RCN's role in the dynamics of research: a scientists' perspective

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Reports in the evaluation of the Research Council of Norway

Synthesis report
Erik Arnold, Stefan Kuhlman and Barend van der Meulen, **A Singular Council? Evaluation of the Research Council of Norway**, Brighton: Technopolis, 2001

Background reports

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1 INTRODUCTION

This report is part of the evaluation study of the Norwegian Research Council commissioned by the Norwegian Ministry of Church Affairs, Education, and Science. In 1993 the Norwegian Research Council (RCN) was established through a merger of five research funding organisations in order to improve the co-ordination in funding across disciplines, across sectors of Norwegian society and to bridge the gap between applied and basic research. Since then RCN has had a key position in the Norwegian research system. Because of this key position, the evaluation addresses a series of functions and roles of the research council, and includes back ground studies and sub-evaluations on specific aspects of RCN and its relationships with actors in the Norwegian research system.

One of the evaluation questions for the overall project is on the role of the research council in the dynamics of Norwegian science. Traditionally, research councils always have had a position in between policy and science.[1] In their relationship with the government they are part of the science policy world and expected to mediate the political and policy interests in scientific research and its outcomes into the world of science and technology. Vice versa they are expected by scientists and their organisations to defend and promote the interests of science and technology in the policy world. But research councils are more than a science policy organisation. Policy makers and scientists also expect the research council to be part of the world of science and to be a scientific organisation. In its relationship with scientists the research council is expected to improve and secure the health of the "science base", as well as contribute to the development of a scientific system which is responsive to the specific needs of industry and society. For the Norwegian Research Council, the expectations and related

[1] Dietmar Braun, 1993, Who Governs Intermediary Agencies? Principal-Agents Relations in Research Policy Making, *Journal of Public Policy,* 13 (2), 135-162.

pressures are probably not very different and like any other research council it has to find the right mix of processes and procedures towards a "Pareto optimum."[2]

Funding research projects and programs with the related practices is at the core of the procedures and processes. In this report we analyse the kinds of influence RCN funding schemes have on the development of research in Norway. If we consider this influence as a result of the funding *relation*, it is not just due to the strategies of RCN but also to those of the researchers who are funded. To address the evaluation question insight is required into the dynamics of actual research as practised in the Norwegian universities and research institutes. The dynamics of research are based on the practices of these researchers. If RCN has any influence on the dynamics of disciplines and fields of research, it is through influencing local research practices and these are put up front in this report

We draw in this study on insights from the sociology of science. Within the world of research councils scientific research is seen as a rational activity aimed at revealing the truth of nature. Through observations, mediated by instruments and systematic experiments scientists get insight in Nature and the progress of science can be seen as a ongoing improvement of theories based on experimental results.[3] Although this model of science may address what scientists experience as their primary activities: experimental work and scientific communication, it ignores institutional contexts of science and the role of research councils and the related practices of resource mobilisation.

Latour and Woolgar's classical study of the laboratory reveals how the mobilisation of external resources is related to the internal research practices. They conceptualise this dynamic relation as a credibility cycle. Resources enable researchers to produce results, which are translated into scientific publications. The possibility to translate research results in *credible* statements increases the possibility to acquire new resources (through *credible*

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

[3] On different models of science see: Michel Callon, 1995, Four Models for the Dynamics of Science, In: S. Jasanoff et al (eds.) *Handbook of Science and Technology Studies,* London: Sage, 29-63.

proposals).[4] These new resources put a new cycle into action. In the eighties this model has been used to understand how at local contexts research lines develop in interaction with resources.[5] Resources seldom come without strings attached to it and the mobilisation of resources obliges researcher through these strings to the aims of the sponsor. But it is a fragile obligation as scientific research has its own dynamics, the use of funding is difficult to monitor and the resources might interfere with resources from third parties. At the local level the policies and instruments of sponsors are translated in strategies of researchers and induce intended and unintended dynamics of research and research organisation.

From such a perspective the strategies of researchers are a necessary anchor point for any funder which wants to influence scientific developments. The perspective also enables to look at national research systems, and national research councils as part of these systems, from researchers perspective.[6] The perspective implies that we present RCN in this report as part of the overall context for doing research in Norway. We are interested in the *process* of the development of research questions and research projects and want to focus on organisational, financial, social and geographical aspects of doing research in Norway. In particular we want to know how these practices of Norwegian researchers relate to RCN funding. To gain such qualitative knowledge our research focussed on three activities and aims:

- To study dynamics of research projects at the local level, and get an insight in the range of dynamics that are enabled, induced, and facilitated through RCN funding.
- To understand the added value of research council funding in relation to other funding sources, esp. institutional funding and contract research;

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[4] Bruno Latour and Steve Woolgar, 1979, *Laboratory Life: the social construction of scientific facts.* Beverly Hills, CA: Sage.

[5] See e.g. Henk Dits, 1988, *Turn to Coal: Mission orientation of Academic Research,* PhD Thesis University of Amsterdam; Peter Groenewegen, 1988, *Scientists, Audiences and Resources: The development of Dutch Toxicological Research,* PhD Thesis University of Amsterdam.

[6] See e.g. Uwe Schimanck, Markus Winnus, 1999, *Public Sector Research in Europe: Comparative Case Studies on the Organisation of Human Genetics Research, Synthesis Report*, Köln: MPG institute for the Studies of Societies, Report for TSER project European Comparison of Public Research Systems, contract nr. SOE1-CT96-1036; Norma Morris, 2000, Science Policy in Action: Policy and the Researcher, *Minerva,* 38: 425-451.

- To understand the relationship between the dynamics at project level and the objectives of the research council.

We use in depth interviews with a number of researchers in Norway. In the second chapter we present the selection of cases as well as the interview methodology.

Before looking into the interactions between RCN and the dynamics of researchers' work, we describe this context and its structural effects on researchers' work as it is perceived by the interviewees, in Chapter 3. The Norwegian Research Council is by far the most dominant external funding source for most university and institute researchers and its almost monopoly implies that most external funding pressures and opportunities are associated with the Research Council. Chapter 3 however will make clear that universities and institutes as organisational context of research are important as well, and structure the possible relationships between researchers and research council.

Chapters 4, 5 and 6 describe the development of group size and structure, the processes of project development in relation to funding issues and on changes in main research themes. The chapters map the dominant patterns in the organisation of research at the local level, as we found them in the Norwegian research system. Some of them are general for scientific research and can be found in other countries as well. Other patterns seem to be specifically to the ecology of the Norwegian system, or at least seem to flourish in that context. The mapping sometimes moves beyond the specific policies and programs of RCN. But given the dominant role of RCN in the research system the overall picture is needed to serve as a reference for an evaluation of the specific RCN role, as well as to assess future recommendations and policies of the research council.

Given the overall aim of the evaluation project, we are particularly interested in the role RCN funding plays in the three processes and whether it has steering capacity or effect with regard to such dynamics. The final chapter changes the perspective. It presents and interprets our findings in terms of the funding modes of the research council. It analyses the role of the so-called "free projects", projects funded through research programmes and infrastructural funds in the dynamics of Norwegian research.

The findings we present are based on the interviewees' information and represent the experiences of researchers being researcher in Norway and being funded by RCN. We have not checked for this report whether their story of, for instance, the universities' research policies, of RCN evaluation procedures and funding rules, and of the influence of ministries on RCN decision making are actual correct. Other parts of the evaluation look at that. Even if the information the researchers about such issues happens to be incorrect, it is important to report these remarks. They are part of the experiences of researchers in Norway and their relation with RCN.

Note on the interviewee's anonymity

We like to thank the interviewees for their co-operation and readiness to share their experiences with us. To guarantee their anonymity, we don't mention names of persons, projects, or research organisations. The size of the Norwegian research system implies that such information would make it possible to relate references to experiences to specific persons. For this reason, we hide the interviewee's sex and present the interviewees per section either as male or female.

2 RESEARCH APPROACH

The aim of our study is to map patterns in the development of Norwegian research projects and Norwegian research groups, and the role of RCN therein. We do not try to analyse how often each of these patterns occurs. The research question deliberately speaks of 'kinds of influence' and not of 'influence' or 'impact' as if we would measure it quantitatively. To cover the kinds of influence we choose a most diverse case approach in which we selected cases along a range of relevant selection criteria. For each of these cases in-depth interviews were made with the researchers and documentation of their research programs were analysed. In this chapter, we describe the selection of cases and our interview approach.

2.1 SELECTION OF CASES

Time and financial restrictions allowed for no more than 24 interviews. Initially we selected projects from RCN's project database, FORISS. From the list of possible interviewees, we selected candidates along a number of criteria. At a later stage, when we discovered that we needed additional projects to have a good distribution over the different possible categories, we asked RCN to suggest us additional names from the database, based on criteria that we provided. Before we selected cases along the relevant criteria, we decided to concentrate on a specific set of projects. We assumed that any influence of RCN on local research strategies could only be expected through substantial grants of at least two years, and left out smaller grants. In our selection, we also concentrated on projects that had been ended recently or were near to their end, in order to assure that some effects of the funding could have occur. From the projects that satisfy these two criteria, 24 cases were selected that were reasonably distributed along four dimensions.

The first dimension was that all six divisions of RCN had to be represented. We focussed somewhat more on those divisions with a specific mission to stimulate disciplinary

development (NT, KS, MH, and MU). We also wanted the three funding modes (free project funding, programme funding and infrastructure funding) to be represented. Thirdly, a reasonable distribution over universities and, research institutes had to be reached. We also took care of the regional distribution of cases as well as the gender distribution.

It proved difficult to assemble a project list that met all criteria. In part, this was compensated because we did not interview projects but project leaders. Usually, these project leaders are leading or have led more than one project. Some interviewees or cases covered multiple categories, for example because the interviewee moved from an institute to a university, or because he applies at more than one division. Table 1 gives the distribution of all the projects we spoke about in the interviews over division and funding type. The inclusion of more than one project per interviewee results in some biases towards some categories, e.g. the high number of programme funded projects for the MU division, and the number of free projects funded by KS. As mentioned, the importance of these dimensions is to assure sufficient divergence of cases. We are interested in mapping variance more than in calculating correlations. We were not able to correlate the dimensions to the outcomes of the interviews, if only because of the limited number of cases. Table 2 and 3 give the gender and institutional distribution of the interviewees.

Table 1: Distribution of discussed projects over divisions and funding types

Division	Responsive mode	Programme funding	Infrastructure	Total
NT	4	3	1	8
MH	2	3	1	6
BF		1	2	3
IE		2		2
KS	5	3		8
MU		10		10
Total	**10**	**18**	**4**	**38**

Table 2: gender distribution of interviewees

Male	Female	Total
18	5	23

Table 3: Distribution of discussed projects over universities

Organisation	Location of Projects	Present location interviewee
University of Bergen	13	4
University of Oslo	5	6
University of Tromsø	4	3
The Norwegian University of Science and Technology	5	4
Independent research institutes	11	6
Total	**38**	**23**

2.2 INTERVIEW PROTOCOL AND PRACTICE

To acquire comparable data on each group, we developed an interview protocol, which addressed the following issues:

- general information about the research group,
- a description of the research programme over the last eight years,
- particulars about the RCN funded projects,
- the position and dynamics of these projects in the group's research development,
- experiences with RCN and role of RCN in group's research development, and
- opinions on RCN.

Each issue had a number of questions and sub-questions. Although we used the interview protocol rather strictly, we were not able to acquire comparable data on all cases on all issues, questions, and sub-questions. In depth interviews have their own dynamics, which may result in loss of comparability, but also in more in depth insight and additional, not foreseen types of information. To prepare the interviews, we requested project data from RCN on all RCN

funded projects of the interviewee, we asked the interviewee to send us information about his or her group (such as literature lists and annual reports), and browsed the group's home page if available. Interviews were done in Norway in April and May 2001 at the offices of the interviewees. One of the interviews had to be cancelled due to personal circumstances. We lacked time to compensate for this missing. We made summaries of the interviews and interviewees could amend the summaries. This report is based on the amended summaries.

3 NORWAY'S RESEARCH ENVIRONMENT

Research takes place in disciplinary, organisational, national and international contexts. We did not address these contexts in our interview as independent issues, but expected that if these were important to the dynamics of research and RCN's role, they would emerge within the interview. Disciplinary and international contexts were of importance, but were often seen as natural to the dynamics of science, and not specifically related to the role of RCN. They are inherent to being researcher. As most researchers have only few peers within Norway for their specific field or speciality, operating within disciplinary contexts implies international contacts. RCN funding is important for maintaining such international contacts, even if relatively small grants are needed for such contacts.

For being researcher in Norway, for the possibilities of researchers to do research, to develop and maintain successful research strategies and for understanding the role of RCN. , national and organisational (university, institute) contexts seem to be more important. In this chapter, we give an overview of the Norwegian research system as it appears from the experiences of researchers. The first section describes Norway as a nation state with little scientific tradition and in a specific geographical situation. The second section describes the organisational contexts and esp. the universities that through their (implicit) research policies frame the possibilities for research. In the concluding section of this chapter, we analyse how these contexts impact on the relationship of researchers with RCN.

3.1 NATIONAL CONTEXT: LOW INVESTMENTS, LOW INTEREST

Discussing the situation of research in Norway, some observations recur in interviews. First of all, that relatively little money is invested in science. Interviewees refer to Norway's position in international comparisons of investments in R&D, which shows that the investments as a percentage of GDP are far below OECD's average. A reference which is

often complemented by mentioning Norway's oil income, that could easily be used to bring investments at international level. Interviewees also come with several explanations for the low investments in R&D, referring either to the policy or to Norway's industrial structure.

Norway lives of export of raw products. There is relatively little industrial need for research although researchers may indicate that there is a need, though industry does not understand that. Some researchers have contacts with industry, but industrial investments in scientific research seem to be limited to a few industries.

Interviewees also feel that the government feels little responsibility for (basic) research and neglects it as an investment in the future. Ministries frequently label donations for particular kinds of research or research topics, which indicates that science in itself is not politically interesting, but only science related to politically interesting themes. Within the system, this may create sufficient funding in some fields of research, but those fields will also be pushed towards applied research. Some of the researchers refer to last year's bill that promised levelling up national R&D investments to OECD level, but it is received with scepticism: they (politics) have promised before.

In addition to the observations or complaints about the investments in research and industrial, social and political interests in research, we find a strong perception of differences between basic and applied research. Researchers who identify themselves as basic scientists, feel that the little resources for curiosity driven research, and the amount of earmarks and program funds provides little opportunity for basic science projects.

The other "national factor" researchers refer to when discussing the contexts of their local research projects and programs, is Norway's geography. Both its internationally remote location and its internal geography imply that there is low mobility of researchers. It remote location and cold climate would make it unattractive for foreign researchers to come to Norway. So even if Norway would spend more on science, it will be difficult to get excellent researchers from abroad. Norway's geography results in a low mobility between research organisations. Researchers tend to stay within the region they study and not to move to another university. The four universities tend to provide similar opportunities for researchers and therefor little incentives for mobility.

3.2 ORGANISATIONAL CONTEXTS: SALARIES BUT NO COSTS

Norway's universities have a particular organisational and financial structure. First, many, if not all university based, senior researchers appear to be professors. Bleiklie et al., in their study on the reformation of Norwegian Universities, report how since the end of the 1970's the hierarchy at the universities has been replaced by an egalitarian system in which the professor title became disconnected from actual positions and connected to formal qualifications.[7] Since 1991anyone with a position at a university, who formally qualifies for a professor title has the right to be promoted that rank. With one exception, all our university-based interviewees are full professor. One of the interviewees confirm that it is rather easy to become professor anywhere. After his PhD, the interviewee continued, a researcher applies for the position of associate professor and then it is mostly a matter of time before he qualifies to become professor. This puts the researcher in a position to build his own research group. Most colleagues with tenure position are professors as well.

Secondly, most university-based interviewees work on individual basis or gather their own personal group of PhD students, postdocs, and MSc students. One interviewee expressed that he preferred to work alone, and since many of his colleagues are professors too, he could not have them in his group. One can not have two captains on a ship, he explained. Putting the first and second observation together, the result is a situation of many professors, each heading their own group of one or more persons. Those interviewees who have their own personal group, also supervise the PhD students themselves, and are responsible for postdocs. As there is a limit to the number of group members one can guide, groups have a limited size. Moreover, scientific ranking in itself has little influence on a (university based) scientist's success.

When it comes to the universities' financial structure, almost all university-based interviewees reported that their university only pays salaries of permanent staff and housing costs because of tight university budgets. From 1985 to 1995 student numbers at universities,

[7] Ivar Bleiklie, Roar Høstaker, Agnete Vabø, 2000, *Policy and Practice in Higher Education: Reforming Norwegian Universities,* London: Jessica Kingsley Publ., Higher Education Policy Series 49.

scientific institutions and colleges grew from 80,000 to over 110,000.[8] For demographic reasons, the student numbers have dropped since – as was expected –. Consequently, student number related budgets dropped as well. As universities had created extra tenure positions to cope with the increasing student numbers, recent reductions imply a reduction of the budget per position. Universities are not able or willing to implement budget reductions through structural reorganisations.

Budget for research costs is provided, but does not exceed a few thousand NOKs. Occasionally, universities pay for heavy equipment costs or PhD positions. In other words, universities do not provide substantial budget for all kinds of 'running costs' such as doing experiments, collecting data and travelling. If a scientist has substantial costs, he has to acquire external funding. Consequently, interviewees depend on RCN to do any research at all, and indeed some of the interviewees wondered how colleagues managed being researcher without any funding from RCN or other external body. Two interviewees reported that their university does not provide administrative support either. So they have to do their own project administration[9], which they perceive as a waste of time. Some claim RCN does not fund project administration and only a few interviewees manage to hire administrative support.[10] The others would have to do their own administration, which limits time to spend on primary tasks.

Interviewees do not foresee many improvements in short time. Universities are cutting their costs and since they spend most of their research budget on salaries and housing, this implies that they have stopped hiring staff and creating new positions. Furthermore, as one interviewee pointed out, it would not be easy to simply exchange scientific positions for administrative positions, because the number of scientific positions depends on teaching needs.

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[8] Ivar Bleiklie *et al.* 2000. *Ibid.*.

[9] One interviewee reported that he had to learn bookkeeping, moreover he had to learn two systems: one for the university and one for RCN.

[10] To avoid misunderstandings, it should be noted that for some kind of projects RCN can actually funds overhead costs, depending on the information in the application. For doctoral fellowships, it is even the rule that on top of the employers personnel costs 15% are provided for all kinds of overhead.

In all, the academic structure and financial organisation on the one hand invites competition by providing easy access for all scientists to the position of full professor, with the possibility of building a personal group, and by not or hardly financing research costs. Those who need money for their scientific development have to acquire external funding. On the other hand, the universities and RCN limit the scope of possibilities by not financing project administration.

Research groups at institutes are more or less in the same position as university based research groups. The institute pays salaries and housing. Research groups also have to acquire external funding to keep research going. However, some institutes do have substantial internal funds at their disposal. Institutes (with the exception of hospitals) differ from universities mainly in the organisational relations between the researchers. In the universities, most research staff is autonomous, while within institutes researchers tend to be organised in a matrix organisation. In that case, a professor does not necessarily head groups[11]. However, a group may very well comprise one (part-time) professor (II). This provides a group with access to relevant disciplines and a student pool. The hospital-based groups that we visited were organized like the university based groups.

3.3 CONTEXTS OF RESEARCH

The picture of the Norwegian research system that emerges from the interviews is far from complete, but highlights important aspects for the role of RCN. A key issue is the amount of funding for research. Researchers we spoke to feel themselves constrained by the low investments in R&D in general, but specifically by the difficulty to get funding for their own research, and the reality that some of their colleagues have no funding for doing research.

For some, the low policy interest and investments are considered as indicative for RCN's role and policies as well. They feel it is part of RCN's job to put research on the political

[11] We visited 6 institute based research groups, including two hospitals. Not counting the hospital based groups, two groups were headed by a professor.

agenda or at least to secure sufficient funding for scientific research. Others do not consider it as RCN's fault that they haven't managed to increase funding and feel that scientists themselves too are to blame.

As important as the general level of R&D investments, for understanding the scarcity is the interference of institutional research policies and RCN funding policies. The organisation of research within the research performing organisations and the de-facto research policy of these organisations puts specific demands on RCN. The interference implies that the amount of external funding has to be distributed over a relatively large population There are many professors and it is relatively easy to become professor. Being a professor provides the opportunity to build a research group and within universities, there is a tendency to maintain equal opportunities. The competition for external resources and esp. for those of the research council is open to 'everybody'. And all researchers actually need these resources. Universities provide hardly any funding for running costs such as for doing experiments, travelling, buying equipment, and hiring research assistants. If a researcher wants to get going, he has to acquire external funding. In this, all researchers are in the same position. At the same time (administrative) support for acquiring external funding is limited and the amount of funding RCN can provide is limited. The 'equality issue' seems to prevent that huge investments are done or that budgets may accumulate. Universities decided not to support applications for strategic university programs from particular groups because the groups were viewed as already big enough

The internal equality and autonomy of researchers implies a strong external competition over scarce resources. In the next chapters we will see that the combination of institutional and research council policies creates a landscape with specific developments of research programs and research strategies. Only few groups seem to have developed stable positions with relatively stable income. Some are at a cutting edge with ongoing uncertainty about the continuation of external funding and viability of the group and some have learned to live with incidental project funding. The next chapters analyse these patterns in more detail and in relationship to specific RCN funding schemes.

4 ORGANISING RESEARCH

Missions of research councils, descriptions of funding schemes and objectives of research programmes tend to speak of research as a general category. In reality, research council funding, and any research policy, impacts upon local research practices, which differ in the way they are organised and have different dynamics. The differences may display personal preferences of researchers and disciplinary characteristics, but more important is how different types of organisation fit within the Norwegian research system. In this chapter, we look in detail to the organisation of research by researchers and research groups who receive RCN funding. From the interviews, four types of research organisation at group level can be distinguished. The four types are recognisable more generally and not specific for Norway. But their size and structure have dynamic relations with research funding and thus at a more detailed level are related to the specific Norwegian research landscape including RCN's funding practices. Section 4.1 describes the four types. Section 4.2 analyses the dynamics of these types as well as changes from one type to another.

4.1 TYPES OF GROUP ORGANISATION

Four types of organising research groups can be distinguished, which we label 'the individual researcher', 'one professor group', 'multi-professor group', and 'matrix organisation'. Most interviewee's research groups can be easily identified as one of these types. A few groups are less easy to identify because the interview did not provide enough information to substantiate a particular identification. We will describe for each of the types the personnel structure, co-operation modes and financial situation.

4.1.1 The individual researcher

Personnel structure

Five interviewees out of twenty-three in our sample work on individual basis. All five are university based. Four of them are professor. They do not supervise PhD students nor have post docs to work with them. They may however tutor *hovedfag* students and be assisted by research assistants for data collection. One interviewee expressed that he likes to work on individual basis. The interviewee working on individual basis is not necessarily a matter of choice and the situation may change in due time. One interviewee is currently applying for a project that includes two PhD positions. Another interviewee moved from an institute to a university. At the institute she headed a research group, whereas at the university she works on individual basis

Co-operations, contacts

Although interviewees work on individual basis they have co-operation relations with others, or join in on other projects locally, on national level or international level. Sometimes a university based interviewee, who would otherwise qualify as ‘one individual group‘, co-operates locally to such an extent, that his type of organisation is identified as ‘matrix organisation‘. One interviewee remarked that for each project she and her colleagues form ad-hoc groups.

Specifics of the financial situation

For doing research, all university-based researchers need to acquire external funding, since the research budgets provided by the universities are too small. In principle, this also holds for those working on an individual base. However, two of the five interviewees reported that they do not need that much money for their research. Both work in the social sciences, and although it may not be true for all social sciences, it does point out that some fields or kinds of research need relatively small amounts of money.

4.1.2 One professor group

Personnel structure

One-professor groups consist of one professor and a number of *hovedfag* students, PhD students, post-docs, guest researchers, and/or technicians. Nine interviewees, mostly university based, head a one-professor group. The group size ranges from two to ten members (including the professor but not counting technicians and *hovedfag* students) and average size is about five to six. Three interviewees reported that they did not want their group to grow further or could not let it grow further. Two of them indicated that the burden of project management and day to day guiding of group members prevented them from further growth. It seems not unlikely that these are two limiting factors. Although not connected to group size, other interviewees also mentioned the fact that universities do not provide secretarial support or project management assistance and feel constrained by that.

Except for the professor heading the group and technicians, other group members are usually temporary staff, such as PhD students, post-docs and guest researchers. Three interviewees reported other permanent group members, in numbers ranging from one to three. In one-professor groups, each temporary group member is assigned to one particular project and usually not more than one project.

Hovedfag students are sometimes considered as group members, and probably this is not without reason. Six interviewees (in all group categories except the one individual) indicated one way or another that they have (need for) a good supply of graduated *hovedfag* students as a pool of candidate PhD students. One interviewee adds that the best candidates are his own *hovedfag* students. Having good candidates, in turn, is essential in standing a chance in the competition for free projects.

Co-operations, contacts

Although each member is assigned to particular project, group members do support each other. One interviewee points out that some group members have special skills and share these with others if needed. He also points out that the temporary group members learn from each other and keep the group innovative. PhD students and postdocs stay at his group for a

few years. Just long enough to enable them, initially, to learn from predecessors, and later to teach their successors. This way, the two permanent researchers and the technicians provide the long term competence and skills, whereas the temporary members keep the group young and innovative, according to the interviewee[12].

In addition to co-operation within the group, also local co-operation exists between groups on ad hoc issues. One interviewee pointed out that although co-operation with other groups exists, it never results in co-authoring publications. With colleagues outsides the own university or institute such more intensive research contacts seem to be more usual.

Specifics of the financial situation

One-professor groups, like others, have to acquire external funding, if only to pay the salaries for the temporary members[13]. Obviously, if a professor wants to sustain the group size at a certain level, he continuously needs to apply for new funding, which of course takes time and effort. On the other hand, having multiple projects at the same time going may help solving administrative problems. RCN works with one-year budgets, and some interviewees claim to have had difficulties to shift budget from one year to another. If a project leader wants to shift money from one year to the next, researchers have to negotiate with RCN[14]. Having multiple projects running at the same time creates a possibility of shifting money from one project to another, as one interviewee pointed out, without going into administrative complexities.

In this respect, it is interesting to notice the preference for freedom in spending money. We met about five groups that have received or are receiving SIP or SUP funding. Two interviewees mentioned freedom of spending as one of the main advantages (for one of them it was the major advantage) of this type of funding. Another labelled it simply as handy money. The relatively large budget that SIP or SUP funding supplies, was mentioned by only

[12] The point about the innovative influence of the coming and going temporary group members is also made by another interviewee.

[13] Admittedly, universities sometimes pay PhD positions, but we met no group that consisted of one professor and PhD students on such positions exclusively.

[14] Note that some researchers claim that transference of funding from one year to another is not possible at all or at very difficult, while others have experienced that RCN usually approves requests.

one interviewee. For him, the amount of funding enabled him to let his group grow. Other interviewees mentioned the advantage of freedom in spending in relation to other types of funding, such basic institute funding. It seems that freedom in spending is as interesting as the size of the budget.

4.1.3 Multi-professor group

We identified three[15] groups as multi-professor groups. All groups were universities based.

Personnel structure

In a multi-professor group, two or more professors join forces. More precisely, they join their one-professor groups and many aspects of one-professor groups also apply to multi-professor groups. For example, group size and composition. The three groups comprise of one group of 5 professors, one of two, and one group of three professors. Their total group sizes are 63, 10 and 19 group members[16] respectively, which calculates to average group size per professor of about 12, 5 and 6 members per professor respectively. (Please note that in the first case the number of PhD and *hovedfag* students were not specified, so the numbers for this case would have to be downward adjusted if *hovedfag* students are not taken into account.) In all, it seems that the average group size per professor of multi-professor groups does not differ from the one-professor groups.

Also, the composition of the groups does not differ from the one-professor groups. Groups consist of a mixture of PhD students, postdocs, foreign guest researchers, *hovedfag* students, permanent technicians, and/or researchers.

Co-operations, contacts

Although groups are joined, each professor still has her own particular research theme and is responsible for her own set of research projects. Each temporary group member is assigned to one particular project and there exists strong mutual support between and within the

[15] One other group may qualify, but group organisation was not discussed in detail in this interview. Based on the group's web site it could be a multi-professor group, but also a matrix organisation.

[16] Not counting MSc students and technicians.

comprising one-professor groups. For example, when it comes to discussing and solving each other‘s problems. In comparison with the one professors group, local research co-operation is stronger and joined applications for funding occur more often.

Specifics of the financial situation

The interviews did not provide any information on the financial situation. However, since all professors in a multi-professor group have their own project responsibilities, specifics of the financial situation probably do not differ from the situation in one professor groups, be it that the co-operation with other professors implies more flexibility and less susceptibility to temporarily fall of external funding.

4.1.4 Matrix organisation

Matrix organisations were found at institutes exclusively. We identified four groups as matrix organisations. Their main characteristic, that distinguishes them from multi-professor groups, is group members work on more than one project at the time and that this is the standard way of project organisation.

Personnel structure

In a matrix organisation a group consists mainly of tenure staff of all degrees (technicians, Dr., MSc, Prof.) with additional temporary group members (PhD students or postdocs). In three out of four cases, a group comprises at least one (part time) professor (II), who in two cases also heads the group and in one case plays a primary role as advisor in all the group’s projects. Group size varies from 11 to 20 members, with an average of about 15. Matrix groups at least those that we visited are about twice as big as one-professor groups. [The size of one group is unknown, the department that holds the group (and one other group) has 20 staff members;] Group members may very well be a project leader of one or more projects. For each project the project leader assembles a small group (say four to six) of people who’s combined capacities and expertise can finish the project successfully. Each tenure group member works on multiple projects. PhD students work on one project.

One interviewee pointed out that the disadvantage of a matrix structure is that it requires co-ordination, which sometimes is problematic. The advantages are that projects mutually benefit and that it enables to tie in different people's capacities. We would suggest that, although the group head probably has to invest time in co-ordination, this type of organisation also relieves the group head of guiding of group members and of writing project applications.

Co-operations, contacts

Compared to one-professor and multi-professor groups, co-operation within the group has a structural character. We have no indications that external co-operation is different from those of the other types.

Financial structure

Institutes may receive basic funding from RCN or government agencies. These funding may be for particular monitoring tasks or other services or may be free funds for basic research. One interviewee remarked that monitoring and services do not only generates income, but also provides the institute with data for research. All group members have a tenure position and any group member may have to acquire funding.

4.2 GROUP DYNAMICS

Groups of all types may decrease or increase in size, depending on their group structure and funding possibilities. The interviews present a landscape of groups in different phases of growth, stable continuation, or decline. RCN seems to be most influential in stimulating growth of new groups and, indirectly, in suppressing growth of small groups. Bigger and well established groups, seem less prone to RCN funding or non-funding, although RCN still does play a role in these group's existence. This section focuses on RCN role in the development of groups, taking into account that other funding sources also play a role. Roughly, RCN can influence group size by stimulating growth, sustaining groups at a particular size, or decreasing group size.

4.2.1 Stimulating growth

Within our sample, there is one interviewee who successfully has built her own research group shortly after her PhD. She followed the path described in section 3.2: after her PhD she held a post-doc position and then applied for a position as associate professor II. She explained to qualify for full professor, one needs to have teaching skills and experience, to have a good research record including a comprehensive publication list and good visibility in the field. To her, becoming professor coincided with building the research group. For the interviewee, the only way to build a research record was to do basic research. Being new in the field, she was not in a position to acquire money from industry for (applied) research. Basic research in the interviewee's field requires money and RCN was the only available source. Other interviewees confirm that when it comes to basic research, RCN is their only potential source. Indeed the EU would also be a source, but not for starting groups.

The interviewee of this example succeeded in acquiring programme funding. In doing so, she confirms one other interviewee who, looking back on the start of her one professor group, noticed that they would not have managed if it was not for programme funding. This interviewee estimated that as a new comer she would not have survived the competition in free project funding.

Already established groups may grow into bigger groups. They may have accomplished this by simply applying more often and via mechanisms described in the next section, but we also identified two particular grow paths. One path is to develop as a group a 'success formula'. A group may specialise in particular knowledge or in developing particular products or services. The point is that this knowledge, these products or services are of basic importance to other scientists or to industry or other users for a longer period of time (say ten years or more). These groups can have a stable existence, but the danger exists that their knowledge or service becomes obsolete in due time. To survive, they would have to shift their research in time (see section 5.1).

Another path is that a group ends up in a 'fast lane'. Just like starting groups, existing groups may profit from niches that are created by new programmes. Particular fields of

research receive (more than average) attention of programme funding. A group would grow if it previously was not within the scope of such a programme, but would be as of a particular moment. This may just happen by accident. Four interviewees pointed out that a number of programmes are the downright result of or at least under influence of political interests. In such cases, Ministries label parts of the funds that they donate and RCN has no choice but to follow this direction when granting applications, as another interviewee remarked.

This might imply that if the political or governmental interests shift, parts of the funding streams shift accordingly. Perceived from their point of view, research groups may accidentally benefit from these shifts. Some interviewees were aware of these and other procedures and actively try to influence the course of events, while others more or less concern it as facts of the life of a Norwegian researcher. One way to influence funding streams is to be member of a programme committee or otherwise become involved in a programme. Being a member a scientist can try to influence the development of the programme, as two interviewees pointed out. Joining a programme committee however has no influence on the selection of programmes, or on the Ministries' labelling practices. To influence such choices, universities may join their efforts to lobby government or Ministries to donate additional money to particular fields or themes. Finally, to end up in a fast lane would be to shift the group's research towards a particular programme - an issue we address in Chapter 5.

The pattern of building up a group is not unique for Norway and might be find elsewhere. What is important however is the role of research programmes appear to have. The creation of a (small) group is far evident in the egalitarian research organisations of Norway. Apart from the Strategic University and Institute Programmes, there were no specific instruments in the past years to promote group development. In the second chapter we found even evidence of mechanisms of professional homogenisation that work against such group development. Although most research programmes do not have capacity building as such as an objective, through the creation of protected spaces with limited competition, they seem to have this (unintended) consequence.

4.2.2 Sustaining groups

Most groups that we visited either have remained at a particular size over the last five to ten years, or have increased in size. Only a few have decreased. It seems that once a group has grown to a certain size, they acquire a particular momentum creating the need to at least keep that size. They have developed a particular capacity in terms of size and expertise and want to keep up that level, or particular investments have been done and require a certain level of operations in order to justify the costs.

Individual researchers and small one-professor groups may not need much funding in order to maintain their size. In case of individuals, the university pays their salary, which keeps them in existence as a research "group". The bigger a group is the bigger the need of a continuous stream of projects to finance the temporary positions and their successors. Researchers have to apply over and over again, depending on their targeted group size and the success rates of applications at the divisions and programmes. We will go into details on the application process in section 4.4 since they are related to the research questions and other matters of content. Here we focus on group size and the ability to maintain a particular size by acquiring funding.

Although acquiring funding is not easy, interviewees feel that being successful increases future chances of acquiring RCN funding. From their records of how they have acquired and maintained momentum, a list of patterns can be made which together reveal a Matthew-like mechanism in the Norwegian research system ("those who have, they will be given"):

- Being successful with a particular project increases chances for funding of a follow-up project. Past record seems to be of importance in evaluation procedures.
- Bigger groups can more easily overcome the damage from a sudden drop out of a temporary group member, which means that bigger groups can more easily finish projects successfully.
- Established and successful groups are more visible in the field. They can build pools of MSc and PhD students, which in turn increases chances of finding a good candidate for a project, and the chances in the competition for (free project) funding.

- Acquiring funding is a matter of being aware of what goes on and submitting project proposals, but also of being known and asked to do certain projects or to submit certain proposals.
- Being a long established research group with a good overview of a particular field makes the group one of the few that can carry out particular projects.
- Being successful in acquiring RCN funding increases the chance to get other external funding. With projects approved by RCN, industry is more interested because RCN's approval is seen as a scientific quality stamp. RCN funding can also be used often as a step up for EU funding. Having RCN funding researchers can complement the partial funding the European Commission grant for projects.
- To keep in touch with former PhD students and post docs, who have started their own businesses or work in industry (we would add, or government for that matter) can be advantageous to the group. The group may provide (paid) services to these companies/industries, for scientific reasons or because these contacts help acquiring industry funding.
- EU funding expands the budget beyond the limit implicit to the RCN funding system (that is the combined effect of a number of funding practices) .
- Being a well-known scientist in the field, a researcher may get invited as guest-professor or lecturer at conferences. These occasions help to build a network, or to travel with low costs for research purposes

The Matthew effect in funding can be found elsewhere. What seems to be specific is RCN's role in the mechanisms in Norway. Growth and first stabilisation depend on RCN funding and only with this RCN funding, researchers acquire the possibilities to find other funding sources. Only in one case an interviewee received funding from another source and could use the results from that funding to get entrance to RCN funding.

The dominant position of RCN in this mechanism implies also some fragility and researchers feel that continuation of success is far from evident. Especially the one-professors groups who could have grown with SIP or SUP funding felt insecure about the possibilities to

continue. When SIP/SUP funding is near its end after some years, the groups are at crossroads of continuation through free-projects and/or programme funded projects, linking up with other groups to get new infrastructural funding or facing a decline into a smaller group or individual research. It appears that to a research group, a SIP/SUP grant is little more than a big project. It may have a special place in the group's development and even have strategic value, but it has little structural value.

In one specific case the dependence on the RCN made a multi-professor group with an acknowledged track record to enter negotiations with RCN staff when faced a decline in funding in a new budget year. Our interviewee told us that the group had done less well in the proposal selection rounds as previous years. The group has good relations with industry and a good record at RCN and at ministries. These ‘resources’ could be used to acquire funding to maintain group size and research infrastructure.

The Matthew effect is not only related in funding procedures of funding bodies and tendencies of decision-makers to avert risks and led decisions by indications of past success. The Matthew effect may also be due to learning effects at the side of the researcher. Through frequent application for funding, he learns about the preferences and practices of divisions, program boards and non-RCN funding bodies. Instead of on “those who have, will be given”, continuation of groups and funding is based on a “those who get, will learn”. (see also section 4.5)

Infrastructural funding reduces the need to apply and thus limits learning effects, and in a way the Matthew effect. Moreover, we found evidence of patterns that hamper the accumulation of resources.

4.2.3 Limits to growth

In section 4.1 we reported that the different kinds of group have under and upper limits to their size. Apart from the individual type for obvious reasons, for one- and multi-professor groups, the general rule holds that size depends on the number of temporary members who are mainly funded by external funding. The number of PhD students paid by institutional funding

determines the under limit of group size. There is hardly any mechanism through which groups can increase much with institutional funding. Groups organised around professors (the one and multi-professor groups) have a maximum size, which is related to the professors' practical work situation. The professor has to guide his temporary group members, has to do project administration, and to spend time on writing applications. The dependency of these activities on the single professor seems to hinder expansion beyond about ten group members.

Matrix groups are bigger than professor groups, but also have a maximum size. These groups basically comprise tenure staff who all may take part in acquisition. Why then, do these groups not grow much bigger then they are? Part of the answer may be that RCN simply does not allow accumulation of projects[17] above a particular level. One interviewee who heads a matrix group, pointed out that RCN's practice of programme funding has a built-in restriction effect on overall spending on particular fields or research themes. RCN internally re-routes applications to the programme (if available) that staff thinks suites the application at best. If an applicant applies at a particular programme, her application may be directed to a different programme, or if she applies for free project funding, her application may be re-routed to a particular programme. Re-routing is practised within and between divisions. And because programmes have limited budgets, RCN's overall expenditures in the fields of its programmes are restricted to these programme's budgets.

This means that groups will have difficulties in their attempts to accumulate projects, by spreading their applications over multiple divisions, over programmes and over programmes and free project funds. Even if RCN does not control for such spreading explicitly, the practice of staff looking for what they see as the appropriate place, may focus all applications into one or two programmes within one division. It would not be too far fetched to assume that programme committees see to it that one group does not acquire too many projects. If a group wants to expand beyond this limit, it would have to find additional funding from outside RCN.

[17] Nor more costly, or longer lasting projects for that matter, but these issues will be dealt with in sections furtheron.

4.2.4 Decline

We met no interviewees who saw their group substantially reduced in size because a programme ended and was not followed by a new programme. However, one interviewee did point out that the danger exists to those who rely on or have to rely on one particular programme. Of the one and multi-professor groups, some groups in need of external funding have difficulties in acquiring RCN funding. We met four interviewees who are or were in such a situation. They can not apply for programme funding because their research fits no programme. Consequently, they have to apply for free project funding, but RCN's funds for free project funding is limited and competition is strong.

These groups have four alternatives:

- To find other funding sources. This strategy may succeed depending on the availability and budgets of funding organisations in the group's field. For example, the Cancer Institute is a well-known funding source in the medical sciences. Three interviewees indicated that for their research field, they see no alternate sources at all.
- To do research with the little means that they do have. This might mean investing personal money and time. Due to our selection procedure, we did not speak with scientists who received no funding at all. However, a few interviewees compared their own with their colleagues' situation and concluded they were rather lucky. We have to take into account that groups of scientists (of unknown size) exist who (are in need of but) receive hardly any or no funding at all.
- To wait for a new programme.
- Last but not least, they can change their research focus and apply for funding at programmes in related fields. Because this involves a shift of research, which is of importance when it comes to possibilities to steer contents of research development (rather than group development) we will analyse this pattern in the next chapter in more detail.

Whatever their alternatives are, decline in group size will not go below the level of one individual - in other words, groups never completely disappear, at least not in case of

university based groups. Professors have tenure positions, autonomy, and some means to continue their research if they want to. At institutes, group members also have tenure positions but have less autonomy. If a group member leads/has no project of his own, then due to the matrix structure, he simply works on others projects (as he would have done in case he would lead a project of his own).

4.3 SUMMARY

In this chapter, we have distinguished four kinds of research groups, ranging from the single individual to the matrix organisation. For each group main characteristics were analysed. The second part looked at dynamics of these groups. Individuals can easily sustain their level of research. Growth into a one-professor group depends on external funding, either as infrastructural funding from RCN's Strategic Institute Programme (SIP), or Strategic University Program (SUP), or as multiple projects funded from one or more sources. One professor groups may join forces into a multiple professor group, but this is not a dominant development in the Norwegian research system. Matrix groups seem to be specific to research institutes and not viable within the university contexts.

Sustaining research groups depends on the possibilities and abilities to acquire a continuous stream of projects. On the one hand, mechanisms seem to be in place which reward past success and result in such continuation of funding. Growth is however limited and the edge between individual research and one-professor groups is thin. Groups built up with infrastructural funds have little certainty whether they can sustain their increased size after SIP/SUP funding ends. In general institutional funding mechanisms and organization prevents both growth far above average, and decline to the point of disappearance.

RCN seems to have a crucial role in these dynamics through the interference between its funding instruments and institutional policies. Firstly, we note that for the establishment of new research capacity not only the SIP/SUP funding is important, according to the aims of this funding type, but also programme funding seems to function for researchers as a entrance

to new fields. Secondly, we find that because RCN dominates external funding of research that it has a rather dominant position in the functioning of the Matthew effect and the accumulation of resources. This puts the council in a key role for the development of strong research groups, but also gives the council a responsibility to guarantee fair (not necessarily equal!) distribution of resources and secure access to funding for newcomers. The latter seems not a real issue yet, as the combination of RCN policies and institutional policies seems to create a ceiling for group development. Only a few groups, which have other funding possibilities in addition to RCN, are able to grow beyond this limit.

5 RESEARCH DYNAMICS

5.1 DYNAMICS OF PROJECT DEVELOPMENT

We have so far concentrated ourselves on the organisation of research and group development. Interviewees position their research not only within a group but also within a (inter)disciplinary context, often within a particular theme. The dynamics of the groups are related to the development of research questions that fit within these themes. The development of these research questions appears to be 'loose' and ad hoc rather than systematic and planned long in advance, but it is not without logic or deliberation.

Many interviewees noted that developing research questions is partly an ad hoc matter. As one interviewee puts it, the general research strategy is to formulate research questions along the way. His group has a long-term plan, but since it is impossible to predict results of the group's research, let alone results from other groups (national and international), alterations to the plan are likely needed. Another interviewee remembered that he decided to choose his *hovedfag* subject, after reading a particular novel. Others reported that ideas just come to mind and then a proposal is written, or that the selection of research material depended on the needs of another group or needs of industry.

On the other hand, some 'logic' or deliberation, some long-term course setting also plays a part. Interviewees used metaphors as 'stone on stone' or 'step by step', or mentioned building up competence or building on earlier work. One interviewee mentioned that a question was addressed because his discipline had neglected the issue. Another interviewee explained that he always has projects in preparation, often for several years before they mature and materialise as proposal. Another mentioned that proposals are being developed via group discussions within the institute. Perhaps the best illustration of the two sided nature of developing research questions are the follow up projects. They evidently continue where a

previous project stopped, but often it would be difficult to tell in advance, on which issue or question the follow up project will continue. This has to do with unexpected findings or observations made during the predecessor project. We encountered five documented cases of such follow up projects.

Three interviewees stressed the unpredictable nature of scientific work. One of them noted that RCN requires specific planning of projects with deadlines, goals and sub-goals planned in advance. However, he remarked, if it would be certain that the goals and sub-goals would be reached at a particular time, then the project is probably not interesting, because the results are known in advance[18]. We have however not come across further evidence that projects plans RCN like any research council asks for are more detailed than usual and the RCN's control on project progress is too tight to enable deviance from project plans if there are good scientific reasons.

Development of research questions should be distinguished from the development of research projects. A scientist may, of course, develop a new research project because a new question comes to mind and then project and question coincide if applications are granted. But not all projects are the result of a new research question. Frequently we found that projects have a different background than the "curiosity" of the researcher. Researchers may be invited by colleagues to join a project, be asked by a funding organisation to apply for a particular project or by industry or other users to work on a particular question that they have. Furthermore, unexpected events, such as drop-outs in (temporary) staff, may influence the development of existing projects and their follow-up projects.

Other interviews point out that also other - not content related - issues play a role; for example, having a candidate, funding issues and group capacity. One of these issues is the researchers' estimation whether or how much funding he could acquire, either at RCN or other funding sources. However, it is difficult if not impossible to establish the nature of role

[18] The interviewee used his remarks to argue that RCN should take this into account and use a more flexible system. There is no evidence however that RCN asks for more elaborate project planning schemes than is usual in research councils abroad.

of funding and at which point (in the project development process) financial considerations play a role. Some interviewees clearly put the research question first, both in terms of timing and content. Others take funding issues into account but the interviews did not make it clear how or when exactly. One interviewee simply put that it would be unwise to continue with a project if there were no funding sources available. Another poses that if there is no funding available, his group simply waits for new RCN programmes that might finance the project. Others do keep track of the development of programmes, which makes it virtually impossible to establish whether the existing programmes or their own ideas triggered development of new projects or influenced the development most. The interviews at least show that a multitude of practices exist. Although nature and timing of financial considerations are difficult to establish, a number of practical issues can be mapped.

5.2 SHIFTS IN RESEARCH THEMES

The two sided nature of the dynamics of research also apples to main research themes, be it that these processes of change work on longer time scales and have deeper impact. About one fourth of the interviewees reported a change of their main theme. We will discuss a number of cases and analyse if and how these are related to issues of funding. Sometimes the interview did not delve deep into these shifts, so some case descriptions are quite short. Like with the development of research projects, shifts of research themes have all kinds of reasons, not always primarily financial, but also not without financial considerations.

Case 1: Start-up shift

In section 4.2.1 we referred to an interviewee who set out to build his own research group. When started the group did not shift its main research theme, but the interviewee had to shift his main theme in order to get started. In Norway, no substantial research capacity or any industry exists in her previous research theme. Deliberately, the interviewee shifted her main theme towards interests of Norway. She did so by successfully inserting her original knowledge and expertise into his new research theme.

Case 2: Shift due to research findings

In time, research results may make a group to shift its main theme. One case showed that an unexpected finding resulted in a shift in the main research theme of the group. The interviewee emphasised that unexpected findings may help solving more interesting and important problems than the ones the researcher started with. This may a very well and legitimately force to change of research direction, according to this interviewee In section 5.1 unexpected research results were discussed in relation to the development of research questions. Here we find it also on the level of main research themes. The previously mentioned cases and the one discussed together also show that it may be difficult to tell whether an unexpected result will lead to a minor or major change of a group's research. At least the mere fact that there was an unexpected result does not tell what kind of shift will be induced.

Case 3: A talk with colleagues;

We met two interviewees who decided to shift their main theme after a talk with colleagues (in both cases colleagues abroad). One of these cases will be discussed under the next heading. The other is about a scientist who's group decided to take up research in what she identifies as a new field. This change of field had its effect on fund raising activities. According to the interviewee, the two programmes that usually funded the group's research, would not support the project. She therefore submitted her proposal as a free project. Positioning her project in the new field, she continues, decreased its chances of success since in the neighbouring field. The money was already divided among the usual applicants. The interviewee also remarked that the group's shift in principle would make it possible to apply at another division. However, because the new field's approach is rather unconventional for this other division the group felt it could not apply there. Secondly, the other division also speaks 'a different language'.

This is a case of 'spontaneous' shift. A shift triggered by a talk or discussion with colleagues abroad and not induced by funding arguments It shows that when a group changes its main research theme, it has to consider whether its new theme still fits within its existing funding

context. If not, the group has to find others funding sources. In fact, she may have to regain an new position, not only in the scientific landscape but also in the funding landscape.

Note that the group would not abandon its old field. It is easy to continue on this field and there is personnel overlap. Just like the previous and the following case, this case shows that a shift of research theme does not mean a break with the old theme.

Case 4: Success formula research

The second group that had shifted its research theme after a talk with (foreign) colleagues is a success formula group. As the interviewee related, this group has had a stable existence for a long period of time. When the group started its research was viewed upon as cutting edge basic science, but in time its activities are perceived more and more as basic information providing. The group has specialised in a technique that has become so successful that more scientists in the field use it by consultation of the groups expertise, and without much knowledge themselves of how it works. The group realised that in order to survive as an academic institute it had to address a particular discipline, to link its research to applications in industry, and last but not least to address other more difficult research questions than those addressed with their technique. The last aspect was in part the result of an advice given by foreign colleagues, according to the interviewee. In addressing a particular discipline and linking to its research to application in industry, choices were guided mainly by local circumstances, such as access to other local groups and their expertise and access to local industry. Co-operation with local groups has been organised in a joint application for centre of excellence funding.

The case shows that the decision to shift its main research theme and the choice of the new theme or direction were not primarily steered by financial arguments, or by purely scientific arguments. Again, the group's speciality is not abandoned but exploited for other research, in this case with a more particular aim in mind than service providing.

Case 5: Change forced by funding

We met one group that had to shift its research because it could otherwise not acquire external funding. The interviewee has to stick to a side-track of his main theme for which he can not

get funding. The research at the side-track is funded by one particular programme. There are no other programmes that he could apply to, and free project funding is not a real alternative because there is a relatively small budget. Even his free project applications that receive very good referee reports are often not funded. He does not abandon his primary interest, but works on it in his spare time or by squeezing it into the projects that he can get funded.

The case shows that programme funding may force research/researchers in a particular direction. Although we encountered only one such clear case, another interviewee regrets - and claims that many people agree - that researchers have to adjust their applications even though they have ideas that are more interesting. This suggests that the case we found does not stand on itself.

The case also shows that researchers resist such forced changes. The interviewee is not enthusiastic about the side track research and does not regard it as potentially innovative. As with the previous cases he shifts, but does not break away from his of primary interest (in this case the adjective 'old' does not apply). In this case simply because he finds it more interesting.

Case 6: No shift

To the list of cases we add one case in which an interviewee at a certain time considered to shift towards more applied research. She reported that she had decided not to because she found the theoretical research more interesting and because she had already build up some competency in this.

Case 7: Shift due to co-operation

One interviewee added a research theme to his existing themes. When he embarked on co-operation in a multi-professor group, he adopted one of the other professors research themes. The case shows that reorganising group structure may involve changes in research themes.

Unpredictability at local level

Shifts in research occur and at local levels they seem to be as unpredictable as the development of individual research projects. It is not always clear whether a change of course is one on the level of main research theme or of project level. Nor is it clear exactly which

direction developments will go in advance (if national or local circumstances were different, groups would have chosen a different direction in cases 1 and 4). Changes to a different theme does not mean that the previous theme is completely abandoned. The old and new theme are related (inserting or applying one theme into the other in Case 1). This means that money is still being spend or will have to be spend on the previous theme.

As far as RCN has a role in the shifts at local level, it is one factor among many others and hardly through direct interventions. Actually when asked explicitly whether researchers felt to be steered by RCN, they deny and emphasise their own role and scientific considerations in the development of their research. At the same time the choices, and the organisation of research and dynamics of research programs are constrained by the institutional policies and funding practices.

6 FUNDING MATTERS

Without questioning the experience of control that researchers feel about their own research, the dynamics of research groups and research itself are affected by funding. If we pose a researcher for whatever reason has a research project in mind, at a particular point in time funding issues arise. She has to answer questions such as at which organisation to apply, which division and programme fits her projects or whether she applies for another funding mode. After applying (we will focus on applying at RCN), she simply has to wait to find out whether her application is granted. This is the simple course of events, or in other words the standard application procedure. Researchers have to go through the steps of this procedure for each project they embark on. The individual may want to start a new project ones every two or three years, or more frequent in case of short projects. Others have to apply for multiple projects each year to keep up the level of their group's size and research. The result is that they learn about RCN's behaviour, about the timing of procedures, about their personal success rates, particular programmes' success rates, about the response they receive upon their successful or failing applications. In time, they may acquire some insight in RCN's policies, programme development or selection procedures and criteria.

Moreover, the researchers start responding to their observations. In case of low success rates, they may simply apply for multiple projects to increase their chance to get a project financed. This in turn decreases success rates even more. Others may stop applying after a number of attempts and try to find other ways to increase their chances of success or try to find other ways of working all together. The chapter describe the practices within and around the standard application model, and which feedback mechanisms are at work.

6.1 WHERE TO APPLY?

For most researchers, RCN is the main, if not the only, funding source. To them the question which funding source to address is not relevant. For others, alternate or additional funding sources are EU funding, industry or ministerial funding, and in case of medical research the Cancer Society. Next to these a large number of other, smaller funding organisations exist, among which F. Nansen fund, VISTA and Nordic Council of Ministers.

Those groups who have access to other sources are of course less dependent on RCN policy, than those who do not. However, as RCN has, these other sources have their characteristics or peculiarities. For example they are selective in scope, do not have as much money to spend as RCN, or have particular selection procedures (researchers do not apply on their own initiative, but are invited to apply). The interviews did not delve deep into these matters, but in the case of EU funding some insights were gained.

About one third of the interviewees actually receives EU funding. EU funding is perceived as source for basic research and viewed upon as a quality stamp. This makes EU funding attractive. On the other hand, competition for EU funding is fierce and the EU is demanding in terms of administration and bureaucracy. Four interviewees reported that they actually decided not to apply for EU funding. The main reasons being: applying takes too much time and effort and the EU has no suitable programme. Also mentioned were the low success rate and the size of the grants.

One interviewee pointed out that EU funding and RCN funding are inter related. In one of his projects, RCN funding filled the budgetary gap that was left open by EU funding. In another project RCN funding was used to scientifically exploit the results of an EU funded predecessor project. This in turn made it possible to keep in touch with colleagues abroad. Having RCN funding was a prerequisite for EU funding in a third project. To this interviewee EU funding expanded his financial means above the apparent maximum of RCN funding.

Which division?

If a researcher applies at RCN, then choosing a particular division usually is a trivial matter. It is a matter of habit or it depends on the programmes that may fit a particular project. A few

researchers have experiences with more divisions, others are by nature of their research linked to one division. There are two factors other than the content of the project, which limit the choice for a division. First of all the practice of re-routing applications within RCN, which implies that applications may end up in another division than the researcher had chosen for. Some interviewees indicated that they had tried other divisions in order to enlarge their possible funding sources. The other one is the anticipation of researchers that he might have difficulties to get into one division, while he has already a good track record in another. Researchers know that project success and reputation increases the chance for new funding. In one case, a researcher who saw good possibilities to extend his research into a new application area, was not eager to do so, because he was unsure whether the chance of success would be worth the effort.

Programme funding or free project funding?

When researchers apply, the choice between free project money or programme funding seems to be pragmatic. Groups apply at a particular programme if one is available, and if none is available, they apply for free project funding. The opposite also occurs: two interviewees apply for programme funding because there is little free project money available. But scientists do see difference between free project funding and programme funding, and tend to be critical about programme funding. Programme funding is perceived as a type of funding that is steering research in general. One interviewee (and on particular issues his remarks are confirmed by others) noticed that there are to many programs, which are narrowly focussed[19]. Since Norway is a small country, she continues, in some programmes only a few groups can apply for grants[20]. Other interviewees pointed out that programme funding provokes that many researchers or groups will start doing the same thing or make them adjust their applications even though they have more interesting ideas. Even with the objective of programme funding to steer research taken into account, they disapproved of these effects. .

[19] Confirmed by another interviewee who noticed that it became increasingly more difficult to find free project funding. RCN distributes much money via programme funding, but the programmes usually have a narrow focus.

[20] On the issue of only a few groups working on particular themes, the interviewee is backed by another interviewee who also shows disapproval about that situation.

Five interviewees noticed that programme funding is in part controlled or influenced by Ministries or politics in general, either in relation to the selection and formulation of programmes, or in relation to the selection of applications.

Having noticed the steering effect of programme funding, a few interviewees also notice that programmes can be advantageous to researchers. Two interviewees remarked that programmes secure research in certain areas for the duration of the programme (see section 4.2) and that programmes enable co-ordination of activities. One of them added that a programme that he had joined virtually forced co-operation between the institutes in the field[21]. A third interviewee remarked that programme activities make the participating scientists part of a research field.

The political character of some programme funding also is an opportunity to increase the chance on funding. Researchers join efforts and lobby ministries or politicians to earmark money for particular research.

Researchers could also adapt to the steering effect and/or political character of programme funding by reformulating their applications, for example by shifting stress from one particular aspect to another, in order to fit their application into a particular programme, but without actually adapting their research. No interviewee actually reported that they themselves practice this, but do know that others do.

Three interviewees see programme committee membership as a way to influence programme funding. They feel that it would make life easier because the interviewee could improve the committee's understanding of the field, or that it is a way to work on RCN's problems, or literally because they feel they can influence the content and development of the programme.

Choice of programme

It is not quite clear why applicants address particular programmes. Two interviewees mentioned that they simply look for a suitable programme after having developed a project.

[21] Please note that a few other interviewees stress that they are selective in co-operation

Researchers do not seem interested in programmes, their goals nor their background as such[22]. When asked, one interviewee answered that programmes are simply bags of money with a name and a contact person. Another answered that he does not identify with the programme's goals, nor that he really cares about these goals. Answering a different question, yet another interviewee did not see a close relation between RCN programmes and development of the project that was discussed in the interview.

6.2 COPING WITH SELECTION PROCEDURES

After applying the researcher simply has to wait and see. About the MH, MU and BF divisions it was reported that the success rates are rather low (about 10 to 20 %). In such cases the applicant can be rather sure that her application is denied. Some, to increase their success chance, apply more often.

Apart from these acceptation rates, researchers feel that RCN is unpredictable in the selection of applications. Three interviewees reported that one or more projects with good referee reports were not granted. Two interviewees not only wondered why particular proposals were not granted, but also why other proposals they had sent in were granted. Researchers feel that this is due to RCN's internal strategies and political influence in programme funding interfering with quality of research. Some interviewees noticed that being member of a programme committee is advantageous because it provides access to RCN's strategies and political undertones of programmes. One interviewee, who has inside experience and has good contacts, reported that even with this insight she finds the evaluation of applications unpredictable.

Apart from these strategic and political aspects, interviewees also say forms of old-boyism pollute the selection procedure. An interviewee suspected that in some programmes the possible candidates are identified in advance and that one simply has to apply to find out whether one is amongst them. Another said that some divisions selection procedures were

[22] Admittedly, one other interviewee was aware of a programmes goals and backgrounds, but he was member of the programme committee.

more susceptible to "old boyish" decision making than others. From the interviews we cannot assess whether these remarks on old boys networks go beyond stories that in a way rationalise unpredictability of the results and indeed reflect real practices of the research council. Although some of the interviewees were open in the way how they opportunistically operate within the RCN procedures, none of them reported to be included in such a network.

We asked researcher about strategies to cope with the unpredictability. A usual clue to anticipate criteria is the program information. A few interviewees commended RCN on dissemination of information about their programmes. RCN's web site is found complex but informative. A few interviewees noticed that RCN is relatively open and inviting when advertising their programmes. However, in cases where parts of programme budgets are earmarked by donating Ministries, this information is not (or not always) passed on in RCN's advertising. One interviewee reported a particularly striking case where advertising contained an open call for applications that suggested open competition aiming on quality primarily and allowing a wide range of topics, whereas the ultimate selection had to fit rather detailed budgeting figures as provided by the funding Ministries. He found out only later when selections had to be made based on the evaluations, and these earmarked budgets came in as separate selection criteria.

Another strategy is to get into RCN and in a way become part of the unpredictability by becoming member of a programme committee and influence the development of a programme. But the advantage of that seems to be limited. More effectively it seems to move around RCN and get in touch with the donating Ministries and try to influence the earmarking or team up with other universities and make proposals to the government directly, in stead of via RCN. But this is clearly not a possible strategy for all researchers and the may be very dependent on the reputation of the researcher.

In principle, the combination of funding policies at university level and RCN provides the possibilities to steer research. This combination includes the universities' financial structure, which makes all research that requires substantial investments depending on external funding.

Secondly, most researchers are to a large extent dependent on RCN funding. They have little or no alternative sources for external funding (see above in this section). Thirdly, re-routing practices function, and researchers may become dependent on particular programmes or maybe even one programme. There is a fyke net in place towards programmes, which enables positive steering towards scientific or political objectives. Interviewees recognise this possibility, see it happen, although perceive that dynamics of their own research depend mainly on own decisions.

In principle, these mechanisms also allow for negative steering. The more precise Ministries labelling practices are, the more precise these practices can rule out research projects. This is not entirely hypothetical. We met two interviewees who reported that they had to cancel parts of their projects for political reasons or that proposals are not approved because of political winds. Scientific criteria may also rule out particular research. This however is not contested by the interviewees. Occasionally they admit that their application was denied with good arguments. Moreover, as is noticed before, programme funding and money distribution may overrule scientific criteria. This practice is criticised by some interviewees.

7 CHANGING LANDSCAPES, CHANGING DIRECTION

Through in depth interviewing of 23 researchers at universities and institutes in Norway we analysed the dynamics of research in its context. Chapter 4 and 5 deal with the dynamics of research groups and research itself. When explicitly asked, researchers tend to relate these dynamics to decisions or events directly related to the group and progress of research. Critical shifts in research programs depend on contingent factors rather than structural changes or explicit external interventions. At the same time, it is clear that the dynamics are constrained by their contexts. Chapter 3 describes this context of the Norwegian research system as it is perceived by the researchers, and which happens to create a landscape that allows some kinds of research groups to flourish. Chapter 6 has looked more specific to the funding matters and especially the relation with RCN, which, in its position as main funding body, is rather decisive whether research is enabled or not, but through its procedures seems to add to the contingency of the dynamics of research.

The first section of this concluding chapter combines these four chapters in an overview of the Norwegian landscape. The second part analyses the role of the three funding schemes of RCN in this landscape. Through the experiences of the interviewees, we have looked already at the respective roles of project funding, programme funding and infrastructural funding in the dynamics of their research. By bringing these experiences together within the context of the Norwegian research landscape, we can analyse the structural dimensions of these funding modes and understand RCN's role in steering research.

7.1 THE LANDSCAPE OF RESEARCH GROUPS

The landscape of research groups[23] seems to consist of many autonomous individuals and small one-professor groups located at universities. Sizes vary from one to about ten members

[23] Please note that it is a landscape of group sizes and structures, not of their disciplines or fields of research.

and all universities provide more or less the same rather low support and facilities to their research groups. In general universities provide a very small research budget and facilities are limited to housing. Project or administrative support is not provided (nor does RCN finance this). At institutes groups are usually organised as matrix groups, and sizes vary from about ten to twenty group members. Facilities and support are basically the same as universities, be it that institutes' research funds may not be equally divided over all researchers (as is practised at universities), but may be distributed more selectively.

The landscape may change, and changes in limited number of ways. New individual or one professor groups may come into existence. However currently universities are cutting costs and do not allow for new tenure positions, so probably this kind of change will not occur that much. One individual groups, may grow into one professor groups, small one professor groups may grow in size, and small matrix groups may grow in size, but growth is limited. Many interviewees feel Norway is spending too little money on R&D compared to the OECD, but this may not be the reason behind the growth limitations. Existing funding streams are compartmentalised in a way that only few groups really have access to multiple resources. Research groups tend to be related to specific divisions and programs.

Occasionally one professor groups join forces into multi-professor groups, leading to more co-operation between these groups and co-ordination of research activities, but not leading to change of size or structure of the comprising one professor groups. Especially younger professors seem to be more willing to join forces.

We met few groups that have substantially reduced size over the last ten years. Some one professor groups were at crossroads and struggled to find new resources, or else would decrease in size or turn into individual research groups.

A rare or non-existing type of change is the switch to a matrix organisation. We met no groups who had made a switch from, say, multi-professor group to matrix organization. Considering the autonomy of professor ship and the many professors at the universities, we do not think it likely that such a switch would occur. We did however meet a few interviewees who either had a one-individual or a one professor group, and who reported that

for each project they seek co-operation with appropriate colleagues at their department. This is a characteristic that we adhere to matrix organization. But such situations differ from the matrix organizations that we encountered in that the combined activities of a group of one individual or one professor groups, are not co-ordinated by a kind of general group leader.

The continuation and changes of group type are complemented by continuation and changes of research themes. The compartmentalisation of funding in divisional structures and programs create spaces in which research groups can continue to work on the topic once they have found a place in the system. This is especially true for groups with access to specific program funding. Changes occur at project level and program level and seem to be inspired by scientific research, discussions and possibilities, but strongly constrained by funding opportunities as well. The funding policies of the main external funding body, RCN, imply that researchers have to cope with a level of unpredictability and unreliability in funding decisions. At the local level, and in relation to individual researchers, it seems that RCN's role is rather contingent on either peer commentaries and policy earmarks and not related to specific strategic objectives of the council. However, if we look at the three funding modes in their context and at an aggregated level, some more structural features - including features whose possibilities have not been exploited - of their role in the dynamics of Norwegian research can be distinguished.

7.2 PROGRAMME FUNDING

Different perspectives on programme funding are possible. First of all, programmes can bee seen as interventions in the dynamics of research to develop a specific field of research for scientific, industrial or political reasons. In its most extreme form a program could exert pressures to make groups to change the course of their research. Established groups do not often (about ones or twice in their existence) change course in their general research theme, and if so these changes have many reasons. The one researcher we met, who had to shift due to funding reasons, kept his primary but un-funded research interest alive with other means. In

other cases of scientists who shifted for other reasons also continued with their previous research theme one way or another. Furthermore all shifts were no major breaks, but shifts toward an area close to or related to the previous research theme. This means that if programme funding would have an effect on changing of established groups' research themes, the shifts probably will never be dramatic.

The relatively limited capacity of programmes to steer also seems due to the low level of a programme's activities besides granting applications. Two interviewees commended the programs in which they participated on these additional activities, but mostly interviewees perceive programmes as box-offices for their applications with no additional value to their own research.

Another role of programmes in the Norwegian research landscape is that these programs secure funding for specific purposes, reduce competition over resources within that area, and provide specific groups with a more stable income. In that respect, programme funding is located between institutional funding on the one side, and the more competitive free project funding and infrastructural funding on the other side. Considering the fragility of research groups in Norway and little possibilities for other external funding, programme funding in areas with long standing political and scientific interest contributes to the continuity of groups and the maintenance of research capacity in certain areas, rather than to changes.

Changes at system level can occur, when new programmes are created. Programme funding also enables the less established to become established in an area and/or provides them with a chance to demonstrate their scientific quality. Both may subsequently allow groups to apply for funding at other sources, either within or outside RCN. One of the young groups we interviewed had been able to develop in this way. The question arises whether such new groups indeed find a place and can survive after their respective programs have ended. Unless a follow up program is launched, this is unlikely, considering the dominance of RCN in the Norwegian research landscape. Indeed we found that once programs come in their final year, pressures arise to continue the programme and secure continuation of investments.

Scientists do not care too much about a programme's goals or backgrounds as such. They present a third interpretation of a program. Caricaturing: programmes are bags of money with

a label and a contact person attached to it. This is not to say that scientists do not know about the programme's goals or backgrounds, nor that they have no opinion about them. Neither do programme's goals or backgrounds by themselves persuade scientists to adjust their research projects. This leaves a pragmatic approach towards programmes, which includes adapting applications to fit a programme, for example by stressing different aspects or benefits in light of the programme. However, in view of the above and of a number of interviewees' reports, adapting a proposal does not necessarily mean adapting the research project. In other words, scientists adapt to the funding situation, and they do not leave it at adapting research proposals.

They also see possibilities in joining programme committees in order to influence the programme. Those who have experience with programme committees notice that membership enables them to better tune their proposals to the programme's aims and policies. Whether these strategies actually work is not a clear cut case, but they do show that scientists orient themselves on ways to improve success rates.

Scientists are aware that RCN occasionally has little choice but to follow Ministries' directions about spending the donated budgets. In general they acknowledge that R&D budgets have to do with politics or policies and organise themselves in order to influence those who direct RCN.

The point here is that programme funding - and for that matter all types of funding[24] - can not be viewed simply as a means external to science and used to steer science. Within Norway, programs also have a role in creating and maintaining a specific research capacity. Even if the objectives of programmes are not met, or little program management is done to increase the chance that objectives are met, programs still can be important. Scientists recognise this and involve themselves in many ways in the steering process, not only on the level of their own groups' research development, which is rather obvious, but also in all encompassing processes.

[24] The issues discussed here were only raised in connection to programme funding.

7.3 FREE PROJECT FUNDING

Free project funding is perceived as a kind of save haven or last refuge for scientists because free projects are granted based on scientific criteria only. If this is the case, then free project funding supports the quality of research. This probably means that the best are enabled to remain the best. However, compared to programme funding and infrastructure funding, there are relatively small funds available for free project funding. It is a safe but small haven. Even if you are the best, you may have difficulties to acquire free project money.

What we like to point out here, is that it seems that an overall effect of free project and programme funding in the Norwegian setting is that the range of research groups does not decrease. Building of new groups and growth is supported in particular areas, but groups do not disappear, at least not for funding reasons. At the same time groups are not able to grow beyond a certain size, nor seem to accumulate relatively large amounts of money when they depend exclusively on RCN funding.

7.4 INFRASTRUCTURE FUNDING

This type of funding provides relatively large budgets to granted research groups, and it allows far more freedom in spending than free project or programme funding do. In principle, SIP/SUP funding may support expansion of a group or it's research expenses beyond a certain limit. Like funding of any research council the funding is temporary. It seems that there are few mechanisms in place within or outside the RCN policies to sustain the increased size after the grant has ended. To secure the investments through SIP/SUP funding researchers should come in a position which enable them to succeed in funding competitions or universities and institutes should have policies that adopt the accomplishments. Researchers do like the freedom of investments SIP/SUP funding gives them, but it seems also to take away the incentive for researchers to find additional resources. There seems to be a risk that groups become less competitive in resource allocation, instead of more. In addition, we have found no indication that institutes and universities use this funding mode to build systematically

research capacity over longer periods, as part of the institutes or universities infrastructure as it were. On the contrary, there are indications that universities sometimes prevent group from acquiring follow up strategic funding and give other groups a chance. The result is, as is the case with the other funding modes and their combination, that a broad range of research groups is maintained and that accumulation of money only exists within a few research groups.

The funding types as portrayed above, each have a particular role in Norway's academic organization. These roles in a way have grown not just as a result of RCN’s policies it seems, but because they function within the broader landscape and in interaction with the kinds of groups that live in that landscape. That implies not only that these roles cannot be static, but also that their further development is not a matter of RCN’s policy exclusively, but also an issue for other actors Norway's research system.