: Funding and the Structure of University research*. Cheltenham: Edward Elgar.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. (1994). *The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies*. London: Sage Publications.

Godin, B. (1998). 'Writing performative history: The new new Atlantis?', *Social Studies of Science*, 28, 465-483.

Goedegebuure, L., Kaiser, F., Maassen, P., Meek, L., van Vught, F., and de Weert, E. (1994). *Higher Education Policy: An International Comparative Perspective*. Oxford: Pergamon Press.

Henkel, M. (2000). *Academic Identities and Policy Change in Higher Education*. London: Jessica Kingsley Publishers.

Kogan, M. and Henkel, M. (1983). *Government and Research. The Rothschild Experiment in a Government Department*. London: Heinemann Educational Books.

Kyvik, S. (1997). 'Funding university research in the Nordic countries', *Science and Public Policy*, 24, 233-244.

Kyvik, S. (2003). 'Changing trends in publishing behaviour among university faculty, 1980-2000', *Scientometrics*, 58, 35-48.

Larsen, I.M., Narud, H.M. and Kyvik, S. (1991). Departementenes FoU-engasjement. Utviklingstrekk på 1980-tallet, *Report 7/91*. Oslo: Norwegian Institute for Studies in Research and Higher Education.

Martin, B.R. (2003). 'The changing social contract for science and the evolution of the university', in Geuna, A., Salter, A.J. and Steinmueller, W.E. (eds.), *Science and Innovation. Rethinking the Rationales for Funding and Governance*. Cheltenham: Edward Elgar.

Mathisen, W.C. (1996). 'Research priority areas and research programmes in Norway', *Science and Public Policy*, 23, 251-260.

Nowotny, H., Scott, P. and Gibbons, M. (2003). ''Mode 2' revisited: The new production of knowledge', *Minerva*, 41, 179-194.

OECD (2002). The Measurement of Scientific and Technological Activities. Frascati Manual 2002: *Proposed Standard Practice for Surveys on Research and Experimental Development*. Paris: OECD.

Rothschild Report (1971). *The organisation and Management of Government Research and Development*. London: HMSO.

Skoie, H. (1985). Departementsmidler til forskning, *Report 9/85*. Oslo: Norwegian Institute for Studies in Research and Higher Education.

Skoie, H. (1996). 'Basic research – a new funding climate?', *Science and Public Policy*, 23, 66-75.

Skoie, H. (1997). Norway – a Province of Science in a Changing World, *Report nr. 32*. Trondheim: Norwegian University of Science and Technology, Centre for Technology and Society.

Slaugther, S. and Leslie, L.L. (1997). *Academic Capitalism*. Baltimore: Johns Hopkins University Press.

UNESCO (1978). *Recommendations Concerning the International Standardization of Statistics on Science and Technology*. Paris: UNESCO.

Ylijoki, O.H. (2003). 'Entangled in academic capitalism? A case-study on changing ideals and practices of university research', *Higher Education*, 45, 307-335.