TECHNOPOLIS

A Singular Council

Evaluation of the Research Council of Norway

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December 2001

"Folket vårt liver under strenge vilkår. Det lyt strida for å halde seg uppe og greida seg i tevlingi. I denne eksistensstriden treng me hjelp frå vitskapen. (...) ikkje berre naturvitskapen, men liks mykje åndsvitskapane lyt vera ein lekk i sjøvupphaldingsstriden åt eit slikt lite folk. (...) Det er ikkje um å gjera at det nye universitetet skal verta ein grannsam kopi av det gamle i alle ting. Det er tvertimot meir verdfullt å skapa noko sermerkt, so den nye høgskulen kann gjeva nye tilskot, fremda eit allsidugt kulturliv i samfundet og gjeva nye idear og tildriv til arbeids- og næringsliv."
Committee to investigate the creation of a university in Bergen, 1939

Preface

Thankfully, the conditions under which the Norwegian people live are not as harsh as they were in Bergen in 1939, but the challenges are as big and the need for knowledge to tackle them remains. The desire to make something special or singular – *noko særmerkt* – in the field of knowledge production persists.

The creation of the Research Council of Norway (RCN) has been one of the biggest and most exciting experiments in research funding of recent years. Evaluating that reform has been challenging and exciting in proportion. Many hundreds of people have helped the team in this task – far too many to name here – both inside and outside RCN. We have tried to impose on RCN as little as possible during the evaluation. Inevitably, however, people there have put a lot of effort into helping us – not least the divisional and top management team. We gratefully acknowledge all these efforts and thank the people involved. Without them there would be no data and no evaluation.

While, in general, we feel that the principle of 'no-one named, no-one forgotten' is a useful one, one person at RCN deserves our special thanks. Finn Simonsen has served as our official 'contact person' at RCN through the evaluation and has cheerfully helped us with a never-ending flow of questions and requests for help.

The reader can see from the cover of this document that a large number of people have been involved in the evaluation and that the organisation has therefore been complex. The Royal Norwegian Ministry of Education, Research and Church affairs (KUF), which commissioned this evaluation, wanted to have a single contractor (Technopolis) to be responsible for the work overall. In addition to those named as authors, a senior panel of international experts in research policy and management has actively supported the work of the team, making sure we were asking the right questions, debating emerging findings with us and quality-controlling many aspects of our work. The panel has showered us with advice, as well as generously putting up with our moments of less than perfect organisation, and we are grateful for its support. We also have to thank our small army of collaborators for their efforts and their professionalism, namely: Marianne Broch, Magnus Gulbrandsen, Johan Hauknes, Sybille Hinze, Egil Kallerud, Per Koch, Liv Langstedt, Paul Simmonds, Gunnar Sivertsen, James Stroyan, Randi Søgnen, Sarah Teather, Ben Thuriaux, Frank van der Most, Heidi Wiig, Alina Östling

The panel

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Chair

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Anders Flodström, KTH (S)
Jacqueline Godet, CNRS (F)
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Any remaining defects are, of course, strictly the responsibility of the authors.

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15 December 2001

Evaluation of the Research Council of Norway
Synthesis Report

Summary

When the Research Council of Norway (*Norges forskingsråd*) was established in 1993, by merging Norway's existing 5 research councils, parliament decided that it should be evaluated once it had had a chance to do its job for a few years. This evaluation fulfils that requirement, and has been prepared by an international team of research evaluation specialists, supported by a senior panel of scientists and leaders of research institutions.

Our mandate was as follows. (The full terms of reference are annexed to this report.)

> The evaluation of the Research Council of Norway is to cover the period from its establishment on 1 January 1993 to 31 December 2000, both dates inclusive. It shall give an overall evaluation of the Research Council in the light of the principal objectives laid down in the report to the Storting St. meld. nr. 43 (1991–92), recommendation to the Storting Innst. S. nr. 231 (1991–92), and the statutes (articles of association) of the Research Council.
>
> The evaluation shall analyse the connection between the Research Council's framework conditions, organisation and instruments, and the objectives laid down for its activities. Assessments shall be empirically grounded, among other things in the experiences of central groups of actors in the Ministries, research institutions, the commercial sector and the Research Council itself. In the light of this analysis, the evaluation shall consider what the Research Council's framework conditions should be, how the Research Council ought to be organised, and what steps the Council itself should take, so that one may be as well equipped as possible to meet the future challenges confronting Norwegian research.

We used a wide diversity of methods to assemble an empirical basis for the evaluation. This work is documented in 16 background reports. Key points are summarised later in this document.

Context
Knowledge is increasingly produced and used in diverse ways across the whole of society. No-one has a monopoly of knowledge production today, if they ever had one. It is increasingly important to cross disciplinary boundaries and to be able to relate the production of fundamental and more directly applicable knowledge together.

Learning takes place in networks with others, both nationally and internationally. Since those who learn necessarily have imperfect knowledge, a range of obstacles to effective knowledge production and use exists. The state has a need and a responsibility to clear these obstacles where possible, and therefore assumes several roles in managing the National Research and Innovation Infrastructure. These include

- Funding basic research
- Funding strategic research
- Promoting technological development
- Developing absorptive capacity, namely the ability to define research questions and make use of research results
- Acting as a 'change agency,' to help reconfigure national knowledge production assets, for example by funding new fields of research
- Doing 'bottleneck analysis,' identifying and analysing research and innovation policy needs

These tasks are pursued with varying intensity at different times. The role of the state is much more like that of a gardener than of an all-seeing planner. In the new Norwegian system, all of these tasks are allocated to RCN. The Norwegian system stands out internationally not only for this reason, but also for the detailed way in which sponsoring ministries manage RCN's activities, the integration of a policy advice role with operational work and the inclusion of a wide responsibility for research institutes in the mandate of a research council.

Norway faces important research policy challenges, which an holistic research council like RCN should be free to tackle. These include

- Overall, comparatively poor industrial performance, financed by revenues from primaries exports
- An industry structure biased towards low-R&D performing branches, and therefore aggregate business expenditure on R&D which is well below the level expected and needed in an economy as affluent as Norway's
- An old-fashioned and somewhat isolated university sector, probably out of balance with Norway's very large institute sector

The Finnish example of investing in R&D as a way out of economic crisis should be considered and imitated by Norway while it has the resources to make this investment. This would cover the likely value-creation gap between predictable national income and the level of income needed to sustain Norway's current and expected levels of economic and social welfare.

RCN Goal Fulfilment

RCN was set up with very ambitious (and rather diffuse) goals, which we have summarised as six tasks

- RCN shall produce useful national and sectoral research policy advice to the government, based on an holistic national perspective
- RCN shall fund research to meet social and industrial needs, taking account of users' needs and promoting the uptake of results
- RCN shall fund the high-quality basic and applied research needed in the national system of knowledge production, seeking to integrate the two as far as is appropriate while securing the place of basic research
- RCN is tasked with strategic responsibility for the research institute sector in Norway

- RCN is tasked with promoting the interaction of Norwegian knowledge production with the international knowledge production system
- RCN shall use appropriate and efficient processes (including evaluation) and organisational structures in performing its tasks

The amount and quality of policy advice RCN has been able to offer government has improved over time. Especially since 1998–99, government has been more receptive to such advice, and has given greater priority both to research policy and to funding research. RCN could usefully ask more dangerous questions in its advisory function, for example, about the balance of effort and scale among the different actors in the research-performing system.

RCN has a wide network of contacts to industry and the public service. It is less well connected to other stakeholder groups in society. Both the way in which some major research stakeholders have sought to by-pass RCN, and the absence of the more open style of Foresight process seen in many countries abroad these days, suggest that RCN could do better at being an **arena** where opportunities can be explored – including the kinds of major initiatives that have not fitted with the budget constraints over much of RCN's life.

RCN has a set of quality procedures in place, which aim to ensure that it funds research that has high scientific quality and that significant parts of its budget are spent on work that is socially relevant – both in the short and the long-term. A lot of the work it funds is fundamental. There is probably scope to focus this activity more in areas that have strategic relevance, and the growth of the Research Fund provides an opportunity to do so. The balance between strategic and completely 'free' research is political, and has not been properly debated in Norway (or, indeed, in many other places). Better integration between applied and more fundamental research requires more policy experimentation than RCN has so far been able to undertake. Better understanding the limits and opportunities for this kind of integration is an outcome we had hoped would have resulted from the RCN merger.

RCN was charged with a special strategic responsibility for most of the research institute sector, but only to a limited extent given the resources and freedom needed to exercise that role. It has achieved increased clarity about funding principles, tidying up the system and setting sensible rules. In the science and technology (NT) division, it is beginning slightly to affect the incentive system within which the techno–industrial institutes operate, but overall, RCN has limited authority with which to exercise its strategic responsibility.

RCN has been very active in setting up a plethora of bilateral international agreements, few of which have much content. More importantly, it has provided financial and coaching support to bring the Norwegian research community into the EU Programmes. Recently, it has started involving an international dimension in many of its activities, such as PhD funding. This is important progress, and can be backed up by further internationalisation of review processes and integration of research providers into international settings, where this gives advantage.

RCN operates a wide range of processes. There is probably more diversity than is actually necessary, and transparency would be served by greater consistency.

Especially given this diversity, RCN's administrative costs do not appear excessive. If anything, the council is under-staffed, given the shape of the current workload. Evaluation is not properly connected to the work of the council. Evaluations have too few consequences, and are barely connected into organisational learning.

History at RCN has shown that very similar organisational structures can provoke conflict or provide a setting in which people can muddle through. The divisions and the Executive Board, however, seem somewhat to inhabit parallel universes, talking to different groups outside the council and having separate concerns inside. It is only in the most recent years that new resources have begun to force these two levels into co-operation, so that overall strategy has practical meaning at the division and programme levels.

Achievement of Benefits from the Reform
The expected benefits of the reform were to

- Provide the government with an organisation to provide research policy advice, based on an holistic, national perspective
- Increase co-ordination in Norwegian research by taking responsibility for all fields of research, avoiding competition and gaps. Norwegian participation in international research co-operation and the development of policy for the research institute sector were explicitly mentioned as important areas for the council to tackle
- Improve integration between basic and applied research
- Provide a more efficient and un-bureaucratic actor at the research strategy level

RCN today has many achievements to its credit, but it falls quite a long way short of realising the challenging ambitions with which it began. Of course, imperfection is built into all human activity, but the fact that limited progress has been made is not a result of poor performance by RCN so much as of inconsistency between the aims and mission given to the Council and the means put at its disposal. The framework conditions under which RCN has operated for most of its existence mean that many of the more radical ambitions for the reform are simply 'mission impossible.' We cannot, therefore, think about changes at RCN without also considering the framework conditions.

When RCN was set up, it was, in effect, five research councils and an innovation agency, with a common umbrella council and staff. Given a birthday present of a large budget cut, followed by several years of apparent government indifference, the organisation locked itself in internal battles and budget struggles. While the public rhetoric was that of the new public management, the ministries were dragged into the conflict to defend their sectoral interests through micro-management. Neither the promised money nor the required autonomy were granted to RCN. Its inability to deliver the expanding budgets expected by the research community means that RCN is widely blamed for national failures of research policy.

Following the White Paper of 1998–99, there was a clear change at RCN. The end of the budget stagnation of the 1990s created the breathing space and 'slack' in the organisation to allow innovation in its policy instruments, and the beginnings of

improved horizontal cooperation. The delivery of the new research resources planned from this period is an absolute precondition for RCN to make further progress towards realising its goals as well as for the success of national research policy in addressing the considerable challenges we describe at the start of this report.

What Next?

We regard the creation of RCN as a big and very exciting experiment. No-one had really tried to find out before whether all the functions of research councils and innovation agencies could be combined into a single organisation. Our first reaction when we saw how little real integration had taken place during the life of the council was one of disappointment. We see two possible conclusions for our work. One is to say that, if it takes eight years to achieve only a modest movement towards an integrated research council, it is unlikely that such a goal will ever be achieved. Our other possibility is to say that the experiment is worth doing properly, and to make some suggestions about how the next stage could develop.

If the Norwegian government decides to stop the experiment now, the probable implication is that RCN should be split up into its constituent cultures. The result would look rather like the new Swedish research funding organisation, with an umbrella research council for basic research, an innovation agency and two or so applied research councils handling agriculture, fishing and the environment – areas which do not fit in a basic research council. An immediate effect will be to recreate the problems in tackling 'horizontal' things like the 1980s Main Action Areas, which led to the formation of RCN in the first place. It will probably be cheaper and quicker to cut RCN up than it was to create it, but the costs of another organisational change will still be very high, and should be measured primarily in the paralysis of policy development that takes place during such changes. RCN is filled with intelligent and competent people. Just as in 1993–1994, business as usual will not stop. But the next two or three major opportunities – the 'next FUGE,' for example – to improve Norwegian research will be missed.

However, we are not optimistic that the RCN experiment can succeed if it continues on an incremental basis. 'Stretch goals' are needed, in order to overcome the inertia caused by the existing divisional structure and the strength of the sectoral principle, which has so far defeated attempts to establish RCN as an independent agency of the state, in the way envisaged in the new public management. These goals must involve adapting RCN's structure to its mission and weakening the links to the sectors. Changes in framework conditions are a requirement for continuation of the work

- Delivery by government of the larger resources planned for research in the build-up plan towards the OECD R&D average. Management of these resources needs to be devolved to the Council, with a requirement that it report on their use. Micro-management would be counter-productive
- Higher quality research management in the ministries, more clearly distinguishing short and long-term needs and more actively engaging in debates about establishing themes in RCN
- The sectoral principle should be articulated, so that it is clear that ministries are responsible not only for obtaining short-term knowledge for policy implementation but also to ensure the availability of relevant research

capabilities. General funds for research should be ring-fenced in a greater number of ministries and passed to RCN without earmarking

- Increased freedom for RCN to manage the institute sector, for example to reallocate funding based on evaluation results
- Multi-annual commitment of research budgets
- A strong and permanent research policy champion, such as an extended RFU, at the highest level of government, able to support RCN and KUF in their efforts
- A specific and significant budget needs to be attached to the 'innovation agency' function, in which RCN should continue to co-operate with SND as its distribution and delivery partner

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1 Introduction

When the Research Council of Norway (RCN – *Norges Forskningsråd*) was established in 1993, parliament required that it should be evaluated after a period of time had passed, preferably by experts from outside Norway.[1] This evaluation fulfils that requirement, and has been prepared by an international team of research evaluation specialists, supported by a senior panel of scientists and leaders of research institutions. Two Norwegian research groups, NIFU and STEP, have supported the evaluation team by conducting surveys, collecting and analysing data. They have not, however, been involved in making evaluative judgements. Our evaluation is based on a large number of background reports (see box), which the interested reader can download[2] from the Internet. The evaluation team was selected by the Royal Norwegian Ministry for Church, Education and Research Affairs (KUF – hereafter 'education ministry') in open competition, following an international call for tenders and a period of negotiation. Members of the team were working on the evaluation for a period of a little over a year.

1.1 Our Mandate and Evaluation Questions

This evaluation has attracted a great deal of interest, not only in Norway but also abroad. The 1993 merger, which placed all Norway's research councils into a single one, has created a very unusual organisation. The central question is therefore: Did this work? More formally, our mandate was as follows. (The full terms of reference are annexed to this report.)

> The evaluation of the Research Council of Norway is to cover the period from its establishment on 1 January 1993 to 31 December 2000, both dates inclusive. It shall give an overall evaluation of the Research Council in the light of the principal objectives laid down in report to the Storting St. meld. nr. 43 (1991-92), recommendation to the Storting Innst. S. nr. 231 (1991-92), and the statutes (articles of association) of the Research Council.

We have broadly stuck to the time period specified in our mandate. However, a number of important new events have taken place during 2001, and we try to take account of these in reaching conclusions and recommendations. The change of government late in 2001 has sparked a reorganisation of ministerial responsibilities and some changes in policy, which affect research. We take no account of these, and

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1 "*Fleirtalet ser behovet for å få evaluert den nye organisasjonen når systemet har verka ei tid, gjerne av kunnige som står utanfor det norske miljøet.*" Innst. S. nr 231 (1991-92), s.5

2 www.kuf.dep.no until the end of 2001, thereafter www.ufd.dep.no or at any time from www.technopolis-group.com

use throughout the ministry names, which applied for most of the period of RCN's existence.

The specific evaluation questions were

> The evaluation shall analyse the connection between the Research Council's framework conditions, organisation and instruments, and the objectives laid down for its activities. Assessments shall be empirically grounded, among other things in the experiences of central groups of actors in the Ministries, research institutions, the commercial sector and the Research Council itself. In the light of this analysis, the evaluation shall consider what the Research Council's framework conditions should be, how the Research Council ought to be organised, and what steps the Council itself should take, so that one may be as well equipped as possible to meet the future challenges confronting Norwegian research.

1.2 The Goals and Tasks of RCN

The first two paragraphs of the RCN statutes set its goals and tasks. They are taken rather directly from the 1991–92 White Paper[3] that set out the government's intention to merge the research councils, and say (our translation)

> **§ 1. Name and objectives**
> The Research Council of Norway shall be a national executive and advisory agency. RCN is responsible for increasing the general knowledge base and shall contribute to meeting society's needs for research by promoting basic and applied research in all areas.
>
> **§ 2. Main Tasks**
> RCN shall develop its research policy and administer grants for research, based on guidelines drawn up by the government and parliament. RCN shall further provide advice as a basis for the development of the government's general research policy.
>
> RCN shall
> - Initiate research, which promotes the development of Norwegian industry and society
> - Contribute to the development of knowledge of humanity's common problems, especially problems related to the environment and development
> - Support researcher-initiated research, among other things by acting as a supplementary source of funding for the institutions, which perform basic research
> - Work to achieve a good balance between long-term basic research and use-oriented research
> - Work to ensure that user concerns are taken into account in applied research
> - Promote international research co-operation
> - Promote quality, efficiency and relevance in the research system
> - Initiate and use the results of evaluations of research and research institutions
> - Take strategic responsibility for the research institute sector in Norway
> - Promote the exploitation of the results of research by the state, industry and the general public

The documents that set out RCN's goals and responsibilities include the report of the parliamentary committee for KUF. This makes a somewhat stronger statement about the degree of independence that the Council is expected to have than other parts of the legislative package. Among other things, it says

[3] St. meld. Nr. 43, *Et godt råd for forskning. Om endringer i forskningsrådsstrukturen*, 1991-92

> The government will give RCN framework conditions that enable the Council to play an independent strategic role. In this connection, the government will ensure stability in the overall budgets given to RCN as it becomes established, and to ensure that the funding structure allows RCN to act as an independent strategic research agency.[4]

In other places, official papers stress more the need to maintain aspects of the sector principle. As we shall see, it is the sector interpretation rather than the idea of RCN as a strategy-making actor that has dominated.

1.3 The Government's Preliminary Evaluation of RCN

The research White Paper of 1998–99[5] included the government's own preliminary evaluation, much of which is consistent with our findings. The White Paper says that the main objective in setting up RCN was to create a strong advisory and executive institution able to handle research strategy across the whole of society. The expected benefits of the reform were to

- Provide the government with an organisation to provide research policy advice, based on an holistic, national perspective
- Increase co-ordination in Norwegian research by taking responsibility for all fields of research, avoiding competition and gaps. Norwegian participation in international research cooperation and the development of policy for the research institute sector were explicitly mentioned as important areas for the council to tackle
- Improve integration between basic and applied research
- Provide a more efficient and un-bureaucratic actor at the research strategy level

At the same time, the reform was expected to maintain diversity by

- Satisfying the needs of the sectors [ministries] and users to make use of research
- Promote the active involvement of all ministries in research and research policy
- Secure the place of basic research, among other things by providing an additional source of funding for university research

The new council was to promote both holism and diversity, advise both the government and individual ministries on policy, integrate basic and applied research while securing the position of 'free research' and reduce administrative complexity while consulting more stakeholders. As the White Paper tactfully put it, "A complex set of expectations lay behind the reform – where the challenge was partly to find the right balance between concerns which could pull in different directions."

The preliminary evaluation concluded that RCN had succeeded in reducing administrative costs. It had successfully supported the research institute sector and increased coordination of Norwegian participation in the European Union (EU)

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4 Innst. S. nr. 192 – 1992–93, p 5

5 St meld nr 39 (1998-99) *Forskning ved et tidsskille*

Framework Programmes for Research and Development (R&D). Integration between basic and applied research had improved, as had the evidence base for making research policy.

On the negative side, the preliminary evaluation concluded that there was scope for improvement in 'horizontal' coordination and cooperation among RCN's divisions. More attention needed to be paid to international co-operation outside the EU, including with less-developed countries. RCN's role as a policy advisor to the individual ministries could be improved.

1.4 This Evaluation and How we Interpret our Mandate

The first problem an evaluator faces is to understand the goals associated with the thing being evaluated. Our mandate does not set out the goals of RCN, but refers to no less than seven different documents which do so, spanning White Papers and legislation from 1991–1999, as well as the RCN statutes. The statutes themselves are the clearest statement of RCN's goals, but even they reflect in their wording a number of compromises between different factions. They imply not only that the council should work to make the knowledge and innovation systems work as well as possible, but also that resources are to be allocated in some 'fair' way among different parties. These two notions are, of course, mutually conflicting, as are several other aspects of the huge set of expectations and goals with which various actors have laden RCN over the past decade.

One of the best-known jokes in English is that the definition of a camel is 'a horse designed by a committee.' RCN's goals are, in this sense, most surely a new breed of camel – an understanding clearly shared by the drafter of the 1998–99 White Paper, whose sly humour we quoted above. It is not possible to make a coherent evaluation against this mixture of goals, hopes and compromises. We have therefore restated the goals of RCN and the reform that produced it as six tasks

- RCN shall produce useful national and sectoral research policy advice to the government, based on an holistic national perspective
- RCN shall fund research to meet social and industrial needs, taking account of users' needs and promoting the uptake of results
- RCN shall fund the high-quality basic and applied research needed in the national system of knowledge production, seeking to integrate the two as far as is appropriate while securing the place of basic research
- RCN is tasked with strategic responsibility for the research institute sector in Norway
- RCN is tasked with promoting the interaction of Norwegian knowledge production with the international knowledge production system
- RCN shall use appropriate and efficient processes (including evaluation) and organisational structures in performing its tasks

This provides a broad but controllable set of tasks against which we can evaluate RCN's performance. These tasks are quite similar to the taxonomy of state functions we develop in Section 2.3 of this report. RCN's responsibilities cover all of these, namely

- Funding basic research
- Funding strategic research
- Promoting technological development
- Developing absorptive capacity, namely the ability to define research questions and make use of research results
- Acting as a 'change agency,' to help reconfigure national knowledge production assets, for example by funding new fields of research
- Doing 'bottleneck analysis,' identifying and analysing research and innovation policy needs

In addition, RCN has been given the lead role in two specific areas: setting and implementing strategy for the research institute sector; and international co-operation.

1.5 Methods

We have been very fortunate in having significantly greater resources at our disposal than can have been possible for the preliminary evaluation team. Thanks to this, we have been able to establish a quite significant empirical basis. During the course of the evaluation we have

- Performed bibliometric analysis of overall publication patterns and of patterns in certain key fields
- Surveyed researchers in institutes, colleges and universities using a questionnaire
- Interviewed research groups in research and higher education institutions
- Interviewed rectors and directors of universities, colleges and research institutes
- Surveyed companies involved in RCN-funded user-oriented R&D projects, using a questionnaire
- Interviewed a range of small and large companies about their involvement with RCN
- Interviewed all the ministries except defence and justice about their research needs and the way they relate to RCN, as well as analysing related documents
- Brought senior scientists and scientific administrators from abroad to review RCN's six research divisions
- Studied and compared RCN's pattern of international research co-operation with that of other countries
- Studied and documented RCN's budgets, policy instruments and operations
- Conducted an extensive programme of interviews and data collection inside RCN, in order to understand how management and its key processes work
- Compared RCN's work in disseminating research results with practices in other countries
- Documented the history leading up to the creation of RCN from the five previous research councils
- Interviewed other agencies involved in promoting innovation, conducted document analysis and considered the division of labour between RCN and others

- Reviewed evaluation practice at RCN
- Reviewed the way in which RCN acts as a policy advisor on research
- Collected background information about research management in other countries, in order to contextualise the way RCN works

The time and resources at our disposal have nonetheless been limited, so we have inevitably had to be selective.

In general, no perfect tools exist to undertake evaluations. This is especially important in the case of such a wide-ranging and complex, systemic evaluation as this one. We take account of this by using multiple methods, and looking for convergence among the findings that result. In some cases, where findings conflict, we have to consider in-built limitations in the individual methods. It is not, therefore, possible simply to map from the background reports listed above to the findings and conclusions of this synthesis. A degree of judgement is involved, and we have tried to make this as explicit as possible.

We have tackled RCN's mission in relation to science, the university sector and the economy. What we have not tackled, but also find little evidence of, is a similarly direct RCN role in relation to societal sectors like health, education, justice in another way than via the government. There appears to be a very strong idea in Norway that the government represents these sectors, and our interviews with ministries confirm that they share this view. We return to this question in our conclusions.

1.6 Road Map for the Report

We cannot evaluate RCN unless we have a clear idea of what we would expect an all-embracing research council to do and unless we understand the context in which it works. In the next Chapter, we therefore explore the way knowledge is produced and the roles that the state needs to play in helping develop the national system of knowledge production and use. The Chapter ends by moving from generic questions to the specific: Is the way RCN has been constructed unusual in an international context? Chapter 3 explores the specific Norwegian situation. What are the major research and innovation policy challenges that face RCN and others in Norway?

Having equipped ourselves and the reader with the needed background understanding, we can then start to explore how RCN has been doing its job since 1993. Chapter 4 describes the pre-history of the Council and the legacy left by policy decisions at and before the time of its birth. It goes on to describe the instruments RCN uses and the way it spends money.

The bulk of our effort in this evaluation is reflected in the various background studies. Chapter 5 summarises what we found. Since we are using an approach involving parallel methods, some of the evidence from different sources is conflicting, and this is reflected in Chapter 5. This means that Chapter 5 is **not** our evaluation but a collection of **inputs** to our evaluation. Correspondingly, bits should not be quoted out of context from Chapter 5, as if they were our evaluation: they are not. (Journalists, especially, take note!)

Chapter 6 **is** our evaluation. There we answer the evaluation questions put to us in our mandate. Finally, in Chapter 7 we make some suggestions about the future.

2 Are Research Councils Necessary?

Some people ask whether it is necessary to have research councils. Why not give all the research money directly to the universities and institutes, and let them get on with their jobs? This is a good question, and if we are to evaluate RCN it deserves an answer. In this chapter we therefore briefly look at current research and theory about knowledge production and use, and describe the key roles the state needs to perform to ensure the health of the national research and innovation system. Once we have done that, we have the equipment to describe the functions that RCN is expected to play within that system. We can then also consider whether the current way of organising these functions into a single organisation in Norway is internationally unusual.

In the next Chapter, we will move the focus to Norway's specific national needs.

2.1 Knowledge Production

In this section,[6] we discuss the ways in which research-based knowledge is produced and how these relate to the idea of basic science. This is important, not least because securing the position of basic science is one of RCN's key jobs. We then talk about the way new knowledge is used in society. Most of the available research about this focuses on economic production.

For the past half century, much of the research community has claimed a special status for basic research as an activity that stands outside society and at the same time brings social and economic benefits. These benefits cannot be programmed, they say, because they arise in random ways. It seems odd to those of us who have lived with the term all our lives, but this idea of 'basic research' is actually rather new[7]. It seems to have become popular following Vannevar Bush's 1945 report to the US president, *Science: The Endless Frontier*, where he argued that the United States should establish a national research foundation.[8] The Second World War had provided powerful demonstrations of the power of science, systematically applied in the service of the state. Society could put the results of science to good or bad use – and certainly science could provide huge contributions to peaceful development – but science itself was neutral. 'Basic research' became that part of science, which was disconnected from society.

In some countries, research councils had existed before the War, and used largely scientific criteria in allocating funds. The great expansion in science funding came

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6 Many of the ideas presented in this section are discussed in more detail in Erik Arnold and Martin Bell, *Some New Ideas about Research and Development*, report to the Hernes Commission, Foreign Ministry, Denmark: 2001, which can be downloaded from www.technopolis-group.com or from the Danish foreign ministry's web server, under DANIDA

7 Of course, it also connects back to the movement towards the fundamental initiated in the German universities in the 19th Century, not least by von Humboldt at the University of Berlin. 'Basic science' is one of several terms which competed to describe this type of longer term research activity

8 see Egil Kallerud, 'Basic research: in a state of crisis?' in Egil Kallerud (ed), *Basic Research in Innovation and Science Policy*, Oslo: NIFU, 1998

after the War when new research councils sprang up and provided expanded arenas where the scientific community could itself allocate resources to research, based on scientific not social criteria. The state provided patronage via these councils, in the expectation that the science they funded would eventually be useful. The Sputnik shock provided an additional impetus. Many countries made big investments in research and higher education during the 1950s and 1960s, with the expectation that this would increase wealth and social welfare.

Arie Rip points out that the post-war social contract with (basic) science was largely stable until the 1970s. Under this regime, the state provided patronage by delegating its responsibilities to research councils, which were largely captured by the scientific community itself. As a result

> Scientists definitely acquired an entitlement attitude: it was their right to be funded, and to be funded on their own terms…. Life on the Endless Frontier was competitive, but competition was kept within bounds by new traditions of patronage [from research councils]. Scientific establishments … could reproduce themselves, and did so (up to reproduction of gender asymmetries). The incestuous element in such a set-up reinforces the risk-aversive tendencies of the funding agency as a bureaucracy… The importance of novelty is recognised and enshrined in the criterion of 'originality.' But to actually get scarce resources awarded to far out proposals is not easy in the multi-layered systems, where scientific establishments as well as bureaucratic accountability must be honoured.[9]

From the 1960s and 1970s, however, new social unease about the role of science appeared. Nuclear energy, the peaceful face of the atom bomb, turned out to be dirty and dangerous after all. The environment was more generally seen to be suffering from the effects of science-based industry, and people began asking just what scientific neutrality meant in the context of weapons development for the Vietnam War. As the Cold War receded, governments became more interested in promoting technology for competitiveness. Some governments, especially in northern Europe, began to wonder about the practical applicability of the social sciences. As a result, over the last 20–30 years, there has been a shift away from the idea that scientists should be supported as autonomous truth-seekers and towards the idea that they should orient their work rather more towards social and economic objectives. They have less autonomy than in the 1950s and 1960s, and are held more accountable. In effect, the nature of the social contract with the research community has changed.

'Basic research' survives as a term in common use, but is one that has many meanings.[10] Scientists use the term variously to mean

- Research that is in some way 'fundamental' and underlies other knowledge[11]
- Research guided purely by the researcher's curiosity. (This is the basis of the OECD definition, used in the collection of research statistics)
- Research that is a long way from application

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[9] Arie Rip, "Aggregation machines – A political science of science approach to the future of the peer review system," (mimeo), University of Twente, 2000

[10] Jane Calvert and Ben Martin, 'Changing conceptions of basic research?' Background document for the OECD workshop on policy relevance and the measurement of basic research in Oslo, 29-30 October 2001; Brighton, SPRU

[11] An idea we can trace back to the long-vanished 'logical positivist' school in philosophy, which believed that all knowledge was ultimately reducible to physics

- Research done in public research institutions
- Research on which there are no limits to publication
- Work in certain scientific fields (physics, chemistry, etc)

There seem to be two important reasons why the term remains current. First, it is an established statistical category. This makes it an object of study and gives it longevity.[12] More important, it was the central rhetorical concept in the *Endless Frontier* vision of asocial science, and it remains the key concept used by the communities which benefited from the science policies of the 1950s and 1960s in defending their funding and their lifestyle. In certain cases it is being used to try to retake 'funding territory' from more socially oriented categories of research.[13] This is a live question in Norway.[14] In these discussions, 'basic research is effectively equivalent to 'researcher-directed' (*forskerstyrt*) as opposed to 'user-directed' (*brukerstyrt*) research, conducted for the benefit of an institution such as a ministry or a company, who intend to do something with the research results. The issue is not what is done but who decides to do it and, crucially, the extent to which the taxpayer is willing to be a patron, rather than a customer, for research.

The related issue, fundamental for how a body such as RCN is organised and does its work, is not only **who** makes knowledge but **how** they do so. Gibbons and colleagues[15] have brought together a lot of recent thinking about this in a distinction between two modes of knowledge production. We have summarised their distinctions between the two modes of knowledge production in **Exhibit 1**. This is a simplification[16] of a complex reality, but one that gives us some useful concepts for tackling policy and research administration.

Mode 1 is disciplinary science, and can often be basic science, though applied science can be done in Mode 1, too. Its logic comes from its internal organisation and control mechanisms. Its institutions tend to be centralised and stable. In terms of education, Mode 1 tends to provide 'basic training' and a disciplinary 'entry ticket' (such as a PhD) for people to qualify as credible researchers in either Mode. However, Mode 1 is not the same as 'basic science.' Research that is in some sense fundamental or long-term can be done in either Mode.

Mode 2 includes not only the practice of applied science in universities and other research institutions but also the generation of research-based knowledge elsewhere in society. Mode 2 work tends to be transient. It forms and re-forms around applications problems. Calling on different disciplines and locations at different

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[12] B Godin, 'Measuring science: Is there 'basic research' without statistics?' Project on the History and Sociology of S&T Indicators, Paper No 3, Montreal: Observatoire des Sciences et des Technologies INRS/CIRST, 2000

[13] See, for example, *Slutbetänkande av kommittén för översyn av den svenska forskningspolitiken* (Forskning 2000), Stockholm, 1998 - Final report of the Committee to Review Swedish Research Policy (Research 2000)

[14] see Det Norske Videnskaps-Akademi, *Norsk forskning ved sekelskiftet: Tid for gjennomtenkning*, Oslo: Det Norske Videnskaps-Akademi, 1999

[15] Michael Gibbons, Camilla Limoges, Helga Nowotny, Schwartzman, S., Scott P. and Trow, M., *The New Production of Knowledge*, London: Sage, 1994

[16] Gibbons and colleagues also get their history wrong, claiming that Mode 2 is new. In fact, it is Mode 1 that is historically new, while Mode 2 is the traditional form of science, as practised for many hundreds of years

times, it is hard to centralise. Since Mode 2 work is performed in an applied, social context, it is normally subject to social and economic evaluation, and not solely to traditional quality reviews by scientific peers. To the occasional irritation of those used to the Mode 1 tradition, this means that relatively frequent evaluation – in part by non-scientists – is normal in Mode 2 work, and has become part of the new social contract between scientific researchers and society.[17]

Exhibit 1 Mode 1 and Mode 2 Knowledge Production

Mode 1	Mode 2
Problems set and solved in the context of the (academic) concerns of the research community	Problems set and solved in the context of application
Disciplinary	Transdisciplinary
Homogeneous	Heterogeneous
Hierarchical, tending to preserve existing forms of organisation	Heterarchical, involving more transient forms of organisation
Internal quality control	Quality control is more socially accountable

The sharp distinction between Mode 1 and 2 can make it seem as if they are alternatives. Many researchers, however, do both, so they take closely related research problems to different research agencies to ask for funding.

In recent years, new technologies have enabled rapid economic development. Many are ones that we think of as 'hyphen' fields[18] such as opto-electronics, bio-engineering, nano-technology and so on, where an explicit or implicit hyphen shows that the field works across the boundaries of more traditional disciplines. These new growth fields are essentially Mode 2 activities. Research funding for them would tend to be ruled out by the internal rules of disciplinary Mode 1 science. The massive use of science and technology in industry and the increase in industry's links with external research which has brought the share of Gross Domestic Product (GDP) devoted to R&D up to almost 4% in extreme cases like Sweden, involves mostly Mode 2 activity.

This represents an important challenge to research policy and funding bodies. Especially in fields like biology and Information and Communications Technology (ICT), fundamental and more short-term research problems are increasingly being tackled in parallel. Over the last 20 years, engineers in industries that make complex products have begun to design different parts of these products at the same time – so-called concurrent engineering. As they need to tackle more fundamental problems at the same time, we can begin to talk about **concurrent engineering and science**.

Generally, when the state becomes involved, the Modes have had different funding and evaluation mechanisms. Mode 1 is underpinned by the part of the funds going

[17] Ben Martin, Ammon Salter et al, *The Relationship Between Publicly Funded Basic Research and Economic Performance*, report to HM Treasury, Brighton: Science Policy Research Unit, 1996

[18] Following Frieder Meyer-Kramer

directly to universities that are intended for research. By and large, traditional research councils are also organised according to the rules of Mode 1, with scientific quality being the main criterion used in setting priorities – deciding who gets money and who does not. Some research councils have been grappling with the new 'hyphen' fields by funding themes in addition to (or, sometimes, instead of) disciplines. Funding sources for Mode 2 are much more diverse. They are more liable to include intended users of research than in Mode 1, where research is more often funded via patronage.

Traditional universities and research councils are systematically liable to both the strengths and the weaknesses of Mode 1. Strengths include stringent and mostly transparent quality control procedures and the ability to build an immense, interesting and often useful body of knowledge over time. Weaknesses include domination by the intellectual and institutional conservatism of the research establishment, slowness to change and difficulty in recognising values outside the scientific core. Collegial decision-making and the use of peer review to distribute resources reinforce the conservatism of Mode 1 science. This leads to problems, notably when research funders and performers react too slowly to the emergence of new fields and opportunities.

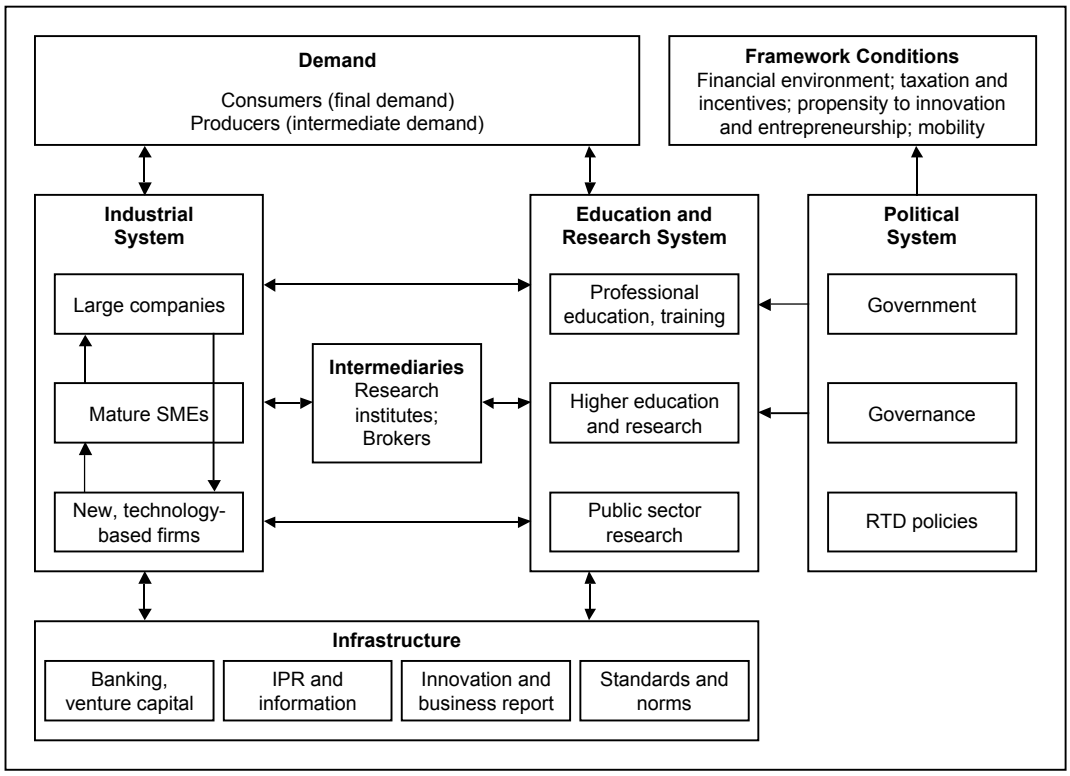
2.2 The National Research and Innovation System

Over the past ten years or so, there has been a revolution – a 'paradigm shift' – in the way we understand the relationship between research, innovation and socio–economic development. Conventional, neo-classical economics viewed firms, in effect, as autonomous and rational robots using perfect information. In the context of technological change, much of the traditional, neo-classical framework has been superseded during the 1990s, through a convergence of evolutionary economics (which stresses firms as 'learning organisations') and research on the innovation process.

Exhibit 2 sketches what **we** mean by a 'National Research and Innovation System' (NRIS)[19]: namely, all the actors and activities in the economy which are necessary for industrial and commercial innovation to take place and to lead to economic development.

[19] This is generally called a National Innovation System in the literature – essentially because the key authors are researchers on questions to do with economic innovation. This is a very unhelpful name, since all three words are misleading. In fact, such systems can be regional and international as well as national. They incorporate the whole of knowledge production and consumption, not just economic innovation. And they are only 'systems' in the sense of many things being connected together. They are not systems in the sense that their behaviour can readily be predicted and controlled.

Exhibit 2 Major Components of a National Research and Innovation System



The current orthodoxy is that economic well-being is founded on a well-functioning NRIS, in which not only the actors shown in **Exhibit 2**, but also the links between them, perform well. In contrast to earlier views, which focused on entrepreneurs as individual heroes, innovation and learning are now seen more as **network** or collective activities.

The new NRIS[20] approach stresses the idea that firms and other economic actors have 'bounded rationality.' This makes knowledge, learning and institutions key to overall economic performance. In the new view, economic actors are no longer autonomous robots, but are deeply interwoven into the economic fabric. The unit of analysis is no longer only the individual firm but also the 'system' of networks within which firms operate. National economic performance is explained as the performance of this total system.

A second key idea, which stems from the central role of learning, is that of historical **path dependence**. What a company or institution can do today depends upon what it could do yesterday[21] and what it has learnt in the meantime.[22] Another implication of path dependence is **co-evolution** among institutions such as funding agencies, which

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[20] See Christopher Freeman, *Technology Policy and Economic Performance: Lessons from Japan*, London: Frances Pinter, 1987; Bengt-Åke Lundvall, *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter, 1992; RR Nelson, *National Innovation Systems*, New York: Oxford University Press, 1993

[21] Nathan Rosenberg, *Perspectives on Technology*, Cambridge University Press, 1976

[22] Bengt Åke Lundvall (ed), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter, 1992

strive to improve their performance within the existing institutional division of labour. As a result, they adapt to each other's presence and different National Research and Innovation Systems develop different institutional ways to achieve similar ends. As Edqvist argues[23] "the notion of optimality is absent from the systems of innovation approaches. Hence, comparisons between an existing system and an ideal system are not possible." The NRIS approach is nonetheless normative, in the sense that it claims that certain system characteristics – such as strong network links between actors – are likely to improve performance.[24]

2.3 The State in the National Research and Innovation System

States fund research for a wide range of reasons, sometimes including pure curiosity and cultural motives, in addition to the pursuit of wider social and economic goals. All research funding can in this sense be thought of as 'instrumental': society has an interest in the outcomes.

The new view of institutions, and therefore of markets, leads to new and different rationales for government policy. The idea that 'market failure' leads to under-investment in research[25] has been the principal rationale for state funding of R&D since the early 1960s. As our earlier discussion of basic science and research funding shows, governments had been funding research long before the economics profession produced a reason. The idea behind 'market failure' is that capitalists invest too little in research because the uncertainties are too great and it is difficult to monopolise the new knowledge that results. Arrow's argument was particularly relevant to more generally applicable forms of knowledge.[26]

The market failure approach assumes away key deficiencies of real institutions, not least what we many years ago called 'capability failures'[27] as well as failures in systems. More recent developments in theory do not invalidate but extend this idea of market failure.[28] We can think of these failures as belonging to four types

- **Capability failures.**[29] These amount to inadequacies in companies' ability to act in their own best interests, for example through managerial weakness, lack

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23 Charles Edqvist (ed), *Systems of Innovation,* London: Frances Pinter, 1997

24 Rodrigo Arocena and Judith Stutz, 'Looking at national systems of innovation from the South,' *Industry and Innovation*, Vol 7, No 1, June 2000, pp 55-75

25 Ken Arrow , 'Economic Welfare and the Allocation of Resources for Invention,' in Richard Nelson (Ed.) *The Rate and Direction of Inventive Activity*, Princeton University Press, 1962; see also Richard Nelson, 'The simple economics of basic scientific research,' *Journal of Political Economy*, 1959, vol 67, pp 297-306

26 His argument is conceptually flawed (actually, circular). It simply **assumes** that there is under-investment in basic research compared with an imagined welfare-economic optimum. It makes this assumption because it implicitly accepts the 'linear model' account of the role of science in economics and development promoted by Vannevar Bush and others: the idea that basic science causes technological and eventually economic development. In fact, no one has observed or calculated what such an optimum would look like

27 Erik Arnold and Ken Guy, 'Diffusion policies for IT: the way forward,' OECD/ICCP Expert group on the economic implications of Information Technologies, Paris: OECD, 1991

28 see Keith Smith, 'Innovation as a systemic phenomenon: rethinking the role of policy,' Enterprise and Innovation Management Studies, 1,1, 2000, 73-102

29 For analysis, see Erik Arnold and Ben Thuriaux, *Developing Firms' Technological Capabilities*, report to OECD, Brighton: Technopolis, 1997, which may be downloaded from www.technopolis-group.com

of technological understanding, learning ability or 'absorptive capacity'[30] to make use of externally generated technology

- **Failures in institutions.**[31] Not only companies but also other social institutions such as universities and research institutes, patent offices and so on need to work well if the NRIS is to facilitate innovation and growth. Rigid disciplinary orientation in universities and consequent inability to change with changes in knowledge would be an example of such an institutional failure. Failure to provide adequate investment in knowledge institutions would be another
- **Network failures**. These relate to problems in the interaction among actors in the innovation system, and can themselves be of several types
  - Inadequate amounts and quality of interlinkages, as where there is low trust among companies or where universities are isolated from their social context
  - 'Transition failures' and 'lock-in' failures, where clusters or innovation systems fail or take on board new technological opportunities or remain locked into old ones[32]
  - Various problems in industry structure, such as too intense competition or monopoly, which stifle innovation, or the absence of key complementarities (such as when a cluster's development is stifled by the lack of a crucial type of producer)[33]
- **Framework failures**. Effective innovation depends partly upon regulatory frameworks, health and safety rules etc as well as other background conditions, such as the sophistication of consumer demand, culture and social values.[34] Deficiencies in these frameworks can have negative effects on innovation and economic performance

These failures justify state intervention not only through the funding of research, but more widely in ensuring that the NRIS performs as a whole – always provided that in an individual case the state is actually capable of reducing failure. Because systems failures and performance are highly dependent upon the interplay of characteristics in individual systems, there can be no simple rule-based policy as is possible in relation to the static idea of market failure.[35] Rather, a key role for state policy making is 'bottleneck analysis' – continuously identifying and rectifying structural imperfections.

If we bring together these arguments, we can identify a small number of key roles for the state in supporting both innovation and research and in maintaining this web of interrelationships in knowledge generation (**Exhibit 3**).

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30 W Cohen and D Levinthal, 'Absorptive capacity: a new perspective on learning and innovation,' *Administrative Science Quarterly*, No 35, 1990, pp 128 - 152

31 This is similar to the idea of 'hard institutional failure' discussed by Bo Barlsson and Staffan Jacobsson, 'In search of useful public policies: Key lessons and issues for policy makers,' in Bo Carlsson (ed) *Technological Systems and Industrial Dynamics*, New York, Kluwer Academic Publishers, 1997. Their 'soft institutional failures' correspond to part of our 'framework failures'

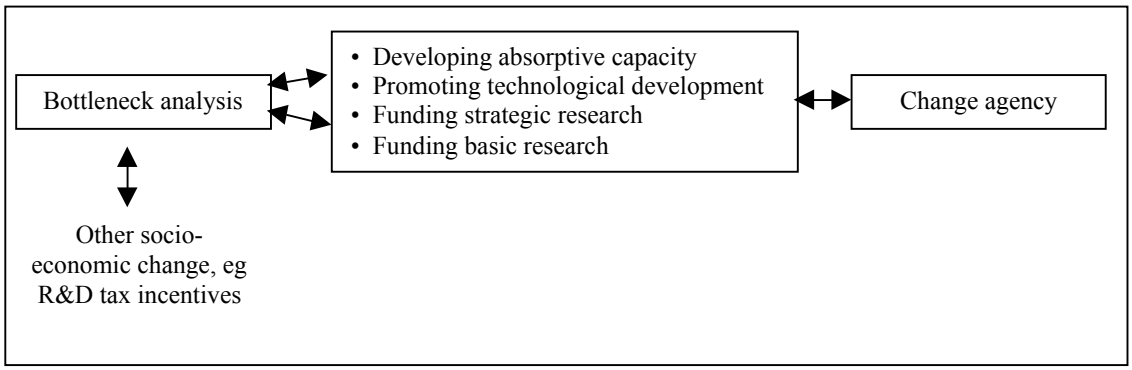
32 Keith Smith, 'Economic infrastructures and innovation systems,' in Charles Edqvist (ed), *Systems of Innovation: Technologies, Institutions and Organisations*, London: Cassel, 1997

33 Franco Malerba 'Public policy and industrial dynamics: An evolutionary perspective,' in Charles Edqvist (ed), Systems of Innovation: Technologies, Institutions and Organisations, London: Cassel, 1997

34 Smith, *Ibid*

35 Johan Hauknes and Lennart Norgren, *Economic Rationales of Government Intervention in Innovation and the Supply of Innovation-Related services*, STEP Report 08 1999, Oslo: STEP Group, downloadable from www.step.no

Exhibit 3 Institutional research and innovation support roles



These roles are

- **Developing absorptive capacity**. This involves fostering the capabilities that companies and other institutions need in order to make good use of knowledge. It overlaps with education policy, because the number of qualified scientists and engineers employed by organisations increases with their absorptive capacity. It also overlaps with business development support, because the best technologist in the world cannot rescue a company from bad management
- **Promoting technological development**. As the discussion of the NRIS showed, there are several types of systemic failure, which impede the development of technology and its productive use. Promoting technological development therefore involves to a considerable extent being a **change agent**. A key part of this role is to ensure the proliferation of linkages between actors and of variety in the system
- **Funding strategic research**. Equally, it is necessary to make choices about where to build up capabilities in the research system, not least because this produces the manpower that is needed elsewhere in the economy. Like the technological development function, this involves a kind of **change agency**, working to alter the structure of the research system. Once the shape of the national investment in strategic research has been altered, it is possible to withdraw the transitional funding and allow the quality-driven values of the research system to determine the amount of effort invested
- **Funding basic research**. The market failures associated with basic research still persist, justifying the state's investment. Generally, the basic research funding systems have been left to operate within the peer-review-based ideology of the *Endless Frontier*. As long as the strengths of the national research infrastructure correspond to the needs of national 'users' of knowledge, it is easy for basic research to be useful because basic research is at the same time strategic research
- **Bottleneck analysis** is a crucial function of the state. This provides the overall 'intelligence' to decide where and how to intervene. It is unlikely that

the bottleneck analysis function can be centralised[36] to a single place. Rather, multiple sources of intelligence will be needed to inform policy makers about needs at different points of the innovation system, so bottleneck analysis needs to involve **arenas** where new ideas and analyses can be considered

It is central to the idea of the NRIS as a dynamic, learning thing that the state can not be doing all these things with equal intensity all the time. Reality is so complex that it defeats attempts at comprehensive planning. The role of the state is like that of a gardener: intervening now and again to change the shape of things, fertilising, weeding, but for the most part leaving the garden to grow. In addition to its role as a manager (or gardener) in the NRIS, the state may develop R&D policies for its own purposes: in its role as a user of research.

2.4 Is RCN Unusual?

It is hardly surprising that there are many similarities among research funding systems in different countries. They serve broadly similar functions, so we would expect similarities in their evolution. The technical and scientific communities they serve are highly international, and – not least through the work of the OECD over several decades – they regularly compare themselves with each other, promoting the spread of good practice, in so far as this is portable between different situations.

The use of councils to manage and distribute funds for research is standard internationally, providing mechanisms for quality control, strategy and accountability to the taxpayer. While it is contentious in parts of the Norwegian research community, an aspect where RCN does not stand out internationally is the use of programmes to implement research strategies. The growth of programming in Norway over the last twenty or so years reflects the similar change in international practice.

RCN and the Norwegian system are nonetheless different in certain respects

- The RCN structure itself – bringing the bulk of the state's research funding functions together in one organisation
- In particular the integration of a technology and innovation agency and other sectoral or user-oriented functions with a research council
- Detailed control of research council activities by their sponsoring ministries. The level of detail with which the Norwegian ministries instruct RCN is very unusual
- Integration of the science policy advice and research funding roles. Generally, these are kept apart, because research funders have an institutional interest in asking for more money, and this means they have a conflict of interest when giving policy advice
- Integration of wide responsibility for managing research institutes with the role of research council

[36] In Norway, for example, we can identify such activities at both the level of the strategy division and individual research divisions in RCN, but also at SND, NIFU, STEP NHO, LO etc

The clearest difference between the Norwegian situation and that elsewhere is in the **RCN structure** itself. This construction is indeed singular. Other funding systems vary in their degree of fragmentation, but nearly all spread the functions of RCN across different institutions. The Dutch research council NWO contains an innovation funding sub-council – STW – which is jointly financed by the ministries of science and economic affairs. However, the economic affairs ministry has a large and separate set of activities in funding innovation, and the sectoral ministries separately look after their own needs. New Zealand has separate funds for academically oriented and other research. Some systems, like the British, have a handful of comparatively free-standing research councils, each tackling a group of disciplines, while the ministries separately procure research to meet their policy needs.

In several countries, academic or basic research councils are organised under an umbrella, such as the Finnish Academy, the Swedish *Vetenskapsråd*, the *Deutsche Forschungsgemeinschaft*. There are mixed models, such as in the USA, where there are separate councils for medicine (National Institutes of Health), humanities (National Endowment of the Humanities) and the sciences (National Science Foundation – which is, in turn, split into large directorates, each handling a cluster of disciplines). In some cases, we see 'sector' councils standing outside the science and humanities research council system. For example, in Sweden two research councils stand outside Vetenskapsrådet. These are the Research Council for Environment, Spatial Planning and Agricultural Sciences (FORMAS), which is under the tutelage of the ministries for agriculture and environment, and the Research Council for Working Life and Social Sciences (FAS), which answers to the ministries of industry and health and social affairs.

Integrating user-oriented funding with more traditional research council funding is the key point of difference between RCN and international practice. The most important reason why there is international interest in RCN and this evaluation is that RCN aims to integrate two very different R&D cultures. On the one hand, it handles research in the university and research institute sectors, where the overriding value is **scientific quality**. On the other hand, it also tackles R&D for industrial and policy uses, where **relevance** to the needs of the user is very important, and where this may be traded off against quality and other aspects in deciding what is to be funded. In other systems, there is a rigid separation between these functions. Thus, in Sweden, there are separate agencies for innovation and technological development (VINNOVA) and business development (NUTEK). In Finland, TEKES, the Technology Centre of Finland, promotes technological development through funding a mixture of university, research institute, and industry projects – sometimes funding single actors; at other times funding networks of researchers and companies. In Holland, most industrial innovation and R&D funding is provided through programmes of the ministry of economic affairs (EZ). In New Zealand, Switzerland, Germany and the USA this separation is maintained. The UK's Engineering and Physical Sciences Research Council (EPSRC) does integrate industrially oriented initiatives into some of its programmes, and co-sponsors 'LINK' programmes of joint industry–academic research with a range of sector ministries. But there is little organisational integration.

While other countries do not generally try to integrate the research council and technology agency or user-oriented research funding roles, there are some signs that

this may be changing. The inclusion of a minority of user-relevant research within NWO and EPSRC are early indications. Denmark has recently proposed[37] to build an integrated research funding structure similar to RCN. In Finland, the recent additional appropriation for research, which was given to the Academy of Finland and TEKES as a short-term increase in budget, encouraged them to begin experimenting with aligning programmes. For example the ETX and TLX programmes of industrial R&D in microelectronics and telecommunications have been run in parallel with the Academy's Telectronics programme, which handles longer term issues in the same areas. Telectronics supports many of the same academic groups as are active in ETX and TLX. This involves examples of the 'concurrent engineering and science' we discussed earlier.

As regards **detailed control of research council activities by sponsoring ministries**, in most other countries the scientific research councils – and often also those funding user-oriented R&D – are subject to very little direct control by their ministry masters. For them, a major reason to create such intermediary funding agencies is to distance the research funding agencies from the day-to-day concerns of the ministries. When ministries have research questions, they tend to go to the contract research market or to semi-captive research institutes for answers. Innovation and technology agencies tend to be liable to more detailed ministry control, because they are bound up in wider industry and development policies. 'Sector' agencies do not exist in all systems. Where they do, ministries tend to keep them rather at arm's length, precisely because they exist as distancing mechanisms.

We have not been able to identify another case where the role of being the **government's main advisor on research policy** is integrated into a research council. In the UK, the Office of Science of Technology and the Chief Scientist take aspects of this role. (OST is formally part of the Department of Trade and Industry. It was originally set up as part of the Cabinet Office, and largely behaves as if this were still the case. It is still physically separate from the rest of the DTI.) Germany has no single policy advisor, but a number of more specialised advice functions such as the *Wißenschaftsrat* and various alignment bodies such as the '*Bund-Länder Konferenz*' and the '*Presidentenrunde*.' Sweden has a research policy function attached to the cabinet, as well as dedicated research institutes. In Finland, this role is played by the Science and Technology Policy Council. This is chaired by the Prime Minister, and effectively makes decisions **above** the level of the ministries, forbidding inter-ministry[38] conflict. Holland has multiple sources of advice. There is a national Advisory Committee on Science and Technology Policy (AWT), but also several sectoral advisory councils (ACRs). In addition, the Royal Dutch Academy of Arts and Sciences – KNAW – is a respected source of research policy advice.

While RCN has responsibilities for managing strategic aspects of **the research institute system**, this is unusual among the medium and large economies. Finland and Germany have large, multidivisional institute structures with central administrations, which are largely self-managing. These include VTT and in

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[37] Danish Research Commission, Report of the Danish Research Commission, No 1406, Copenhagen: 2001

[38] This is an important advantage. In many countries there is a long-running battle between the education and industry ministries for control of research funding. Making decisions above the level of the ministries is a way to create a common purpose

Germany the Fraunhofer and Max Planck institutes. In the Netherlands, the applied institutes are grouped together in large, multi-functional organisations (of which TNO is the largest). From the 1980s onwards, the more basic research institutes have either been linked to the universities or – where independence from the university sector is important – to the Royal Dutch Academy for the Arts and Sciences (KNAW) or the research council (NWO). The UK pattern looks rather *ad hoc*, with privatised state laboratories and various Research Association institutes being free standing. Many are organised in a trade association (AIRTO), but this does not provide money or management. A handful of institutes is under the tutelage of research councils. In Sweden, however, VINNOVA handles core funding for the applied technology institutes (much as NTNF did in Norway in the second half of the 1980s, after it divested them) in partnership with the IRECO holding company and (to a declining extent) the KK research foundation. KK has been involved to help the institutes make a transition from being foundations to becoming private, non-profit making companies, and is now withdrawing from institute finance as this is achieved.

2.5 Conclusions

Knowledge production and use takes place in complex systems, where different actors are interdependent. In order to obtain social welfare, it is important that everyone performs well. The nature of the 'social contract' between the research community and society has been shifting, with society increasingly exerting influence over research and wanting to see useful results. This shift has been accompanied by the massive growth in knowledge production and use that we call the 'knowledge society' with many more parts of society engaged in research and other knowledge-related activities. What is generally called 'basic' research is not detached from the rest of knowledge society, but is an important part of it. In many fields where results can be exploited in society, the distance between fundamental work and its application is decreasing. Important fundamental work can often be triggered by unsolved applications problems, and *vice versa*. The changing ways in which knowledge is produced means there are no monopolies in knowledge production any more.

There are real limits to planning in the knowledge system. At the same time, there are many opportunities. The state has several roles – funding, quality-assuring, enabling change and development – which other actors cannot perform, or can do only in ways that are inherently imperfect. These include the things that research councils do, namely to debate and set priorities, consider new as well as old ideas, and enforce standards of quality and relevance with a rigour that cannot be obtained only by giving money to researchers and leaving them to get on with whatever they would like to do.

The state, then, needs to be a bit like a gardener – an important part of something bigger, selectively enabling and helping growth. Different countries organise the gardening in different ways. Putting most of the work into a single organisation – RCN – is very unusual. So is the detailed level of management by the ministries, and the integration of the policy advice and research funding functions. The Norwegian gardener is expected also to be the garden designer, but is at the same time told in great detail which flowers and vegetables to grow and where to put them. There may be better ways to get a beautiful and useful garden.

3 The Norwegian Economic and Institutional Context

In this Chapter, we briefly describe features of Norway's economic and innovation performance, arguing that – despite its immense oil wealth – Norway faces a significant value creation gap, which needs to be filled by new, knowledge-based activity in order to maintain current welfare levels. Much of industry is tied into branches, which are inward looking and not knowledge intensive. The knowledge infrastructure of universities and research institutes, however, is locked into patterns more appropriate for a newly industrialising country catching up with OECD levels of wealth and industrial capability than for a modern knowledge society. The challenges for research policy are significant.

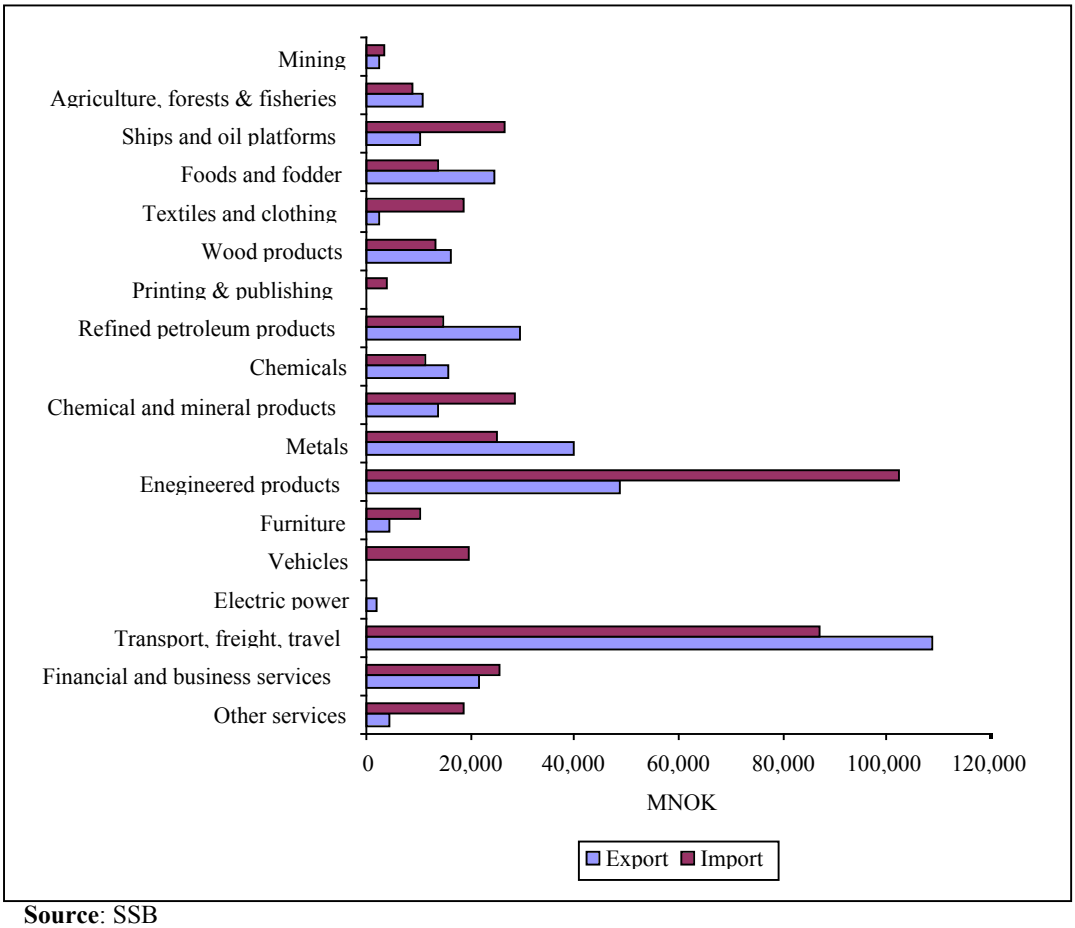
3.1 Economic and Innovation Performance

The Norwegian industrial structure is unusual even among the more resource-intensive OECD countries for its heavy dependence on oil and other mineral extraction, which makes up 17.7% of national value added, compared with an OECD average of 1.1%. Manufacturing and services are correspondingly smaller contributors to the economy.

Norway has traditionally competed on factor endowments, with much industrial activity evolving around upstream activity, and adding value to resource-based sectors. Total GDP in 2000 was some 1,400 BNOK, or 1,040 BNOK if we exclude indirect taxes and state services. There is a massive trade surplus in primaries, which is actually driven by 307 BNOK of unrefined oil and gas exports. Manufactures are in deficit and services roughly in balance, giving a 230 BNOK surplus. The economy overall is very open, with both exports and imports being very large in relation to GDP.

Exhibit 4 disaggregates these numbers (omitting the massive oil and gas surplus, in order to make the chart readable). It shows a positive balance in traditional resource-based sectors. Norway's historical strength in shipbuilding has eroded, and the more value-adding sectors tend to be in deficit. This is most clearly the case with engineering. Transport and travel services – especially shipping – continue to be a Norwegian strength. The overall picture of the economy today is therefore not all that different from the traditional Norwegian one of a country with a huge merchant marine essentially making a living by trading low value-added resource-based products for higher value manufactures. As a crude indication of the importance of raw oil and gas exports (to which no value is added beyond lifting them from the ground), subtracting the value of these from the export numbers would leave an economy with a trade deficit of about 5% of GDP.

Exhibit 4 Norwegian Exports and Imports, 2000 (Excluding Oil & Gas)



Source: SSB

Norwegian industrial performance is poor – total factor productivity growth is amongst the lowest in the OECD.[39] The rate of innovation is low. According to the 1996 Community Innovation Survey, 20% of Norwegian firms had introduced new products within the three preceding years, compared with an international average of 31%. [40]. Knowledge-Intensive Market Services (KIMS) and medium–high technology manufacturing are generally seen as key contributors to competitiveness and growth. The contribution of these to value added in Norway is among the lowest in the OECD.

There is increasing national agreement that Norway does not have an option to depend in the long-term on petroleum revenues. Even though large amounts of state oil revenue have been ploughed into an international investment fund, extrapolation suggests there is a considerable gap between the national income to be expected from national industry plus the oil fund, and the income needed to maintain historical rates of income growth (**Exhibit 5**). The major 'cluster' project, **A Value-Creating**

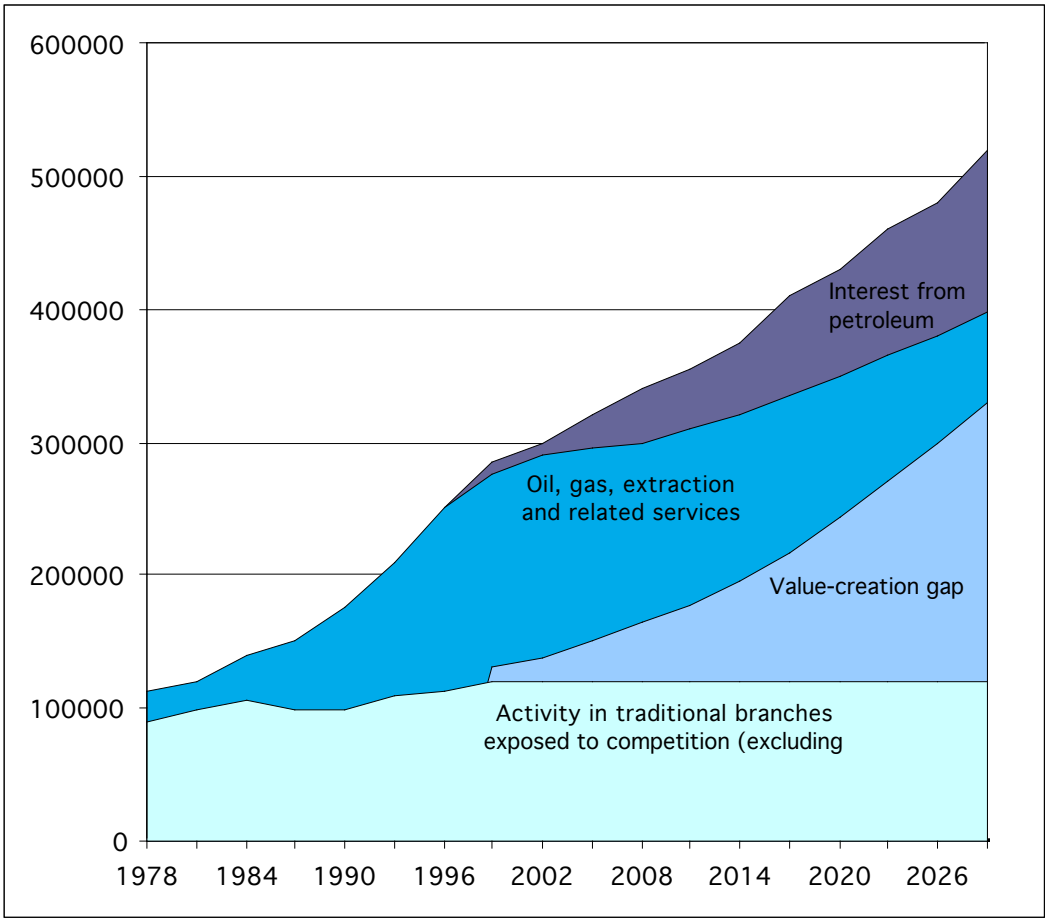
[39] see Torger Reve and Erik W Jakobsen, *Et Verdiskapende Norge*, Oslo: Universitetsforlaget, 20011; also OECD STI Scoreboard at www.oecd.org

[40] RCN, *Det norske forsknings- og innovasjonssystemet - statistikk og indikatorer* 1999. The reader should note that there are important unresolved methodological problems in comparing national rates of innovation based on CIS data. However, the difference between the Norwegian rate and the OECD average one appears so large that we think it should be taken seriously

Norway,[41] conducted with large industrial participation in 1999 and 2000, pointed to the need overall for higher innovation rates and for the development of actual and potential clusters in seafood, energy, maritime, ICT, trade and finance.

Exhibit 5 The Value Creation Gap

Gross national product in branches exposed to competition. Constant prices (1998 kroner)

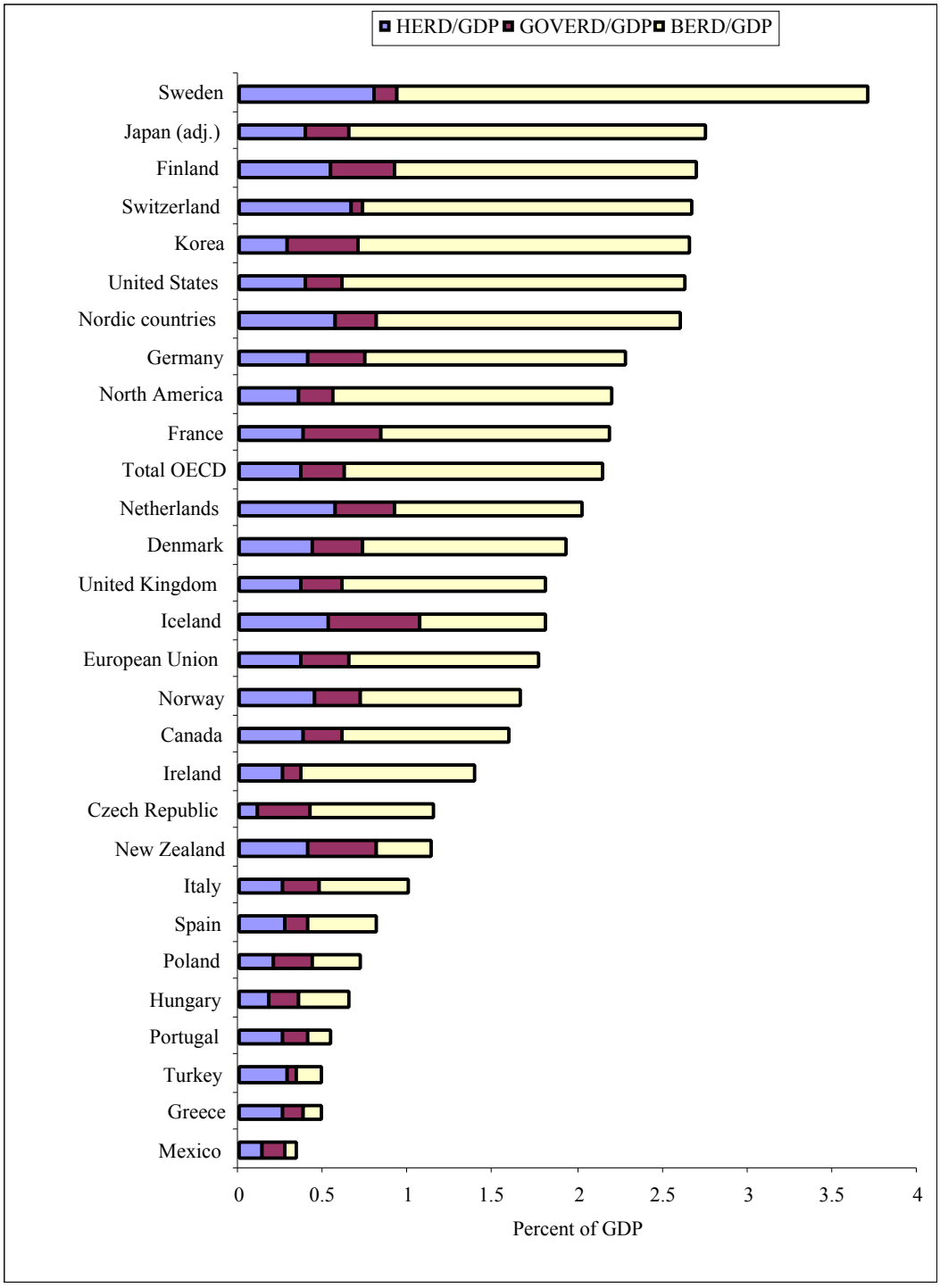


Source: Torger Reve and Erik W Jakobsen, *Et Verdiskapende Norge*, Oslo: Universitetsforlaget, 2001

Norway is among the less R&D-intensive economies in the OECD. The share of GDP devoted to R&D is similar to that of Canada and a bit above that of New Zealand – resource-intensive economies with which it would be reasonable to compare Norway. R&D investment in all three countries lies below the OECD mean. Raising national R&D investment as a proportion of GDP to this average level has been a policy objective in Norway for much of the last decade.

[41] Torger Reve and Erik W Jakobsen, *Op Cit*, 2001

Exhibit 6 R&D/GDP, 1997



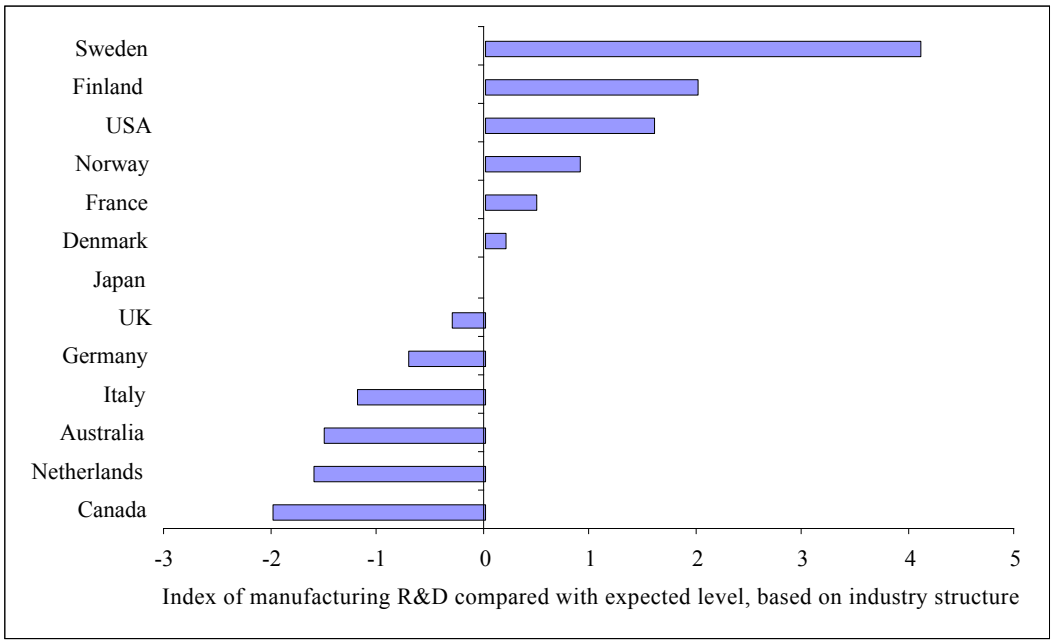
Source: OECD, Main Science Indicators

It is possible to make a 'fairer' comparison of industrial R&D expenditures in different countries by comparing the actual R&D intensity of each branch of industry with the global average for the same industry. The STEP group did this for a selection of OECD countries, and calculated an index which compares the actual

R&D-intensity of each country with the R&D-intensity one would expect to see, if companies were 'averagely' R&D-intensive for their own industry. **Exhibit 7** shows the result. Sweden, Finland and the USA are countries where significant multinational companies have their headquarters, which is probably why they invest much more in manufacturing R&D than one would expect. (Typically, multinational companies do a disproportionately high share of their total R&D in their home country.) Australia and Canada are resource-based, 'branch-plant' economies, investing less in manufacturing R&D than their industry structure would suggest. According to this analysis, it turns out that Norway invests somewhat **more** than the average in manufacturing R&D, taking into account the structure of industry. This raises two important questions

1 Regardless of the level of R&D investment, does Norway have the industry structure it needs in order to close the value-creation gap?
2 If Norway's manufacturing R&D investment is more than we would expect, who is making the investment?

Exhibit 7 Index of Actual Compared with Expected Manufacturing R&D, Selected OECD Countries, 1991

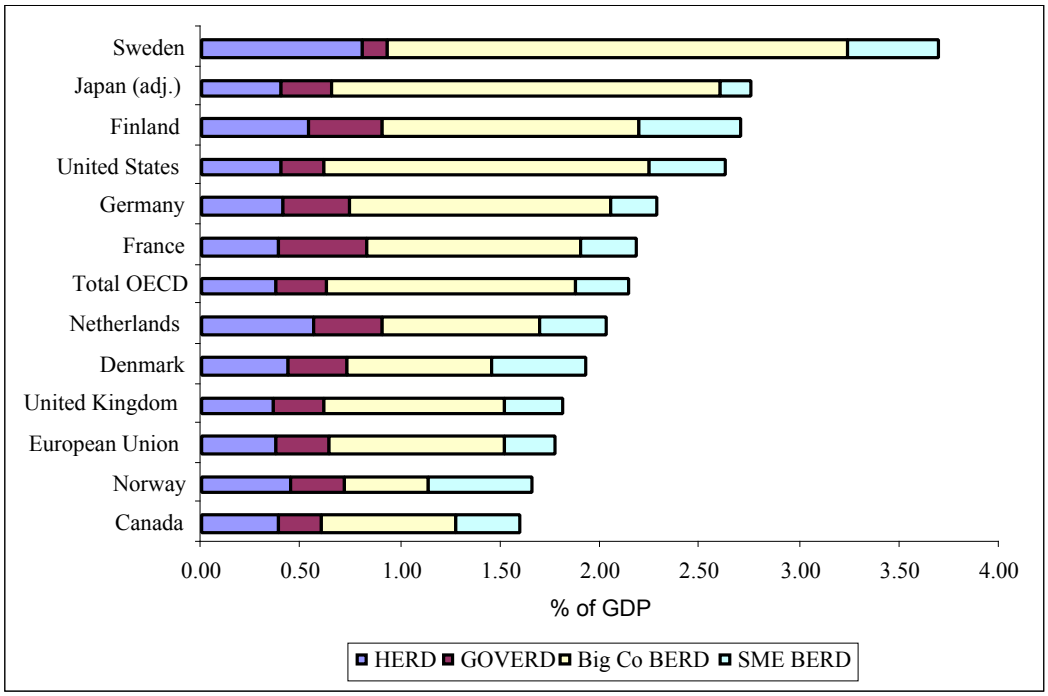


Source: STEP, *Kvikk-STEP* 1998, No 3

Reve and Jakobsen have already answered the first question with a definite "No." Relying on the existing, mature industries is not going to generate the growth needed. Norway has to build more knowledge- and R&D-intensive businesses, starting by making use of comparative advantages in existing clusters, but also diversifying the industrial structure. In regards to the second question, it turns out that, surprisingly, much R&D is done by smaller companies, and collectively little by the big ones who dominate the more traditionally Norwegian manufacturing branches (**Exhibit 8**). These branches are themselves generally not R&D-intensive.

In most developed economies, most of the industrial R&D is done by big companies: in the OECD as a whole, over 80% of industrial R&D is conducted by firms employing over 500 people. In Norway, the big firms do about one third of the industrial R&D. Of the 24 countries for which data are available, only in Poland, Portugal and Iceland do the big firms perform a smaller proportion of R&D than in Norway.

Exhibit 8 R&D by Companies Over and Under 500 Employees, 1997



Source: Main Science Indicators, STI Scoreboard

In Norway, roughly 600 firms currently perform formal R&D. 80% of these have less than one full-time R&D employee. Fewer than 50 companies, 35 of which are Norwegian-owned, have more than 10 full-time R&D workers. Narula has recently explored[42] the structure of Norwegian industrial R&D through an interview-based study of 26 of these Norwegian-owned firms, a sample collectively accounting for almost two thirds of Norwegian BERD. Narula divides his sample into two groups (see **Exhibit 9**)

- Group 'A' firms, which come from the traditional raw-materials based sectors (eg Norsk Aluminium, Elkem, Norsk Hydro, Norske Skog, Kværner), or which have enjoyed state protection as 'national champions' (eg Norsk Jetmotor, Telenor, Dyno Chemicals, Lilleborg)
- Group 'B' firms, which are engaged in the more knowledge-intensive sectors, and can be regarded as science based or non-traditional firms

[42] Rajneesh Narula, 'Explaining 'Inertia' in R&D internationalisation: Norwegian firms and the role of home country effects,' University of Oslo/STEP, July 2000

Both groups sell the majority of their products abroad, but in general Group A firms are bigger but less internationalised than those of Group B.

Exhibit 9 Narula's Sample of Norwegian R&D-Performing Companies

Sub-samples	% Sales Abroad	% of Sales in Low-Tech	Total Employees	% of Employees in R&D	% of R&D Done Outside Norway	NFR Subsidies as % of R&D Budget
Group A	59%	92%	52,000	3.2%	5%	3%
Group B	88%	46%	10,300	9.4%	29%	1.2%

As the employment numbers suggest, Group A is much the larger of the two groups. With R&D focusing on process questions, these low-technology firms co-operate within their domestic supply chains. Their other technology relationships focus on the Norwegian education and research system. The SMEs in Group B are more international and eclectic in their technology relationships. While both groups have good links to the Norwegian education and research system – especially NTNU and SINTEF – only Group A firms have the clout to influence curricula.

While pointing out that all innovation infrastructures suffer from inertia, Narula argues that the Norwegian system is especially locked in to the needs of the Group A firms. This reduces the diversity of impulses available to the population of innovating or would-be innovating firms in the economy. Most of the Group A firms continue to be large and successful, and to operate on the basis of accumulated technological and other advantages. But the many smaller R&D performers and innovative firms which are excluded from Narula's sample, therefore work within a system tuned to needs other than their own. Geography means that when these firms seek technical help, it comes most readily from the Norwegian system. This tendency has been reinforced by NTNF and NFR supports for 'user-directed R&D,' which have effectively provided Norwegian firms with money to spend at Norwegian institutes. Narula therefore argues for increased competition and internationalisation of R&D supply – a need to which RCN's Industry and Energy Division has recently begun to respond.

The Norwegian industrial R&D sector is, in fact, not very internationalised. Impulses from world research can be obtained through two kinds of internationalisation: 'outward,' where domestically-owned companies operate R&D facilities in many countries, benefiting from access to multiple innovation systems and research manpower labour markets; and 'inward,' from the R&D activities located in the country by foreign firms. Unlike its neighbours Sweden and Finland, Norwegian industry lacks the outward facing 'window' on world research that the highly internationalised R&D organisations of companies like Nokia, Pharmacia-Upjohn and ABB provide. The largest Norwegian-owned R&D unit operating outside the country appears to comprise 65 people. Compare this with companies like Ericsson, Nokia or Astra, which employ tens of thousands of R&D staff, the majority of them outside the Nordic region. The amount of 'inward' internationalisation through the presence of R&D-performing foreign company subsidiaries is better but still limited, accounting for perhaps 10% of BERD and concentrated especially among ABB, Siemens, Ericsson and Alcatel.

3.2 The Institutional Structure

Research on innovation and economic development[43] clearly shows the primary importance of technological capability **within industry** as the motor of economic growth. The notion of 'absorptive capacity' is key to learning and the development process. Crudely, it says that the ability of companies to learn depends on their internal capabilities, and that these capabilities can often be represented by the number and level of scientifically and technologically qualified staff in an organisation. Altering the balance of R&D (and, more generally, innovation) expenditure and effort between the business system and the state is therefore one of the key phenomena in economic development.

The economic and technical trajectories of countries in rapid development (such as the SE Asian 'Tigers') over the past few decades show a change from a pattern where the state undertakes most of the national R&D effort, to one where private industry dominates. **Exhibit 10** illustrates this for Korea, which is one of the best-documented cases, but also one of the most extreme, with large industrial groups targeting key sectors right across the engineering industries. By the end of the period considered in the **Exhibit**, Korean industry was investing as great a share of the Korean national R&D effort as US industry did in the United States. With 57% of the national R&D effort being undertaken in the business sector, we can in this sense think of Norway as being today roughly where Korea was in 1985.

Exhibit 10 Transition In The Structure Of The Korean Technology Development System

	1970	1975	1980	1985	1990	1995
Total R&D Expenditure*	10.5	42.7	282.5	1,237.1	3.349.9	9,440.6
Of which, shares (%) of:						
Universities	3.8	5.2	9.2	9.6	7.3	8.2
Govt. Research Institutes	84.8	65.8	37.0	29.7	21.8	18.7
Private Sector	12.4	28.8	28.8	60.7	70.9	73.1
R&D/GNP (%)	0.38	0.42	0.77	1.58	1.95	2.69
Researchers/10,000 population	1.7	2.9	4.8	10.1	16.4	28.6
No. of Corporate R&D centres	1	12	54	183	966	2,270

* billion won

Successful catch-up and development trajectories emphasise reverse engineering and creative imitation in the company sector, supported by massive investment in engineering education. During the process of catch-up, the higher education and research sectors do not play major roles as suppliers of ideas, but are crucial as providers of trained people and can be very helpful in working with industry to improve absorptive capacity. During the catch-up process, major investments in the

[43] For a summary review, see Erik Arnold and Martin Bell, *Some New Ideas About Research for Development*, report to the Hernes Commission on DANIDA, Brighton: Technopolis and SPRU, 2001. The review can be downloaded from www.technopolis-group.com and from the Danish Foreign Ministry server

basic research and scientific system risk creating capabilities disconnected from the economy and society, which are unlikely to have developed the absorptive capacity to make use of such investments. They also risk being below critical mass unless they are highly focused.

Once countries reach the scientific/technological frontier, the way forward is no longer so clear. Huge amounts of effort are devoted to R&D in the developed economies, and a very large proportion of this is 'wasted' – in the sense that it does not result in a commercialised product or process innovation. The absolute quantity of research in the higher education and research sector tends to become substantial at this stage. With no-one to imitate, the only way to make progress is to put up with the 'waste' involved in doing original research.

As economic development proceeds, research institutes need to move 'up-market', increasingly tackling more questions to do with research and fewer with development and technology adaptation. Their functions increasingly overlap with those of university research, so we see tight links between applied research institutes and universities in many of the more technologically advanced countries. The Fraunhofer Society in Germany is a good example, where institute directors have simultaneously to hold chairs at a university.

Such links are clearly developing in Norway. They have always been strong in Trondheim, in the environment of what is now NTNU, and where there is an enormous concentration of applied research institutes. However, compared with other OECD economies, there is an enormous imbalance in the respective sizes of the institute and university sectors. The high share of institute activity in Norway is much more like that found in, say, Thailand or Indonesia than that normally seen in the OECD.

Research is needed to investigate the particularities of the Norwegian situation, since it is possible for different institutional structures to work well. However, the high share of the institutes in the total research system runs three important risks. First, it can crowd out the formation of absorptive capacity by companies, by making it more attractive for researchers to work in institutes than in companies, or by creating incentives for institutes to do development **on behalf of** companies, effectively preventing the companies from learning. Second, it can impede the modernisation of the universities, leaving them overly locked into 'basic' research and stifling the development of mechanisms in use elsewhere to strengthen their links with the rest of society and their ability to develop and implement their own research policies. These mechanisms include contract research, patenting, industrial liaison, and industrial and educational outreach programmes. Third, it limits the possible impacts of research and knowledge building through educating academics, limiting the opportunities to build critical mass and centres of excellence.

Later than in other countries, universities in Norway have been confronted with a large increase in student numbers and a crisis in budgets. From 1985 to 1995 student numbers at universities, scientific institutions and colleges grew from 94,000 to 177,000. University student numbers[44] rose from 41,000 to 83,000 in the same

[44] Including the scientific colleges

period. For demographic reasons, new university student numbers have dropped since – as was expected from demographic figures. Consequently, student number related budgets dropped as well. Unfortunately, universities had used the increase in funding to create more tenured positions to cope with the increasing student numbers. The total number of professional personnel in the universities and colleges rose from 9,000 to 12,500 between 1994 and 2000. Universities are not able or willing to implement budget reductions through structural reorganisation and reductions in staff, so budget reductions can only be implemented through a reduction of the research budget per position. As institutional funding for research at universities is mainly spent on salaries, whether researchers can actually do research depends partly on the level and availability of external funding. Moreover, the replacement of the professorial hierarchy at the universities by a more egalitarian system has meant that the title of professor became disconnected from actual jobs and connected to formal qualifications.[45] Since 1991 anyone with a position at a university, who formally qualifies for a professor title has the right to be promoted to that rank.

Academic research in Norway is very often done on an individual basis or in small groups headed by a professor and with no other tenure research staff. Whether these groups can do research depends on their ability to acquire external funds, for which RCN is seen as the most important source. In principle this could result in fierce competition, but it is mitigated by the fact that losers in the competition will not lose their tenured position and the gain for winners is relatively small. Universities do not stimulate the acquisition of external resources, let alone reward it with extra funding from internal resources.

Unlike universities and university systems in other countries, Norway's seem not have found an appropriate response yet to the challenges of the budget crisis. Reviews of international developments in the university research sector have shown that university systems in other countries have gone through a transition. The main components of the changes and driving force for institutional modernisation of universities are[46]

- The development of a more competitive and user-oriented funding system, either through the reduction of institutional funding, the increase of competitive funding (research council or new funds), providing institutional funding on a competitive basis. In some of the new funding schemes, interaction with users is a prerequisite. Universities responded by rewarding the level of external funds with extra institutional funding, stimulating interactions with users, and developing formal partnerships with industry
- Implementation of quality control for university systems, through periodic evaluations often on a disciplinary basis and with direct or indirect consequences for funding. Depending on the precise design of the evaluation system, universities/university departments were pressed to take action on low performers. Management also got independent information to identify the research quality within the organisation and a base for a more differentiated allocation of institutional resources

[45] 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.

[46] OECD, 1998, University Research in Transition, Paris: OECD

- Priority setting, through foresight or similar processes at a national level made external funding more depending on relevance, and stimulated universities to set priorities as well at the institutional level
- Organisationally, centres of excellence within a university or hybrid institutional structure with university as one of the partners (with governmental institutes and industry as other possible partners) emerged, creating opportunities for academic research within universities to grow beyond (implicit) financial, disciplinary and organisational boundaries of the university

None of this has yet been really implemented in Norway. Universities are not operating strategically and still rely very much on institutional funding.

In an internationally comparative perspective, RCN's budget for university research is low in relation to the institutional (block grant) research funding. In other countries with similar dual funding systems like the Netherlands, Germany and Switzerland, we have found ratios for research council funding to institutional funding of 1:4 as a minimum and often around 1:3. In Norway the ratio is about 1:5.8.

3.3 Implications for Research Policy

Is the Norwegian pattern of R&D expenditure then 'wrong'? **Exhibit 11** shows that Norway spends a little more of its GDP on R&D in the Higher Education sector (HERD) than the OECD or EU in general, while other government expenditure on R&D is at about a normal level. The anomalies are in business expenditure on R&D (BERD). Norway's big companies would need to double their R&D expenditures collectively to reach the EU average, and treble them to reach the OECD mean (which is heavily influenced by the large-company dominated R&D expenditures of the USA and Japan). Small firms' expenditures on R&D would have to halve in order to reach the international norms. However, it is also clear from **Exhibit 8** and **Exhibit 11** that there is a Nordic pattern of higher than average spending on R&D by small firms – probably because these are small economies with well educated labour forces.

Exhibit 11 R&D Spending in the Nordic Countries, EU and OECD as a Percentage of GDP, 1997

	HERD	GOVERD	BERD in Cos >500	SME BERD	GERD
Norway	0.44	0.27	0.43	0.52	1.66
Denmark	0.43	0.30	0.72	0.47	1.92
Finland	0.54	0.37	1.28	0.51	2.70
Sweden	0.80	0.13	2.30	0.47	3.70
EU	0.37	0.27	0.88	0.25	1.77
Total OECD	0.37	0.25	1.26	0.26	2.14

Source: OECD Main Science Indicators, STI Scoreboard

Moving out of the existing lock-ins requires substantial re-education, changes in incentive systems and a good dose of fear. Reforms are needed, which go well beyond the scope of our evaluation. Reorientation towards knowledge-based industry is needed. This will require a willingness to focus 'basic' research resources in strategic directions, reform other parts of the state system and alter framework

conditions. We suspect there must also be wider changes in culture and the public understanding of research and science.

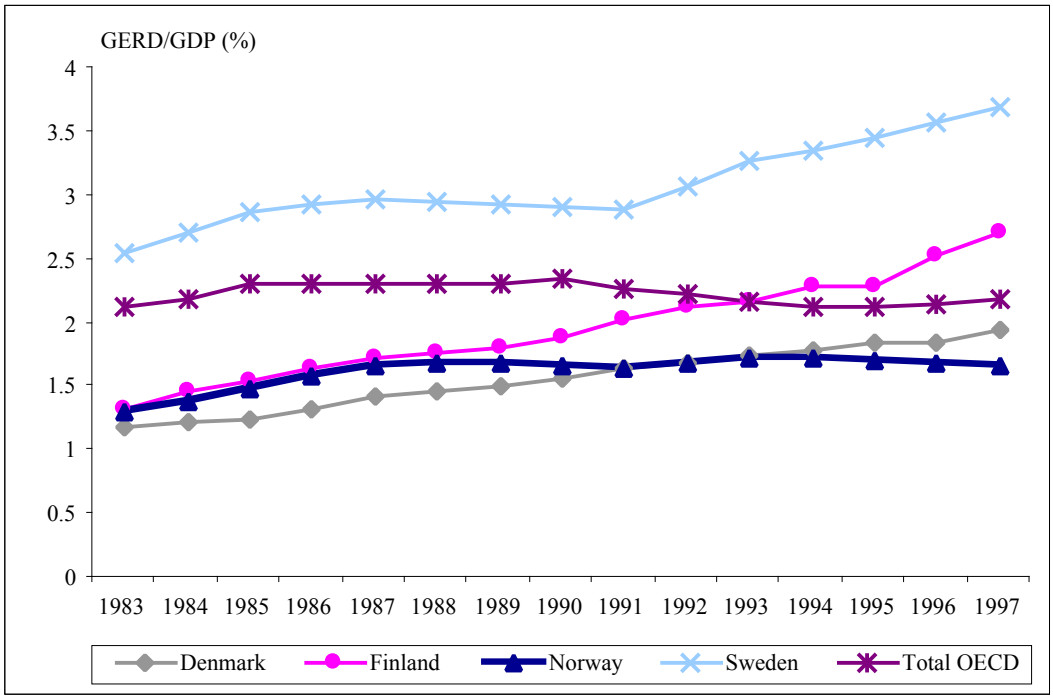
Our analysis so far suggests a number of conclusions for innovation and research policy

- While there is every reason to nurture and build upon the now traditional strengths of Norwegian industry in raw materials and process based industries, policy needs also to foster the growth of new, knowledge-based branches
- Despite the large size and strong capabilities of the applied Research Institute sector, whose mission has been conceived as performing innovation on behalf of companies, the innovation rate of both large and small companies is generally low. This rate needs to be increased also by means that augment companies' **internal** technological capabilities or 'absorptive capacity'
- Modernising the higher education and research sector as a whole involves increasing the institutes' involvement in research, improving the universities' strategic capabilities and their links to society more generally and making the division of labour between the universities and the research institutes less distinct
- This is, in turn, only possible if the higher education system is producing an adequate number of scientific and technical workers at degree and doctoral levels
- Increased internationalisation is necessary, in order to access that great majority of the global research effort that is undertaken abroad, as well as to benchmark and quality control the Norwegian R&D effort

Exhibit 12 shows how Norwegian GERD/GDP has stagnated since the mid-1980s, while that of the other major Nordic countries has continued to rise, leaving the Norwegian economy as the least research-intensive by the mid-1990s. The most striking feature of the **Exhibit** is perhaps the way Finnish expenditure began to pull away from the Norwegian at the end of the 1980s, pulling further ahead through the economic crisis. This crisis was caused by the collapse of the Soviet Union, which had represented about 20% of Finnish exports before the fall of the Berlin Wall, together with problems in monetary policy and the liberalisation of the financial markets, followed by the global recession of 1991. At this crucial moment, Finnish policy makers decided to **increase** state expenditures on R&D, focusing the majority of the increase into industry.

Based on other countries' experience and national development needs, the required trajectory for Norway could involve tracing out a Nordic development path in R&D expenditures (see **Exhibit 11**). The first stage is to raise large companies' investments in R&D towards the Danish level. Given the Norwegian industrial structure, this will mean increasing the R&D-intensity of existing large companies but also building new ones. As industry becomes more research-intensive, it makes sense to expand R&D expenditure in the higher education sector, as has been done in Finland, to a level above the EU and OECD averages. We might think of the Swedish R&D investment structure as an 'endgame,' but one that will take a very long time to reach.

Exhibit 12 GERD/GDP in Nordic Countries and OECD, 1983–97



Source: OECD Main Science Indicators

This kind of a development trajectory cannot simply be laid down by the state. It involves growing whole branches of industry. Making progress towards this will need the agreement and trust of industry and the research community. Above all, it requires the political will to make a major investment in R&D, initially led by the state sector, with a strong emphasis on industrial capability but accompanied by a significant expansion in basic and strategic research.

4 The Research Council of Norway

In this Chapter, we describe the history leading up to the creation of RCN, and the concerns that therefore prompted the reform. We go on to describe the way RCN is funded and what its research divisions do.

4.1 Prehistory

Norway began to set up a research council system immediately after the Second World War, as key scientists and engineers returned from abroad, after working in the research part of the war effort. Before the War, Norwegian science had been strongly under the influence of the German research system, where many of the leading figures had been educated. After the War, Norway turned west and reached for more Anglo–American models.

Norway established national polytechnics in technology (*Norges Tekniske Høyskole* in Trondheim) and agriculture (*Norges Landbrukshøyskole* at Ås, outside Oslo) at the start of the last century, but research councils, separating funding from execution, were a new phenomenon. NTNF, the Norwegian Research Council for Scientific and Industrial research, was established in 1946, linked to the Ministry of Trade and Industry (NHD). Within a couple of years, it began setting up various applied technology institutes – notably the Central Institute for Industrial Research (SI), which it owned and funded. In 1946, also, NLVF (Norwegian Research Council for Agriculture) was established, linked to the Ministry of Agriculture (LD). A council for basic research was set up three years later, in 1949: NAVF, the Norwegian Research Council for Science and the Humanities. NAVF comprised four sub-councils

- RMF: the medical research council
- RSF: the social science research council
- RHF: the research council for the humanities
- RNF: the natural sciences research council

Throughout the post-war period the council system has played a key role in Norwegian R&D policy debate. Several sectoral R&D initiatives were formulated as proposals to create new research councils, for example for consumer research and trade research. After a decade of debate, a research council for fisheries research was approved in 1972. A proposal by the Social Democrat government to create a council for 'research for societal planning' in the mid-70s was politically contentious. However, it resulted in the establishment in 1978 of a new sub-council within NAVF for 'research for societal planning' (RFSP), which in 1987 became the independent NORAS council for the applied social sciences, while remaining under the tutelage of the education ministry. Another semi-autonomous council for environmental research, NMF, was established within NAVF in 1987, and was generally considered to be the *de facto* research council of the Ministry for Environment.

NTNF, and to some extent NAVF, began to assume tasks for others than their 'owner' ministries by the 1980s, foreshadowing RCN's later role as the servant of multiple ministries.

Co-ordination and co-operation between the research councils has been an issue at several points in the history of the research councils, often phrased in terms of the role of various committees for co-ordination and co-operation between the research councils. A series of high-level committees were put in place in the post-War period, to advise on research policy, with varying degrees of success. The joint committee of the research councils (*Forskningsrådenes fellesutvalg*) was in being from 1949 to 1965, when it was reconstituted as the main committee for Norwegian research (*Hovedkomiteen for norsk forskning*). It was reconstituted again in 1982 as the research policy council (*Forskningspolitisk råd*), and remained in existence until 1987. Following a change of government, the council pointedly failed to resign their positions, to enable the new government to appoint its own people. The government promptly abolished the council – aptly summing up the history of these organisations, whose ability to influence policy had almost always depended upon personal links to the government. At no time did it really seem to have been accepted that such a committee could offer politically neutral yet useful advice. From 1971 to 1992, the research councils themselves set up a co-operation committee, FSU (*Forskningsrådenes samarbeidsutvalg*). Strengthening this committee was considered by some to be an alternative to setting up a single, integrated research council organisation.

A proposal put forward in 1970 to establish a single research council was turned down, due to its "centralist" character. Several issues arose during the 1980s, however, which pointed to a need for reform in the research council structure.

It was emphasised throughout the 1980s that the research councils should to a larger extent than they were, be 'strategic agencies' – that is as mediating actors between the political level on the one hand and the research performing, institutional level on the other. This issue was in particular raised within the 1981 review of the NTNF system, in which the Norwegian system for industrial R&D was criticised for having become fragmented through 30 years of accumulation (not least of institutes) and through extensive earmarking of appropriations by the ministries. The strategic role of NTNF was also seen to be in conflict with its role as the legal owner of several research institutes – a criticism clearly inspired by the Rothschild reform in the UK, which institutionally separated customers and contractors in the state R&D system.

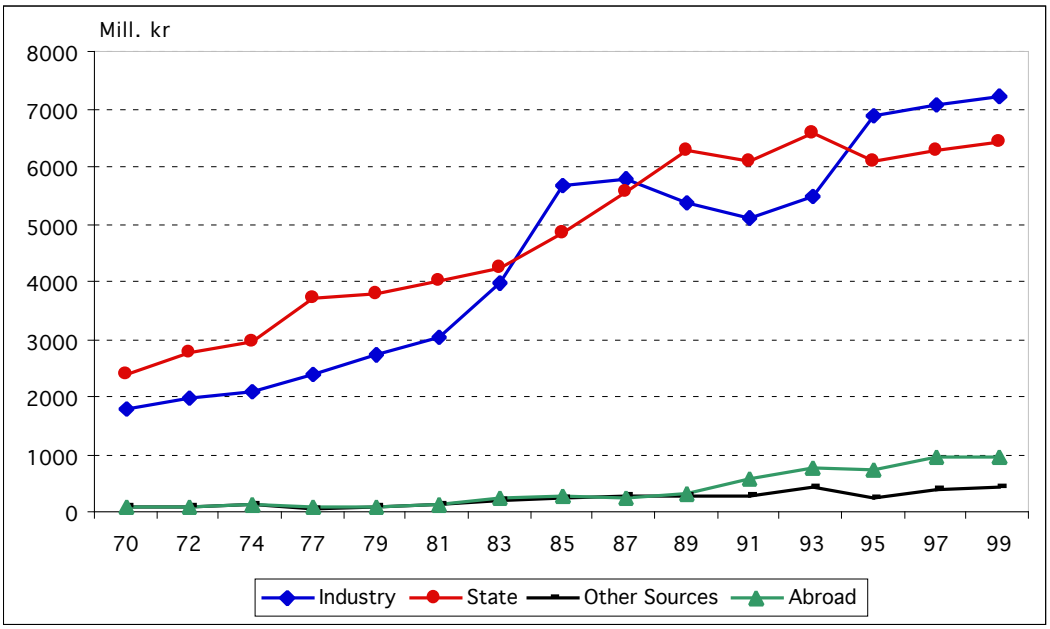
The relationship between ministries and research councils was to be handled through the so-called 'Langslett doctrine' in the early 1980s. This doctrine involved the principle that ministries should not buy research needed to support policy development directly, but should define research budgets and spend these via research councils – distancing themselves from the research and the researchers, and introducing a professional research procurement function.

Another issue in this period was increasing tensions between NAVF and the universities, which saw the research councils as a costly bureaucratic detour for public university research funds. The universities had increasing ambitions to become more active in determining their own research policy. (As we will show later in this report,

however, their power to do so was and remains limited. Considerable reform will be needed in the university sector before anything like a coherent research policy emerges there. Even if such a policy should emerge, there remain solid reasons – as the rector of Oslo University has recently pointed out[47] – why a research council function is needed.) The growing practice of allocating money through research programmes, in addition to the more traditional 'free research' (or, in UK jargon, 'response-mode') model was a key area of disagreement. Through the programmes, the research councils were beginning to articulate a strategy and a set of national priorities – effectively overruling the desires of the universities themselves to perform this function. Many of the current discussions about RCN centre on the balance between programmes and non-programmed areas of research. It is therefore worth noting that, as long ago as 1989, NAVF was programming 26% of its research funds, NORAS was programming 71% and NTNF 43%.[48]

The latter half of the 80s was a period of growth for Norwegian research (**Exhibit 13**). The major part of the new public funds was channelled as appropriations to what was originally four 'growth areas', and which eventually became nine so-called 'main target areas' (*hovedinnsatsområder*).

Exhibit 13 Funding of Norwegian R&D 1970–99 (at 1990 prices)



Source: NIFU

[47] Kaare Norum, Foredrag i Trondheim I Norges Tekniske Vitenskapsakademi, 24 september 2001

[48] *Organisering for helhet og mangfold i norsk forskning*, NOU: 1991:24

These were all cross-disciplinary and cross-sectoral fields of research, and each main target area could involve several ministries and research councils. The areas were

- Biotechnology
- Fishing and aquaculture (Havbruk)
- Health, environment and the quality of life (HEMIL)
- Information technology (IT)
- Culture and research on the preservation and communication of traditions (KULT)
- Management and organisation (LOS)
- Oil and gas
- Materials technology
- Environmental technology

A complex organisation was set up to cope with their cross-disciplinary nature, including national committees for strategy development, co-operation and co-ordination. The organisation of these committees was complicated and varied, and their authority was not well defined. Most of the funds allocated to these areas were channelled through the established funding structures and procedures of the research councils. **Exhibit 14** shows the way responsibilities for funding were distributed across the research councils

Exhibit 14 Roles of Research Funders in the 'Main Target Areas'

	Biotech	Havbruk	HEMIL	IT	KULT	LOS	Materials	Oil & Gas
NAVF	XX	X	XXX	XX	XXX			XX
NTNF	XX	XX	XX	XXX			XXX	XXX
NLVF	XX	XX	XX					
NFFR	XX	XXX	XX					
NORAS		X	XX	XX		XXX		XX
FSU	XXX							
EMBL	XX							
Industrifondet								XX

Key: X = minor participant XX = participant XXX = lead agency
Source: Analysis of Karl Erik Brofoss, *Innsatsområdene som forskningspolitisk virkemiddel*, report 4/1993, Oslo: NIFU, 1993. The Environmental Technology area was started too late to be included in this analysis

Both the evaluations of the main target areas and our interviews with various people involved indicate that an inefficient structure had been employed. Co-ordination and management of the new cross-disciplinary and cross-sectoral fields of research were poor, and this was widely seen as a failure of the existing research council structure. There was frustration that the expansion of research funding in the latter 1980s had become tangled up in an organisational mess. The research White Paper of 1993[49] explicitly argues that the innovative organisational potential of the main target areas was quickly brought under control by the existing research councils, leaving the research funding system as complex, lacking in transparency and in need of simplification. This had been a key motive for the government in launching an investigation into that structure in 1989.

[49] St Melding nr 36 (1992-93) *Forskning for fellesskapet*

The government had explained in its research White Paper[50] of 1988–89 that the research funding system had become complex and unworkable. Responsibilities were unclear and the government wanted to see a simplification of the entire structure, based on a thorough analysis of the existing structures. The Grøholt committee was set up in 1990, to undertake this task, and reported a year later. Key points in its analysis were

- The importance of finding governance mechanisms, which both make it clear what the research funding task comprises, and have legitimacy within the research financing and research performing communities
- The unduly high influence of the sector principle, which both hampered the development of a modern, internationalised research system and tended to suppress so-called 'free research'
- The prevalence of overlaps and inefficiencies in the funding system, not least a failure to separate strategic from operational issues and to delegate decisions to an appropriate level

As we show later on, many of these points remain valid today. The Grøholt report underlined the importance of retaining but modifying the sector principle, so that a national research strategy became possible. Research councils should still be key instruments in the system, as part of a process of increased delegation combined with evaluation. Basic and applied research should be better integrated and research management professionalised, not least through the development of an evidence base for research policy. Those involved should not act as representatives of interest groups. Rather, the funding system should manage and contain conflicts of interest.

The Grøholt committee proposed that there should be a single research council, made up of three strategic disciplinary councils, respectively for life sciences, physical sciences and technology, and culture and social science. The government should appoint members of both the Executive Board and of the three Disciplinary Boards, and the whole organisation should have a unified administration, led by a director general. Each Disciplinary Board would be served by a director and staff, operating with powers delegated from the director general, who would oversee common staff services such as strategic planning and finance. The sector principle would be retained, but the core funding of the council would be granted to it by the education ministry. (This involved transferring research resources to the education ministry from other ministries.) The new council would take over responsibility for the core funding of research institutes from the ministries, but would not otherwise have wider powers than the sum of the old research councils. The sector principle would be retained, but the role of the education ministry would be strengthened, providing co-ordination. The research policy council (*Forskningspolitisk råd*) should be re-established, so that research policy advice and implementation would be separated.

As is normal in Norway, there followed a period of consultation on the Grøholt report, during which there was general agreement[51] with the overall lines of the proposal, but considerable conflict about the divisional organisation of the new council. After a tumultuous political process that lasted from December 1991 to

[50] NOU 1988:28, *Med viten og vilje*
[51] The ministry of fisheries, however, objected

February 1992, a compromise was constructed that proved acceptable to the major research ministries and the research councils. The compromise that salvaged the main one-council idea was an internal organisation based on the six divisions we see today

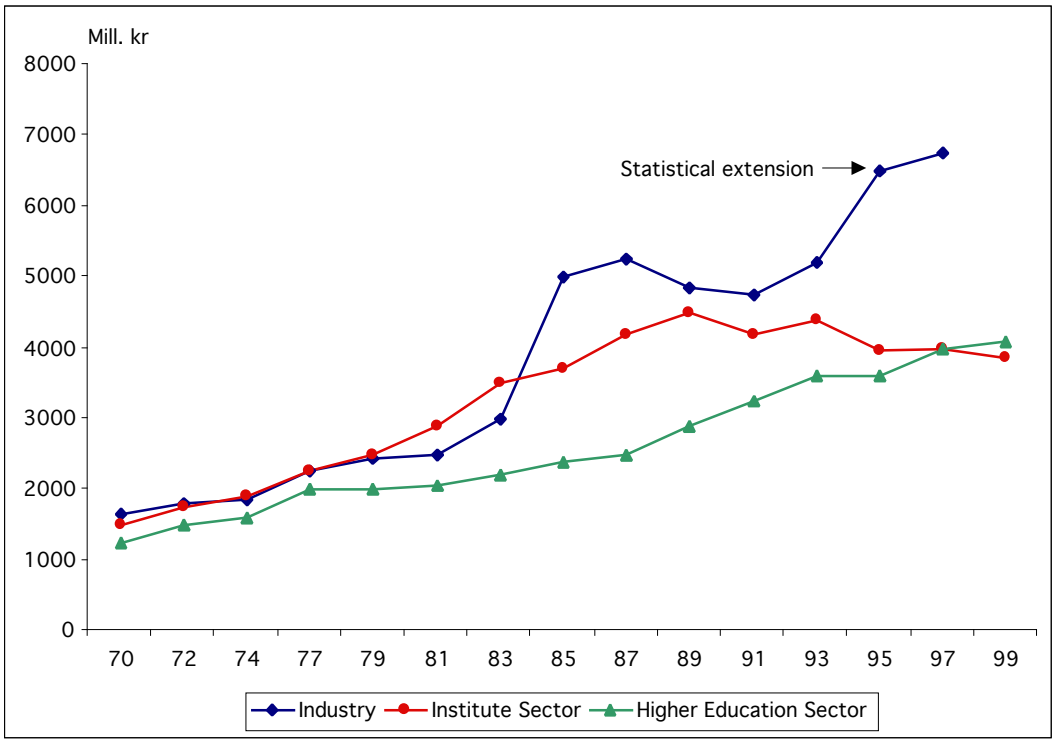
- Culture and society (KS)
- Science and technology (NT)
- Industry and energy (IE)
- Bioproduction and processing (BF)
- Environment and development (MU)
- Medicine and health (MH)

One consequence of this was that the common organisation for fundamental and more applied research in a single council at NTNF was cut in two, to form the NT and IE divisions at RCN. The government put a proposal to parliament on June 1992 that differed from the Grøholt proposals not only with respect to the divisional structure but also in other respects. The Government saw no reason to re-establish the advisory council for science and technology policy, but made this a formal part of the tasks of the new research council. The council's Executive Board, not Government, would appoint divisional boards, while the government itself would appoint the Executive Board. The White Paper emphasised in particular the unified nature of the council, through the unified organisation of the council's administration. It also emphasised the key role of the internal organisation of the council as emblematic of the innovative nature of the new organisation. The details of its internal organisation were thus expressly part of the formal, political decision to establish the council. As we shall see, by legislating an organisation which in practice did not work, the government lit the fuse on a bomb which was to explode within the first year of the new research council's life. In the meantime, the government appointed an interim board, all but one of whom became members of the first Executive Board. They hired six research division directors and three staff directors (strategy, information and finance/organisation) in December 1992. RCN was formally established on the first of January, 1993.

RCN was set up in a period of very active educational reform. From the late 1980s, the government was struggling not only to fund an expanding research funding system, but also to pay for a big increase in the population of students in higher education. University financing was driven by a formula based heavily on student numbers, and the universities recruited new faculty in large numbers to meet the growing demand. Since 50% of faculty time is in principle spent on research, this drove up the apparent overall research spend and, eventually, the demand for research council money, while at the same time making it harder for the government to fund the research councils. In 1993, with the students' unions demanding better grants and the overall government budget under pressure, the government reallocated money from research to fund student grants, reducing the budget of the new council. As our later analysis will show, the government therefore unknowingly created conditions which would make it very difficult for the vision of an integrated research council to be realised. This birthday present of a 10% budget cut set divisions and ministries against each other in a struggle for resources, reinforcing the very obstacles to a more co-ordinated research policy that RCN had been created to overcome. As **Exhibit 15** shows, government funding for research in the higher education sector continued to

grow (driven by increasing student numbers), while its spend in the institutes stagnated. RCN's research budget did not recover in real terms to its 1993 level until the start of the next decade.

Exhibit 15 Norwegian R&D by Performing Sector 1970–99 (1990 prices)



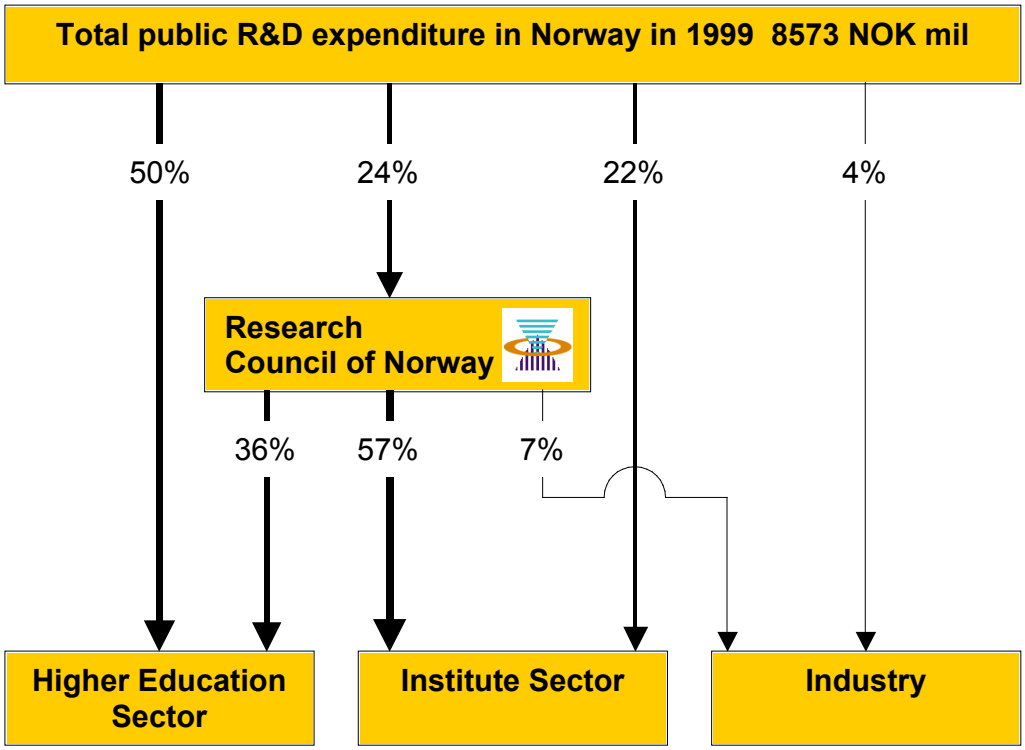
Source: NIFU, Statistics Norway

In addition to earlier changes in the schools, in 1994 the further education college structure and curricula were reformed (Reform 94). A further reform at the same time restructured the fragmented system of regional colleges, leaving a pattern of 26 larger University Colleges through wholesale merger, and making research as well as education a part of their core tasks. Here, as with the uncontrolled growth of the universities in the first years of the 1990s, there seems to have been a disconnection between education and research policy. Large increases in the number of people in the higher education system expected to do research were not matched by increases in research council funds. In effect, RCN was expected to serve more people better than before and with less money.

4.2 What RCN Does

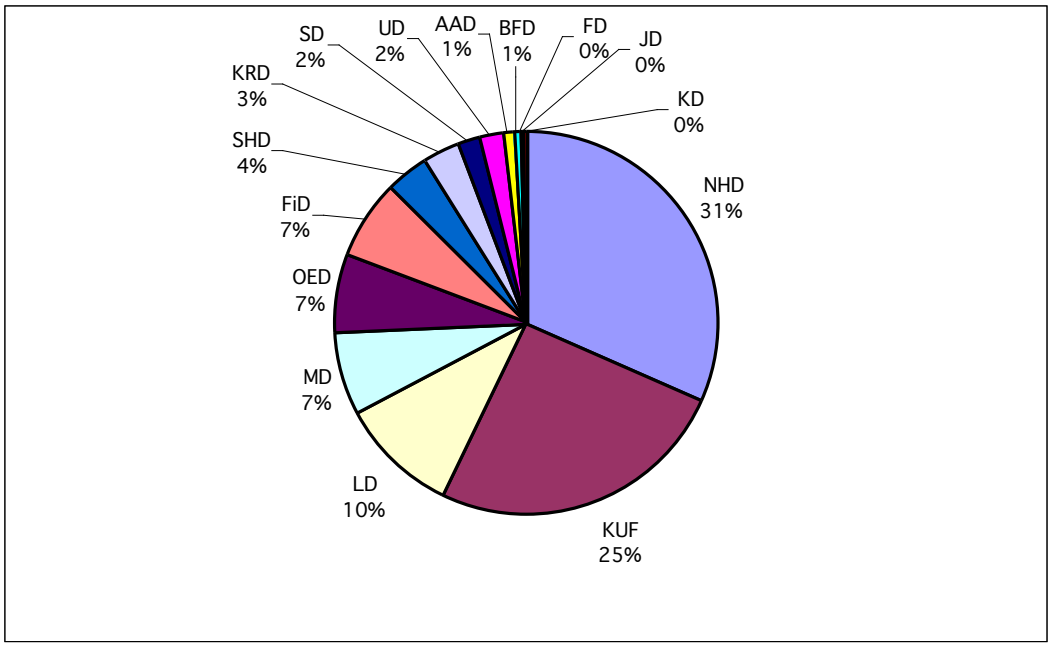
RCN handles about one quarter of the state's R&D expenditure, or half the money which does not flow to the higher education sector as part of its block grants. RCN, in turn, passes on somewhat over half the research money it gets to the institute sector. **Exhibit 16** shows that 57% of RCN's spend ended up with the institutes in 1999, of which 17 % was for base funding (including so-called Strategic Institute Projects – SIPs) and the remaining 40 % funded projects. Over a third of RCN's spending provides project funding to higher education, while a small minority goes direct to industry.

Exhibit 16 Role of RCN in Public R&D Expenditure, 1999



Source: NIFU

Exhibit 17 Sources of RCN Funds, 2000 (excluding administration and Research Fund)



Source: KUF, St prp nr 1, 2000-01

RCN receives funds from 15 ministries – in fact, all the ministries except defence. As **Exhibit 17** shows, the income is dominated by 6 ministries. Of these the oil and industry ministries (OED and NHD) were formerly a single ministry. These larger contributors are the ministries, which formerly owned research councils. **Exhibit 18** shows which ministries fund which divisions in RCN. The sheer number of Ministries, but perhaps more importantly, the nature of the relationships, has huge consequences for the workload of each Division, and the constraints within which each has to operate.

Exhibit 18 Ministries Funding Research through RCN in 2000, by Division

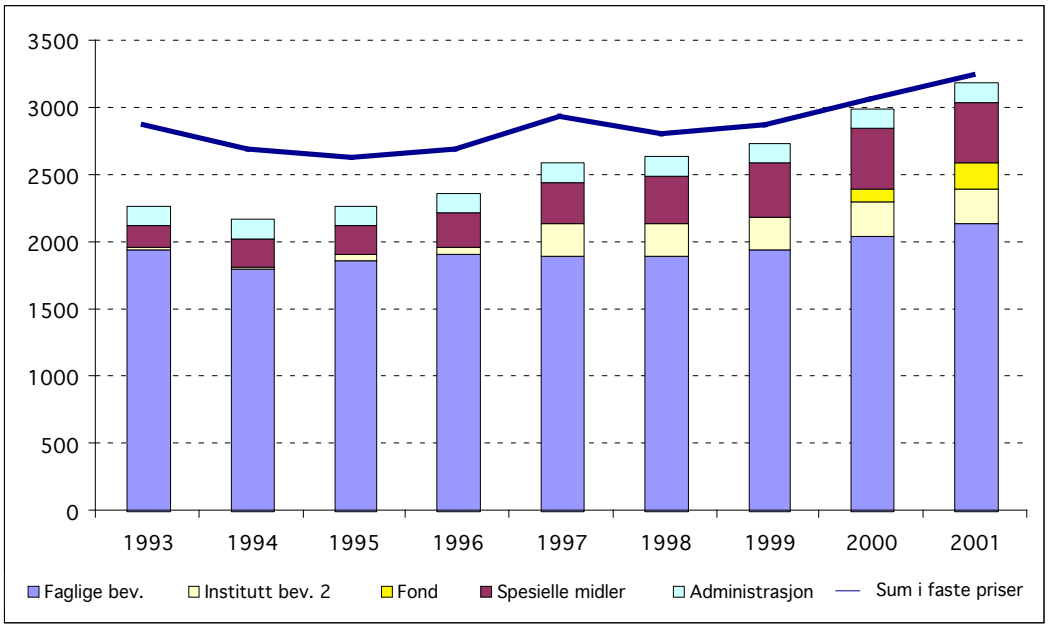
Division	Number of Ministries
Bioproduction and Processing (BF)	5
Industry & Energy (IE)	8
Culture and Society (KS)	14
Medicine and Health (MH)	7
Environment and Development (MU)	10
Science and Technology (NT)	5

The budget of RCN currently has five main components: general funds, special funds, core funds for public research institutes, proceeds from the new Research Fund, and the administrative budget it receives from the ministry of education. The Research Fund (for research and innovation – *forskning og nyskaping*) was set up by the government in 1999, with an initial capital of 3 BNOK. Its capital was increased by 1 BNOK from July 2000, a further 3.5 BNOK from January 2001 and is now 10 BNOK. The estimated proceeds were 90 MNOK in 2000 and were expected to grow to over 200 MNOK in 2001. Parliament indicated that money from this Fund should supplement, and not displace, the ordinary state research budget.

Exhibit 19 shows that RCN budgets stagnated through the 1990s. The general funds come from the old research councils' former owners, and they have declined in real terms, but this has been compensated by new funding sources – institute core funding transferred from the ministries[52] and the Research Fund.

[52] This is, of course, not 'new' money. Formerly, it went directly from the ministries to the institutes. Now it flows via RCN

Exhibit 19 RCN Budgets by Type of Funds, Current and Fixed 2000 Prices



Key: General funds, Institute core funding (reconstructed for 1993–96), Special funds, Administration. Total in 2000 prices. Note tate Institute funding in the NT division is treated a 'general funds'

RCN has three main policy instruments (*virkemidler*): independent projects, research programmes and infrastructure. There are three 'official' categories of research programmes: basic research programmes, action-oriented programmes and user-controlled programmes.

- Basic research programmes are network programmes established to produce knowledge or competence within prioritised fields
- Action oriented (*handlingsrettet*) programmes are primarily geared towards the public sector or organisations, and shall make contributions to the enhancement of the knowledge base for societal planning on various levels of government (forvaltningsnivå), for the development of public sectors and for political decisions
- User-controlled (*brukerstyrte*) programmes are geared towards industry (*næringslivet*), in which users and researchers collaborate, and in which users specify the nature of the projects and contribute to their financing

In addition BF has a fourth category which is a combination of the three ('Value chain programmes').

RCN has a strategic responsibility for the institute sector, and a more general role in helping make sure that needed competences are available within the research community. It therefore handles

- Core funds (*grunnbevilgninger*) for a number of institutes. These funds are for the institute to use in its development and are not earmarked by RCN
- Strategic Institute Programmes. These are large projects intended to allow the institues to develop or strengthen, user-relevant capabilities, which they can exploit in their future contract research
- Strategic University Programmes. These are intended to create or strengthen research capabilities in the universities, and generally involve PhD funding

The "Infrastructure" category consists of Basic funding for research institutes, Strategic programmes for the institutes and universities[53] (SUP and SIP) and Advanced scientific equipment. In addition Centres of excellence are planned within this category from 2001. **Exhibit 20** shows which instruments are used by the various RCN divisions. RCN also has different funding modes used within the policy instruments. **Exhibit 21** gives an overview of such funding modes.

Exhibit 20 Overview of policy instruments, by RCN division 2000

	BF	IE	KS	MH	MU	NT
Independent projects		x	x	x	x	x
Research programmes						
User-controlled programmes		x		x		
Basic research programmes			x	x	x	x
Action-oriented programmes			x	x	x	
"Value chain programmes" ("Verdikjedeprogram")	x					
Infrastructure						
Basic institute funding	x		x		x	x
Strategic institutional programmes (SUP and SIP)	x		x	x[54]	x	x
Advanced scientific equipment				x		x
Centres of excellence (planned from 2001)						

Sources: RCN web pages 2000 and "Doksy".
Note: According to their budgets some of the RCN divisions also apply policy instruments not checked off here, cf. Appendix 1 to Preliminary report from Egil Kallerud of 02 April 2001.

[53] The colleges (*høyskoler*) can now also apply for these
[54] Includes MHs version of SUP, called "Miljøstøtte": 0,8-1 million NOK per year in three years to specially selected research groups at universities.

Exhibit 21 Overview of funding modes, by RCN division 2000

	BF	IE	KS	MH	MU	NT
Project funding	x	x	x	x	x	x
Fellowships						
Student fellowship ("hovedfag")		(x)	x	x	x	(x)
Doctoral fellowship	x	x	x	x	x	x
Postdocs	x		x	x	x	x
Guest researchers	x	(x)	x	x	x	x
Senior fellowship (no webinfo)	(x)		(x)	(x)	(x)	(x)
Stay abroad	x	(x)	x	x	x	x
Industrial fellowship (no webinfo)						(x)
Other fellowships (bilateral agreements etc)	(x)	(x)	(x)	x	(x)	x
Other funding modes						
Seminars/conferences	(x)	(x)	x	(x)	(x)	x
International R&D co-operation (not in "kodeplan")	x	x	x	x	x	x
Funding for information or publishing	(x)	(x)	x	(x)	(x)	(x)
Research training courses (not in "kodeplan")			x		x	

Source: RCN web pages 2000 and "Kodeplan 2001 Norges forskningsråd."
x = use the funding mode according to RCN web pages 2000
(x) = projects/applications registered in this category in the RCN project database (Foriss) within the period 1994–2000.

Exhibit 22 shows how RCN's six research divisions have together used the funding instruments and modes over time. The table needs interpretation with care, because RCN's categories do not always map readily onto the categories in which we might normally think about research funding and its use of its own categories is not always consistent.

RCN's role in funding institutes changed significantly in 1997, when it acquired strategic responsibility for a large number of institutes and about 150 MNOK in institute core funding was transferred from various ministries to RCN. While this increased RCN's budget – as can be seen in the near doubling of the 'Basic institute funding' line between 1996 and 1997, this was not new money. Previously, the ministries paid it direct to the institutes.

The **Exhibit** suggests[55] that the amount of resource for RCN programmes has gone up significantly during its life. The apparent spend on 'independent projects' has gone down across the same period. However, important parts of these trends amount to a reclassification of activities.

There has been a small amount of genuine growth in the amount of action-oriented programme activity. But the major part of the growth in programmes has been caused by changes in the way the Bioprocessing and Production (BF) and Industry and Energy (IE) divisions handle proposals. These divisions mostly fund projects intended to be of relevance to users, and systematically involve users in programme

[55] For the detail, seeEgil Kallerud, Liv Langstedt and Randi Søgnen, *RCN budgets, policy instruments and operations Background report No 7 in the evaluation of the Research Council of Norway*, Oslo: NIFU, 2001

committees in order to help ensure that projects actually are relevant. They have moved to operating 'wall to wall' programmes, in the sense that any proposal relevant to the division automatically has a home in one of the programmes, and can therefore be included in an assessment process that involves user influence. 'Independent' projects in these two divisions have therefore over time been moved to be handled within programmes. In the case of IE, these have been use-directed programmes. In BF, many of these projects will have been handled in action-oriented programmes, but some also in user-directed ones. This reduces the spend on project support in both divisions, and on scholarships in BF.

Exhibit 22 RCN Research Divisions' Use of Funding Instruments (Current MNOK)

	1994	1995	1996	1997	1998	1999	2000
User controlled programmes	601	703	767	759	779	673	667
Basic research programmes	177	174	198	200	215	227	266
Action oriented programmes	365	416	435	454	476	581	610
Sum programmes	1 144	1 293	1 400	1 413	1 471	1 481	1 542
Scholarships	176	165	162	160	99	102	99
Project support	195	120	50	55	16	27	42
EU projects	85	60	17	10	6	5	5
Other projects	75	61	63	61	173	187	202
Sum independent projects	530	407	292	285	293	320	347
Basic institute funding*	166	163	177	326	320	315	313
Strategic programmes	150	248	256	298	330	370	424
Equipment and instruments	10	8	14	10	10	25	12
Other infrastructure	25	20	18	32	25	16	80
Centres of excellence							9
Sum Infrastructure	350	439	464	666	685	727	829
Subscriptions internat. coll.	20	21	19	15	16	15	15
Information/publication	4	7	7	10	10	10	11
Planning/evaluation	15	9	9	7	9	10	13
Stimulation/networks	7	41	39	39	46	41	44
Sum various R&D activities	46	78	74	71	81	77	83
TOTAL (MNOK)	2 070	2 217	2 230	2 435	2 530	2 605	2 801

Souce: NIFU data on RCN revised budgets, Technopolis analysis
* Grunnbudjsetter

RCN's budgets classify European Union (EU) projects as 'independent' projects. They are, of course, actually parts of the EU's Framework Programmes, and could equally logically have been included in the lines for programmes in **Exhibit 22**. Norway bought into the Fifth Framework Programme from 1996. Before this time, RCN funded the Norwegian part of EU projects directly. The change is clearly visible in the **Exhibit**. The effects of this, together with the procedural changes in IE and BF, are to reduce the apparent total of independent projects in RCN from over 500 MNOK to almost 300 MNOK over a short period. From 1997 on, it can be seen that a growing amount was actually spent on free projects.

'Basic' programmes have increased over the period, largely driven by growth in the Culture and Society (KS) and Environment and Development (MU) divisions. This growth in these divisions has been accompanied by an increase both in action-oriented programmes and in independent projects.

In terms of proportions, the overall picture is of some shift in user-oriented categories from independent projects to programmes in the first years of RCN's life, and a slight overall movement from programmes towards infrastructural measures in the later years.

5 Evidence

Behind this report lie many hundreds of pages of evidence about RCN, which is assembled in the background documents listed at the start. We obviously cannot reproduce this in its entirety in a summary report. Equally, we felt it would be difficult for the reader to see how we reach conclusions if we do not in this report set out at least some of what we found. In this Chapter, therefore, we present a summary of the evidence we have collected, so that the next Chapter – where we offer our judgement on RCN's performance against its goals and answer the evaluation questions which were put to us in our mandate – makes sense. (In other words, this Chapter is not our evaluation of RCN, but a collection of evidence, which we will later use. Chapter 6 **is** our evaluation of RCN.)

Our work programme was extensive and complex. We have grouped the evidence we present here into ten categories, mindful that the detail of our mandate from the education ministry specifies that we shall consult the major groups with a 'stake' in RCN. In this chapter, we therefore start with an international perspective by using some bibliometrics to map the international position of Norwegian research and to ask what impact RCN may have had on it. We asked foreign scientists and scientific administrators to review each of the RCN research divisions, so we maintain the international viewpoint by presenting a summary of their reflections on RCN. Next, we look at RCN through Norwegian eyes using questionnaires and interviews. First we review the experience and views of the research community in the universities, university colleges and research institutes. Next, we consider the views of industry. We then analyse the views of the funding ministries, reporting both what they think of RCN and analysing the ministries' performance in contributing to the governance of RCN. We go on to offer some evidence about administration and organisation, which is based on a mixture of interviews in Norway inside and outside RCN and on some international performance benchmarks. We consider RCN's role as a strategist and research policy advisor, how it co-operates internationally and how it tries to spread understanding of research and research results. Finally, we look at the effectiveness of RCN's interactions with the research institutions: the universities and, especially, the research institutes, for which it has been given special responsibility.

5.1 Norwegian Scientific Publication

Looking at the pattern of publications from Norwegian researchers does not allow us to make very definite evaluative judgements about RCN, but it does let us understand a little about how Norwegian scientific production differs from that elsewhere. The particular Norwegian pattern has, of course, been set over a very long time. It would be surprising if RCN could make a difference to it in a few short years. However, when we move down from the overall level to look at some areas of research that are important in Norwegian scientific production, it appears that RCN is supporting strong research, much of it in 'basic' journals but with a great deal that can also be applied.

Measured by publication output and the share of the world-wide production of scientific papers[56], Norway is one of the smaller countries producing scientific knowledge (**Exhibit 23**). Norwegian scientific productivity is lower than that of its Scandinavian neighbours in particular if based on population size. Publication output *per capita* is, however, higher than it is for Germany and only slightly behind the UK. Taking the relation between R&D input and publication output as an approximation for cost-effectiveness it was found that Norway lags behind its Scandinavian neighbours.

Exhibit 23 Publication Shares of the World Total 1993–2000

Country	Share of World total	No. of papers per 1000 capita[57]
Norway	0.6 %	7.9
Finland	0.9 %	10.8
Denmark	1.0 %	11.8
Sweden	1.9 %	13.6
Germany	8.4 %	5.6
United Kingdom	9.4 %	8.8
Switzerland	1.9 %	13.9

Data Source: SCI, NSIOD

Norway was able to increase its share of world-wide publication output since the end of the 80s, as a result of increasing international collaboration. The number of articles published in international journals that are covered by the Science Citation Index (SCI) is an indicator reflecting the research output of the Norwegian research system. While the Norwegian publication volume appeared flat during the 1980s, from the early 1990s onwards there was a continuous growth of number of papers published. This was partly because the proportion of Norwegian papers covered by the SCI started increasing in 1989 and partly because a growing share of Norwegian papers was internationally co-authored. Adjusting for the increase in international co-authorship, Norway's share of papers remains stable over time at about 0.5 %. Norwegian researchers' publication patterns therefore appear to be internationalising at about the same rate as those of researchers in other countries.

Citation data provided by the SCI were used to analyse the impact Norwegian science has internationally. Citation frequencies differ significantly between disciplines, thus a country's citation rate depends on its engagement in the different disciplines and the relative distribution of papers published in those disciplines. The weighted citation index, which was used as an indicator to analyse the impact of Norwegian science, takes into account those national differences, and thus allows international comparison and a benchmark against the world average (1.0). The results are given in **Exhibit 25**.

[56] World output = total number of papers included in the SCI data base; Norwegian output = total number of papers that contain at least one Norwegian address, complete count

[57] Population size as in 1998 was used to calculate the indicator.

Exhibit 24 Norwegian publication output 1981–2000 (Data Source: NSIOD)

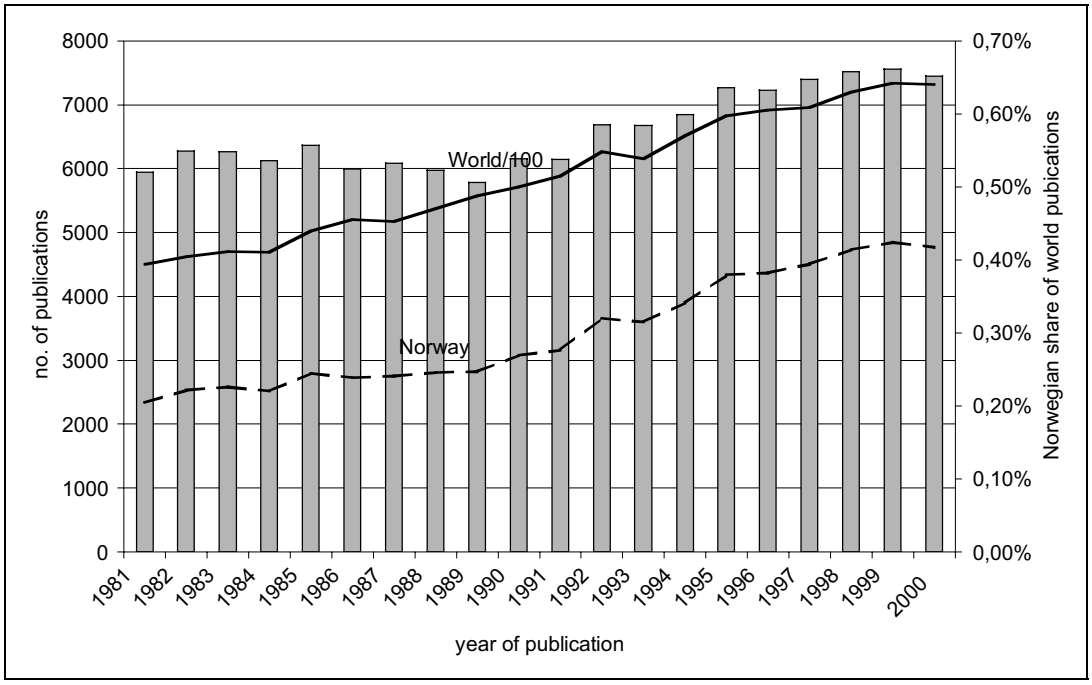
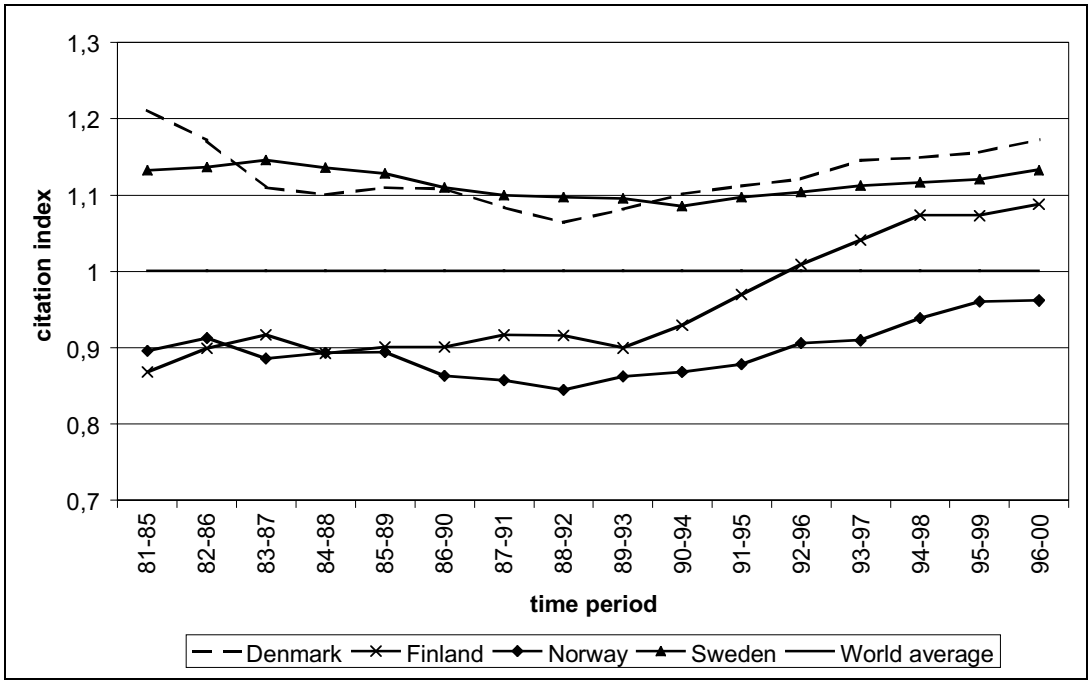


Exhibit 25 Weighted Citation Index



Data Source: SCI; NSIOD

It was found that in recent years Norway is the only Scandinavian country with indicator values below the international average. Reaching around the same indicator values as Finland until the late eighties, Finland succeeded in increasing the international visibility of its science between 1992–96 more effectively, however, Norway is also closing the gap. The other Scandinavian countries are clearly above the international average.

Glänzel[58] has developed four basic paradigmatic patterns, which he says are visible in publication profiles, namely

- The 'Western model', that is the characteristic pattern of the developed western countries, with clinical medicine and biomedical research as dominant fields
- The characteristic pattern of the former socialist countries, present economies in transition and China, with excessive activity in chemistry and physics
- The 'bio–environmental model', most typical for developing and natural resource-based economies
- The 'Japanese model', now also typical of other developed Asian countries, with engineering and chemistry being predominant

The publication record shows that Norway follows a 'bio–environmental' specialisation pattern, focusing its scientific activities predominantly on areas like Marine and Geosciences. Ecology and Environmental Sciences are intensively researched. International collaboration, which is becoming increasingly important world-wide is even more relevant for small open economies. All Scandinavian countries have similar high and growing level of international collaboration. For Norway, partnerships with member countries of the European Union are crucial. About 28 % of all Norwegian scientific papers are co-authored with scientists from EU countries.

We looked more closely at Norwegian publications in marine sciences, biotechnology and economics. Compared with world norms, the Norwegian publication pattern is very specialised in the marine area and economics. In biotechnology, Norway is close to the world average, but is becoming more specialised over time.

Norwegian publication activity in marine sciences – in absolute and relative terms – rose between 1993 and 1998, as did the average number of publications per principal investigator. After 1998 decreasing publication activities were found which might be related to decreasing funding. RCN-funded marine science publications had high impacts, compared to Norwegian as well as international standards. RCN funded marine sciences publications appeared to have a higher basic science content than the world average for this field, and than Norwegian work funded from other sources. Application orientation seems to play a less prominent role. However, at least parts of the research activities undertaken point to a stronger focus towards industrial application than is the case for the other Scandinavian countries. The share of collaborative activities exceeded the overall average for Norwegian research.

The number of Norwegian biotechnology publications rose – in absolute and relative terms – between 1993 and 1998. Afterwards, there was a slight decrease overall and per principle investigator – an indication that scientific productivity was declining in the area. One factor influencing decreasing publication activities might be a decrease in funding. RCN funded biotechnology produced a higher share of basic research publications that the world norm. However more then one third of the publications are oriented towards applied research and technological sciences indicating significant

[58] Wolfgang Glänzel, 'Science in Scandinavia: A bibliometric approach,' *Scientometrics*, 48 (2), 2000

orientation towards industrial application. RCN funded biotechnology publications had a higher 'impact factor'[59] than other Norwegian biotechnology publications, whose impact was at about the level of the world average. In biotechnology the share of collaborative activities was found to exceed the overall average found for Norwegian research.

Our case study in economics proved inconclusive, owing to the small numbers of observations we could make and the small proportion of Norwegian research in this area that is indexed. We were not able to say whether performance in the economics field differed from the norm in a statistically significant way.

5.2 Expert Reviews of RCN Divisions

In order to get an international view of the way RCN is operating, we asked 14 experts[60] to visit the RCN to review the research divisions. The members of the review team were identified by Technopolis and subsequently approved by the relevant RCN division. For each division, at least one senior scientific administrator was included on the panel as well as one senior scientist with knowledge of the types of subjects handled by the division. The benefit of involving senior scientists is that such people are regularly invited to sit on assessment and evaluation panels and so are involved in the committee work associated with running research councils. They therefore tend to have a broad understanding of research governance practices abroad.

Each division provided the Panel with an extensive briefing document. The foreign experts then spent two days with the division they were reviewing, listening to presentations of the division's strategy and development, its portfolio of activities and discussing strategic and operational issues. The experts wrote reports individually, using a standard format, which Technopolis synthesised and sent back to the reviewers for validation and approval. The documents were then sent to the relevant RCN division to allow us to correct any factual inaccuracies and to allow their comments to be recorded.

In four cases, following minor changes, the division directors were satisfied with the final evaluation report. In two cases the reviewers and the division "agreed to disagree" about certain aspects of the report and the response of the division has then been appended to the specific report. This section is based on our analysis and summary of the final divisional reports. However, it must be understood that –whilst, as evaluators, we may share some of the reviewers assessments – the opinions expressed are those of the review panels. The judgements made in the overall evaluation reflect not only the reviewers' conclusions but also inputs from other parts of the evaluation.

After the reviews were complete, RCN management pointed out to us that combining the reviews of the IE and NT divisions could have given the visiting experts a more complete picture of their roles and activities as in the pre-RCN organisation that had together comprised most of NTNF. This limited the reviewers ability to see beyond

[59] Meaning that more people cited them in subsequent publications

[60] The reviewers represent 5 European countries and includes eleven men and three women – reflecting the skewed gender distribution in international science, especially among senior scientists

the division and it would clearly have been useful to take this better into account in designing the interaction between RCN and the external reviewers. At the same time, it is also evident from RCN's mission and structure that there should be managed complementarity among the divisions more generally, this is an issue that was addressed in all the reviews.

The 14 Members of the Division Review Panels

Expert	Position	RCN Division
Dr D. Shannon	Chief Scientist, Ministry of Agriculture, Fisheries and Food (UK)	Bioproduction and Processing (SRA)
Prof. W. Van Muiswinkel	Vice-President of Department of Animal Sciences at Wageningen University in the Netherlands (NL)	Bioproduction and Processing (SSc)
Dr. J. Marks	Director Earth and Life Sciences NWO (NL)	Environment and Development (SRA)
Prof. M. Redclift	Professor of Human Geography and the Environment at King's College London (UK)	Environment and Development (SSc)
Prof. A. Warner	Director of the Centre for Mathematics and Physics in the Life Sciences and Experimental Biology (CoMPLEX) at University College London. (UK)	Science and Technology (SSc)
Dr L. Thompson	Senior Programme Manager at the Engineering and Physical Sciences Research Council (EPSRC) – coordinating the interaction between the Natural and Life Sciences (UK)	Science and Technology (SRA)
Dr H-P Hertig	Secretary General of the Swiss National Fund for Research (CH)	Science and Technology (SRA)
Prof. E. Klasen	President NWO, and previously Head of the Medical Research Council. (NL)	Medicine and Health (SRA)
Prof. O. Stendahl	Secretary General, Swedish Medical Research Council (S)	Medicine and Health (SSc/SRA)
Prof. R. Åberg	Dean of the Faculty of Social Science at the University of Umeå (S)	Culture and Society (SSc)
Mr C. Caswill	Director of Research at the Economic and Social Research Council (UK)	Culture and Society (SRA)
Prof. E. Mumford	Emeritus Professor at the University of Manchester Business School (UK)	Culture and Society (SSc)
Prof. J. Swithenbank	Professor of Chemical and Process engineering at the university of Sheffield – previously President of the Institute of Energy and of the Science Research Council (UK)	Industry and Energy (SSc)
Dr M. Maurer	CEO of AIF, the German Research Foundation for SME industrial research (D)	Industry and Energy (SRA)
SRA: Senior Research Administrator SSc: Senior Scientist		

The individual exercises amounted to a form of modified peer review. Their strengths included that most of the experts were able to rapidly absorb information about the Divisions, to ask incisive and difficult questions and to provide reasoned, experience-based judgements based on international experience of good practice. Weaknesses included

- The fact that the experts focused on one component of the system and were not equipped with systematic data enabling them to properly review RCN as a whole
- The difficulty of briefing the experts so extensively that they could understand the history and wider sets of path dependencies in the Norwegian research policy situation
- Use of the reviews by the RCN divisions and external representatives as an opportunity to lobby the evaluation
- A lack of resources to resolve any strong disagreements between the reviewers' assessment and the divisions comments on their individual reports.

The particular strength of carrying out six separate reviews, however, means that we were able to look for areas of convergence between the reviews as an input into the overall evaluation of RCN.

5.2.1 Overall View of RCN

In terms of the Council's mission to improve interdisciplinary research, five of the six reviews argue that the merger was a significant improvement on the previous system. It simplified the relationships between the research and funding base, and forced research funders to begin to deal with truly interdisciplinary research. The reviews also suggest that the creation of a single research council has

- Built the foundations required for national research coordination
- Given Ministries that did not previously have a research council the opportunity to fund policy relevant research

Whilst there has been some progress towards improving national research coordination, three of the reviews comment that within the current structure RCN does not appear to be providing the required advisory role on national research funding. Two problems are identified by the review teams

- There does not appear to be a body capable of receiving and acting on RCN advice regarding research and innovation policy
  - Research is not considered important enough to form a strong part of national policy
  - The sectoral principle fragments the funding for research
- There are no suitable mechanisms to allow the RCN to develop and co-ordinate research because it is
  - Heavily dependent on 'earmarked' funding from Ministries
  - In a situation where it suffers from a conflict of interest in having to advise on research funding whilst at the same time being the main body responsible for allocating funds.

The reviewers feel that the current arrangements are an improvement over the previous structure. However, they argue that in order for the RCN to fulfil its mission, Norway needs to weaken the sectoral principle, which places the rationale for funding research outside the RCN. Whilst aspects of the sectoral principle have had a positive effect in creating good links between RCN divisions and Ministries, the RCN should be given greater responsibility for prioritising research.

Whilst the unitary structure has prevented multidisciplinary applications 'falling between chairs' some of the reviews suggest that the small amount of cross-divisional collaboration or active joint programme management indicates that RCN is still not able to encourage and deal with truly multidisciplinary research. One of the more positive reviews characterises the current system as one in which other divisions are kept informed of activities but where there is relatively little joint work across divisions on programmes and projects. Other reviews were considerably more critical of RCN's performance in this respect.

A further comment by the reviewers was that the RCN seemed to spend considerable resources on strategy formulation but seemed to have limited resources and flexibility to implement strategies. Given the lack of funding, some of the reviews were surprised that that the Ministries, Executive Board, division board, national committees with the mandate to draw up strategic plans for individual disciplines, RCN staff, and a specialist division in RCN are all involved in strategy formulation.

The lack of staff mobility within the council (and the lack of awareness of junior staff about the activities in other divisions) suggests that there are strong separations between the RCN divisions. The reviewers identify this as evidence that, eight years after the merger, the RCN is still operating as six different research councils.

5.2.2 The View from the Divisions

Whilst they inevitably comment on the overall RCN system, the expert reviews concentrate on providing assessments of

- The strategies adopted by the divisions
- The structure and resources of the division and how these are managed and governed to support the delivery of its missions
- The choice and relevance of research portfolio supported by the division and the way in which these are designed and used
- The effectiveness and apparent impact of the portfolio

Overall, the experts are fairly positive about the efforts of the divisions. Four of the reviews are complimentary about the progress of the divisions and the other two largely attribute the problems they witnessed to structural and resource problems.

Exhibit 26, below, presents in tabular form the main issues identified by the six divisional reviews. The principal conclusions from the reviewers are that

- In most cases the division **strategy** appears appropriate given the constraints that the divisions are operating under (for example, earmarking and fragmentation of funding). However, in a number of cases the divisional strategy is criticised by reviewers for being overly pragmatic in that they principally respond to Ministry priorities rather than setting their own priorities.[61] Consequently, it is difficult for the reviewers to judge whether

[61] In the one instance where this was one of the principal conclusions of one of the divisional reviews it was the subject of some counter arguments by the division - these are presented as part

some of the programmes that have been launched form part of a strategy, or whether they would have been funded anyway because of Ministerial requests

- The **structures** of the divisions are broadly appropriate given their responsibilities and research portfolio
  - The reviewers responsible for evaluating the Industry and Energy division argue that it is a structure which suggests it performs significantly different work from the other divisions and that this might be an indication that the functions of this division could usefully be separated from the rest of RCN
  - Concerns were also expressed about the Environment and Development division because the reviewers felt that it appears to have a rather weak position within the RCN, partly due to its history, and partly because important parts of environmental research are funded outside MU
- The reviewers generally praise the **management and administration** of the divisions. Most of the reviewers found the Director and senior staff they met to be strong leaders and skilled administrators. In several cases the reviewers praise the commitment and drive of the senior division staff given the difficult situation they face
  - A number of reviews suggest that the RCN staff are not aware of operating practices in other divisions and that the RCN suffers from a fragmented organisational culture. Two reviews also suggest that project officers lack sufficient training
  - One of the reviews suggests that the practice of relying on external contractors to act as programme coordinators (to overcome the freeze on RCN recruitment) is not providing RCN with long-term access to technical competence
- The **governance** by the Division Board is generally felt to be appropriate. Whilst the reviewers met only a limited number of past and present Division Board members their overall assessment is that these are suitably qualified men and women capable of fulfilling their role
  - The reviewers suggest that additional Board members might be introduced in the Industry and Energy and Natural Science and Technology divisions to strengthen their academic and industrial competence respectively
  - Three of the reviews suggest that the stability of the system could be improved by introducing a system to increase the continuity of Board appointments
- Although the reviewers did not interview Executive Board members, two **governance** issues were regularly identified at the divisional level
  - The relationship between the Executive Board and the Divisional Board is identified as problematic in all the reviews. The problem appears to be caused by a lack of representation of the Divisional Boards at the level of the Executive Board. This has improved in recent years but the RCN is still at odds with the standard practice of automatic membership of the board for the chair of subordinate goals
  - The representative composition of the Executive Board led to a number of questions about the resources of the Executive Board to formulate research and innovation policy. From the limited overview obtained from evaluating the divisions, few reviewers see it as making a useful contribution. Some reviewers felt that the Executive Board would benefit from having direct access to the work of the Division Board so that there are dual lines of command through the board structure and the RCN administration
- Overall, the divisions have worked hard to reduce the number of programmes within the RCN and the coverage of the respective divisional **portfolios** appear broadly appropriate. However, the reviews suggest that the RCN is devoting insufficient resources to funding research in a responsive-mode

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of the divisional reviews in appendix 5 to the main report. In most other cases, the reviewers and RCN staff agreed that the division strategy was more dependent on Ministerial policy than would be the case in other countries.

- A number of reviews identify the size of programmes and projects as subcritical and that more work will need to be done to create fewer and larger programmes or to reduce the ambition level of smaller programmes
- The reviewers argue that current funding arrangements mean that RCN is concentrating on supporting PhD students and individual post-doctoral fellows but cannot provide sufficiently large funds to provide long-term support for emerging research groups

· The division reviews identified that there appeared to be weak mechanisms to promote integrated coverage of particular fields of research or to allow divisions to co-manage programmes and this seemed at odds with the ambitions of creating a single council capable of dealing with multidisciplinary research

· Given the lack of leverage that RCN can exert on Research Institutes, the rationale for making the RCN responsible for administering core-funding for Research Institutes on behalf of Ministries is called into question.

Exhibit 26 Issues Identified During Evaluation of RCN Divisions

	KS	MU	BF	IE	NT	MH
RNC level issues						
RCN advisory role not properly fulfilled		✓		✓		✓
Too many fragmented funding sources	✓	✓	✓	✓	✓	✓
Excessive earmarking by Ministries	✓	✓	✓	✓	✓	✓
Weak collaboration across Divisions		✓		✓	✓	✓
Lack of RCN culture	✓	✓		✓	✓	✓
Division level issues						
Division strategy is too reactive or underdeveloped	✓	✓				
Division strategy separated from RCN strategy				✓		✓
Peer review process should be improved					✓	✓
Link between Division Board and EB	✓	✓	✓	✓	✓	✓
Programmes too small unfocused to deliver goals		✓				✓
Project size too small	✓	✓	✓	✓	✓	
Unclear focus on Research Institutes	✓	✓	✓	✓		
Few response mode grants for emerging groups	✓		✓	✓	✓	
Difficulty dealing with multidisciplinarity	✓	✓			✓	✓
Lack of internal human resources				✓		

5.2.3 Proposed Solutions

The reviews identify significant problems in several areas within the current RCN. A significant number of these appear to be caused by a lack of clarity in the internal relationships and 'micromanagement' by the actors responsible for funding research in Norway.

The reviews propose a number of solutions to improve Norway's Research and Innovation support. These can be broken down into **structural** solutions, **budgetary** proposals and **management** recommendations.

A number of the reviews identify the inherent conflict of interest in RCN acting as the main sources of advice on research policy (and research funding) and its responsibility to fund research. In addition there is an issue about the lack of coordination for the implementation of a national research strategy. The reviewers suggest that a separate independent body should be created to advise on Research and

Innovation policy. At the same time they suggest that the Government needs to create some co-ordinating mechanism to overcome the parochial focus created by the sectoral principle, so that there are suitable co-ordination and financial mechanisms to act on the advice of the new advisory body.

Even from the limited overview afforded to the reviewers, the review of the Industry and Energy division suggests that this division does not sit well within the research council. It would benefit from being separated from the Research Council to create a bridging mechanism between academic research and innovation support agencies. Smaller (incremental) changes would probably not be adequate to overcome the problems of the RCN.

The RCN is operating in a system, which assumes that research-performing institutions are well funded and that it can provide support for the marginal costs of projects. This is apparently not the case as funding for university departments has (until recently) been largely driven by student numbers rather than research results. The issue of university funding, and in particular the responsibility for PhD research training should be resolved so that RCN can concentrate its efforts on developing a research base rather than having to contribute to scientific education.

The reviewers perceive a low level of support for responsive-mode funding and identify this as a serious issue, suggesting that the funds available for this mode should be increased. The RCN should do more to prioritise the research funding it provides and abandon what appears to be a concern to ensure that funds are distributed 'thinly but equitably'.

In addition, since the main source for responsive-mode funding is the funding provided by KUF, one of the obvious conclusions is that the treasury needs to increase KUF's research budget. Other solutions would be for the funding Ministries to reduce the level of earmarking associated with their funding to allow the different divisions to redirect additional funding to responsive-mode support.

The RCN lacks a unitary culture and staff seem to be largely unaware of the actions and practices of other divisions. The reviewers suggest that the introduction of significant staff exchange programmes across divisions and scheduling staff rotation as part of staff development would help staff keep up-to-date with new practices, and would help to create a broader awareness of the full range of activities of the RCN.

The interactions between the Executive Board and the Division Boards should be strengthened so that the Division Boards can represent their views to the Executive Board without relying on communication through the RCN administration. Representation would also introduce more research competence into the Executive Board, allowing it more effectively to draw on the skills of and competence of the Division Boards.

The RCN should strengthen its peer review practices in line with international best practice by

- Allowing evaluation committees to devote sufficient time to the review process

- Allowing rejected applicants to comment on referee's assessments
- Ensuring that administrative staff responsible for supporting peer reviews are adequately trained

Exhibit 27 Possible Solutions Identified During Reviews of RCN Divisions

	KS	MU	BF	IE	NT	MH
Creation of separate policy advisory organisation				✓		✓
Increase responsive mode budget		✓			✓	
Simplify sources of funding		✓		✓	✓	✓
Delegation of authority for research (i.e. removing earmarking)	✓	✓	✓	✓		
Turn IE into Innovation agency				✓		
Strengthen divisional collaboration		✓	✓		✓	✓
Eval. Rationale for institute funding		✓		✓		
Staff rotation and exchange in RCN		✓	✓		✓	
External secondment	✓	✓	✓		✓	
Improving peer review process					✓	✓
Rotating board appointments				✓	✓	
Fund larger projects for team leaders	✓	✓	✓		✓	✓
Working with universities to resolve PhD training needs	✓	✓				✓
Improving communication channels and representation between boards	✓	✓	✓	✓	✓	✓

5.3 Researchers' Views and Experiences

We used two main instruments to gauge researchers' views and experiences of RCN: a postal questionnaire; and a series of interviews with research groups around the country. In addition, many of the people we interviewed in their capacities as university or college officials, or in order to capture their experience in RCN management, made useful contributions to our understanding.

5.3.1 Survey of Researchers' Views and Experiences

Our survey (conducted by NIFU) of researchers covered universities, state colleges, university colleges and research institutes. About half the respondents came from Eastern Norway, a fifth each from the West/South and from Mid Norway, and the remainder from the North. Our sampling aimed to be representative, so about a quarter of the sample were women, as were a quarter of the respondents. We obtained 613 valid responses and a response rate of 50%.

Unsurprisingly, male respondents tended to hold more senior posts than women, while senior people were more likely to get research grants from RCN than more junior ones (except in the case of Strategic Programmes). Women are not under-represented as recipients of RCN funding, but here, as elsewhere, it will clearly take time for action on equal opportunities to filter into daily practice.

Several positive messages emerge

- Many beneficial effects of the various types of funding were described, and researchers who have had concrete interaction with RCN are generally more positive about the application process, administrative procedures and benefits than those who have not actually experienced these things
- Those who have received the most funds also generally have the largest number of rejections, which indicates that you do not "automatically" get (more) funding once you are "on the inside" of the system
- Cross-disciplinary research is high on the priority list of Norwegian researchers, but respondents from cross-disciplinary units also have a high degree of success when it comes to RCN funding and interaction. While other parts of the evaluation indicate that the RCN divisions are poor at building links among themselves, about a sixth of the researchers indicated they themselves had contact with at least two divisions. There seems to be a continuing development of new specialities and focus areas in the intersection between traditional dividing lines
- Although there is a fairly large group (more than one-sixth of the respondents) who has never had anything to do with RCN, the data on funding and interaction show a broad involvement of disciplines, institutions and regions in the various funding schemes. The data furthermore point to the centrality of the institute sector in the Norwegian R&D system. Respondents who have not received RCN funding, quite often report that they have alternative sources of money
- The "results profile" of the four main funding mechanisms indicate that they tend to achieve their intended aims and that they address different parts of the research system

Perhaps the most serious negative message is the low share of respondents that agree that applications receive a thorough and just assessment. Many (around 50) open comments in the questionnaire dealt with this issue, and there are frequent complaints that "irrelevant" criteria too often play a role in project (and programme theme) selection, e.g. geographical and institutional "fairness" or "representativity". Ensuring legitimacy of the review system may be a great challenge for RCN.

There is a strong call for basic research to be given higher priority. However, the data also clearly show that important segments of the research population have other priorities. No matter what "profile" RCN develops in its funding mechanisms and administrative procedures, it will probably be impossible to satisfy everyone.

In the opinion-oriented questions about developments in the Norwegian research system, respondents tend to agree strongly with a set of statements indicating that funding is more competitive, priority setting has moved to national level and is user-oriented, research positions have become more flexible, while the research job is overworked and underpaid. To some extent these opinions reflect a general critical attitude of academics towards governments, that is also found in other countries.[62] However, the same set of questions have been used for a survey among researchers in

[62] See e.g.. Jack Sommer, 2000, Year 2000 Survey of Scientists, Report of the Results, University of North Carolina Charlotte: December 2000

eight European countries, which gave a more differentiated picture.[63] As in Norway, researchers in other European countries feel that priority setting has moved from the individual level to the national level. But in other European countries, researchers feel less overworked and underpaid. They are also less emphatic about the change from institutional funding towards competive funding, with an increase in bureaucracy for getting funding. In Norway over 70% claimed this change. In the INNOCULT survey more than 40% indicated that they didn't know whether this was the case, and for the others numbers of agreement and disagreement were balanced. An explanation for these high figures of dissatisfaction may be that Norway has not found a way to modernise the universities.

The majority of respondents have *never received/taken part in* the studied funding types (free funds, regular programmes, user-controlled programmes and strategic programmes) and interactions (referee, project leadership, membership in various committees, PhD scholarships and rejected proposals). Most of those who have received funds or carried out other tasks have a relatively low degree of interaction for each type (1–3 times in the 8-year period in question). A small group has a high degree of interaction, and "success" (received funding or carried out other tasks) in one activity type often means "success" in other respects as well.

Universities dominate the "free funds" and "referee" categories, while IE (and to some extent BF) dominate user-controlled programmes. One fifth of the respondents has received funds outside of ordinary calls for proposals and competitions. Senior personnel and the university colleges are over-represented in this group. In general, the state colleges have a low score on all items (their highest absolute scores are in the "rejection" items). Respondents with many successful applications for one type of funding also have a higher number of rejections than others, suggesting that they treat proposing projects as a 'numbers game.'

The most successful applicants are those in Full Professor/Researcher I positions, institute researchers, respondents from technological and agriculture/fishery-related disciplines and cross-disciplinary units (and the IE/BF divisions), researchers with a high degree of international collaboration, and members of formal groups. At the low end of the scale, we find Assistant Professors/Researcher III's, the state colleges, the humanities and researchers with no formal group membership and/or little international contact.

It is not easy to get a clear picture of reasons for not applying. Research institutes frequently have other funding opportunities. People who had applied to the RCN system were more likely to understand it and to be more successful at extracting money than those who had not.

RCN seems to have a bad reputation among those who lack experience of dealing with it. Researchers who had never applied for funding are the ones who most strongly claimed that the "rejection rate is too high" and that the "application process is too bureaucratic." Respondents with no or little RCN experience are significantly more negative about the application documents, feedback about review results and end-of-project reports than those who are actually qualified to comment on these

[63] Innocult project

things. With a few exceptions, researchers who have not received a particular type of funding are also more negative about its benefits, status and organisation.

Respondents' appraisal of the application documents is positive, but many felt the application process takes longer time than it should and that they have not received any assistance in the application phase. Respondents belonging to IE are much more pleased with the assistance than respondents dealing with the other divisions. Only a tenth of respondents were happy with the length of time needed to process an application. The most "impatient" ones are found in the IE, BF and MH divisions. Almost half the respondents express dissatisfaction with the feedback about the review results.

When turning the attention to administrative procedures and selection criteria, the picture is somewhat mixed as well with slightly positive experiences with the reporting but critical remarks about too little focus on originality. The respondents with actual RCN experience disagree that the mid-term and end-of-project reporting are too comprehensive (they are slightly more pleased with the latter), and more than half agreed that reporting underway may be useful to the projects' efficiency. On the other hand, the experienced respondents agree relatively strongly that "RCN does not use the end-of-project reports". Almost 80 % agree that many good applications do not get funded (only 2 % disagree), while 60 % agree that "originality/innovative research is given too little priority" (7 % disagree). Finally, more than 60 % agree with the statement "my problems often fall between two RCN stools", and almost 50 % agree that too few funds are distributed to too many research units. Respondents with success in obtaining RCN funds agree more strongly to the latter, as do respondents from the institute sector in general.

The picture emerging from the analysis of the experiences with free funds is very positive. The successful applicants strongly agree (between 72–82 % of them) that free funds are a stamp of quality, that they make it possible to enter new specialities and that the competition for these funds is too hard. A little over 50 % of them agree that free funds yield good professional networks. Researchers in a Full Professor/Researcher I position are over-represented among the recipients of free funds, as are the medical and natural science (and the MH and NT respondents). The most common results of free funds are scientific publications, development of new knowledge and training of (young) researchers.

People in senior positions also dominate the receipt of regular programme funds. The most successful ones mainly come from universities and institutes. Researchers with regular programme funding seem to depend more upon RCN – their share of RCN funding is high and their basic funds are relatively low. Furthermore, the more money from regular programmes, the more money the researchers report from international public sources.

Of the recipients of regular programme funds, 50 % or more agree that programme research is professionally revitalising, enables entering new fields, yields more internal co-operation, constitutes a stamp of quality and yields good professional networks. However, 64 % agree that "non-researchers get too much influence on professional decisions." 57 % agree that "programmes have made the researchers do more applied projects." The most common outputs of regular programme funds are

scientific publications, development of new knowledge and training of (young) researchers.

Institutes receive user-controlled programme funding much more frequently than researchers in the other three institutional settings. Technologists and researchers from agriculture/fish-related disciplines and cross-disciplinary units are over-represented. The general picture of experiences with user-controlled programmes is positive, but with some critical remarks. 41 % agree that such funds enable entering new fields, 49 % that they are a good source of competence increases, and 51 % that they yield good professional networks. The shares that agree to beneficial effects and other positive statements (network effects, opportunities for entering new fields, funds as a stamp of quality, hard competition) are lower than for the other three main funding mechanisms, however.

Almost two-thirds of the recipients of user-controlled funds agree that "users rarely have the competence to control research activities" and that "it is difficult to find a good balance between research and development work". Open comments suggested that some people oppose user control as a general principle. In line with their intended aims, the main results of user-controlled programmes are reported to be knowledge transfer to users, development of new knowledge, exploitation of knowledge and new interaction with users.

RCN's Strategic University Programme (SUP) and Strategic Institute Programme (SIP) are less dominated by senior personnel than the other funding mechanisms, confirming that they play a developmental role. Two-thirds of the recipients come from the institute sector. Technology, agriculture/fish-related disciplines, social science and cross-disciplinary units are over-represented as well. Of all the funding mechanisms, strategic programmes receive the highest scores when it comes to "status" (funding as a "stamp of quality") and beneficial effects like possibilities for entering new fields and the creation of new professional networks. More than 80 % of the recipients also report that strategic programmes yield more internal interaction. The most frequently mentioned results were development of new knowledge, scientific publications, training of (young) researchers, development of research capacity and new collegial interaction.

5.3.2 Laboratory Life: Interviews with Researchers

In addition to the large-scale postal survey, we interviewed members of 23 research groups in universities and institutes around the country and across a spread of disciplines, in order to understand in a more qualitative way their needs and the extent to which RCN helped to meet these.

We were struck by some special features of the Norwegian research community

- Its fragmentation, both in terms of subject matters and the very small size of research groups, ranging between one and only 10 members in the universities, and up to 20–30 members in 'matrix' groups in the institutes
- The high proportion of group leaders who are professors (a result of recent reforms, which grant the status of professor to those who are qualified to hold

it, rather than to those who win a competition for appointment to a particular Chair)

- The low mobility of researchers, even among Norwegian institutions.

We could distinguish four kinds of research groups, the individual researcher, the one professor group, the multiple professor group and the matrix organisation. The dynamics of these groups are important for understanding RCN's possibility as change agent. Individuals can easily sustain their level of research as they usually have a tenure position. Growth into a one-professor group depends on external funding, either as infrastructural funding from RCN's SIP or SUP, or as multiple projects funded from one or more sources. Single 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 organisation prevent both growth far above the 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 it has a rather dominant position in reinforcing points of strength and the build-up of research groups. This puts the council in a key role but also gives the it 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. Small group size is a problem in many fields, where the minimal critical mass needed to do good research is rising.[64]

A number of our interviewees argued that there are limits to research group growth hidden in RCN's practices. Programmes are small, and no-one can be permitted to take too big a share. Groups applying to multiple divisions are liable to find that RCN administrators redirect their applications to the 'right' funding source within the council, preventing diversification of the groups; funding portfolios.

Our interviewees' impressions of the extent of ministry earmarking of budgets appears exaggerated, compared with the picture we have from the ministries

[64] Our bibliometric analysis shows that Norwegian science is comparatively unproductive. Small group size could be part of the explanation for this

themselves. It seems that programming has acquired a bad name in parts of academia (perhaps a long time ago – it was part of NAVF practice already 30 years ago), and that its image has become somewhat detached from the reality.

Free project funding is perceived as a kind of safe 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 with 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.

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 in the universities. 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.

5.3.3 Industry and RCN

This section is based on a study by STEP and reviews of others by Møreforskning and AIM, which are described at greater length in the background report.[65] The user-oriented (or 'user-driven') research and development programmes of the Research Council of Norway are to contribute to wealth creation, profitability and competitiveness in industry. By involving companies as partners and co-funders of RCN programmes, the authorities want to encourage increased industrial R&D activities and R&D investments. The users are to initiate, manage and partly finance R&D activities, in order to ensure that the research is relevant to the needs of industry, and that the results are used.

Although the programmes originally focused on *financial* support for research and technological development only, the activities have gradually absorbed aspects of modern innovation theory. This means that the Research Council – in addition to traditional objectives like the production of new products, processes and services – also takes other factors into consideration, like for instance networking, general competence building and the companies' ability to learn (i.e. absorb new knowledge and technologies). Over recent years, user-driven projects have moved from creating binary relationships between companies and researchers, and increasingly involved networks. This reflects the shift in our theoretical understanding of innovation processes, and is consistent with our discussion of the National Research and Innovation System earlier on.

There is a consensus in Norwegian politics regarding the need for an increase in national investments in R&D. If Norway is to reach the goal of an investment level comparable to the OECD-average as measured as a proportion of GDP, industry must

[65] Heidi Wiig Aslesen, Marianne Broch, Per M. Koch, Nils Henrik Solum, *User oriented R&D in the Research Council of Norway. Background report No 13 in the evaluation of the Research Council of Norway*, Oslo: STEP, 2001

take its part. Given that there is no industrial organisation that can force companies into investing more in R&D, the government must find ways of encouraging such investments. User driven research programmes may be one relevant measure, provided that they actually do succeed in increasing company R&D investments.

One way of measuring the success of a policy instrument is to determine its 'additionality', meaning to what extent the measure is encouraging activities that would otherwise not have taken place. The surveys show that the additionality of user-directed projects is rising, but not to an extent where most of the companies are being persuaded by subsidy to do things that make no strategic sense for them. Rather, RCN encourages them to undertake research sooner and on a larger scale than they otherwise would have done. The research done in the projects is becoming longer term and more risky in nature since 1997. The projects have more to do with generating new knowledge and less with product and process development than before. Main benefits are an improved internal knowledge base, better ability to tackle technical problems and an expected increase in company R&D expenditures in the period after the project.

The user-driven projects are now focused on the most innovative group of firms in the economy, three-quarters of which do formal R&D. These firms are more networked than the average. On both counts, they are therefore likely to have the best development potential. Low capability small firms are being left for others in the support system to handle. Those supported are also small: 60% have less than 50 employees, while 74% have under 250. The biggest additionality from the projects is for companies in the range 20–49 employees. These are small enough to be significantly hampered by cash flow constraints on their growth, and this is probably why they are the most ready to change their behaviour in response to the mix of risk-sharing and knowledge support offered by user-directed R&D projects.

We conclude that RCN/IE is focusing its user-driven efforts on types of firms likely to generate the kind of growth needed to tackle the value-creation gap, discussed earlier. A problem, however, is the apparently low amount of 'churn' in the customer base. More firms need to be involved in this type of programme if Norway's R&D intensity goals are to be reached. If RCN really has reached the majority of its potential customers for user-driven R&D, it becomes especially important that its activities are complemented by other actors, who can stimulate firm creation and capability development. SND and SIVA are national actors, who can do this.

All the surveys show that RCN (IE) has limitations as an adviser to the companies. It knows about research funding and can help both with identifying partners in the research sector for companies needing such links, as well as with configuring projects. But RCN is not a good source of advice about how to carry on, in technical terms, once the project is complete. Nor is it knowledgeable about the rest of the business support system. In institutional terms, this means that RCN has been supporting companies well in relation to its own domain of user-driven R&D, but is less able to advise companies in areas where help is available from the regionally decentralised SND (and, to some degree, SIVA) organisations. Rather than try to extend its skill base, RCN might do better to continue its arrangement, where SND 'retails' RCN programmes or brokers a contact to RCN, as needed. We are concerned, however, at the recent year's changed plans and processes for IE, which

involve withdrawing the advisory role it has so usefully offered to applicants for the past decade in favour of more of a 'arms length' competition among applications. This is likely to continue to favour the 'usual suspects' among the customer base.

5.4 Ministries and RCN

This section examines governance: the way RCN is governed and steered by the ministries to which it reports. The empirical basis for this report is interviews with ministries, which we approached at the level of the permanent secretary (*departementsråd*). The permanent secretaries themselves decided whom it was most appropriate for us to meet. In many cases, we met with several people from different directorates in addition to the ministry's research co-ordinator and, on a number of occasions, the permanent secretary herself. We interviewed all the ministries except defence, which does not fund RCN, and justice, which asked to be excused since its total funding of RCN was only 3.6 MNOK. For some of the ministries, this involved several visits. We asked a series of questions designed to discover how the ministries

- Identified their research needs
- Procured the necessary research
- Received reports about it and used the results

and, more generally, what their experience was of working with RCN over time. The ministries also supplied us with copies of research strategies, background documents and allocation letters (*tildelingsbrev*) to RCN. We have additionally made use of interviews with current and former RCN personnel and board members.

Norway is in the process of implementing many of the same, modernising administrative reforms as other countries. This has placed RCN within a hierarchy of relationships connecting state funded research with parliament and the electorate, and implies a comparatively 'hands off' style of governance. Typically, such hierarchies develop a division of labour, where the implementers of policy acquire detailed knowledge of their task and a high degree of control over it, while the policy makers confine themselves to setting broad directions. In Norway things are more complicated than this.

Developing the RCN budget involves a large number of people and committees, and therefore a lot of compromises. In our analysis, the budget process is one of the reasons why RCN has struggled to reach its full potential as an arena for research policy and – crucially – as an organisation that can help launch the rather radical changes that are needed in the Norwegian knowledge system. The new Research Fund has been a crucial factor in improving RCN's ability to work towards its main goals in the recent past, because it provides resources which are free from sectoral constraints.

About a quarter of the Norwegian ministries' funds for R&D are spent through RCN. The industry and education ministries are by far the two biggest spenders, but all the ministries except defence channel at least some of their research spend through the council. Some act as 'patrons' – channelling money through RCN, for others to spend, without seeking much influence in how this is done. Most act as 'customers' – ordering research results from the council, which they need in order to do their work.

It is not really clear who pays to maintain the national research capabilities in all the areas where ministries want to buy research.

The ministries identify their research needs in a range of different ways.. Ministries, which owned research councils before RCN was created in 1993 tend to be the best equipped in this respect. Interaction with RCN tended to be a more useful way to learn about research needs among the medium and large spenders than among the smallest.

Ministries tended internally to co-ordinate their funding of RCN, but not of other research spending. Few had clear ways to distinguish short- from long-term needs, and some ministries without formal research strategies saw a risk that short-term concerns crowded out long-term needs. While administrative aspects of budgeting and governance were becoming smoother, ministries continued to have incentives to specify in considerable detail the way RCN should spend their money. While the people involved know and trust each other, institutionally, the ministries trust neither each other, nor RCN. The distinction between patronage and custom had largely broken down, and the governance system was locked into over-determining what RCN should do.

The ministries tended to feel that RCN was unable effectively to work 'horizontally,' and break through the watertight compartments within which the individual divisions sit. They wanted RCN to be more holistic and at the same time for it to be more under their own control but did not generally recognise their own role in preventing holism in RCN. However, the previous system of multiple research councils was no better in this respect.

RCN is seen by many as having difficulty in taking big steps in research resource allocation. Some recent initiatives have bypassed RCN, and launched discussions about major state research funding in other arenas. While RCN has managed to 'capture' the implementation work for some of these, these events bring into question its ability to act as a research policy arena and change agent under the current framework conditions.

The education ministry is the lead ministry for research matters in Norway. It co-ordinates research spending across the ministries and chairs inter-ministry discussions of research policy. Its annual budget bill provides a key place in which it sets out its overall research policy, in effect setting the agenda for RCN and others. A major success of the ministry, in which it has been supported by RCN, has been to establish a firmer national research policy via the 1998–99 White Paper on research. In a much clearer way than in the past, this sets out a series of national research priority areas (four areas plus basic research in general) and launches a key initiative to create growth in the budgets for more fundamental research, in the form of the Research Fund. Perhaps more important still, it provided a document and a policy of increased spending which legitimised research in the budget process, helped protect research budget lines across the ministries from cuts during that process, and enabled the government to make significant commitments to rising budgets. These include putting aside 10 MNOK in the Research Fund.

RCN is an agency of the education ministry, with delegated powers. Hence, that ministry occupies a special position in RCN's governance. It writes the council's statutes. The King in council (therefore, in effect, the education minister) appoints the Executive Board. As the 'owner' of RCN, the education ministry has overall budgetary responsibility for RCN and takes the main role in approving new tasks and instruments for the council, such as the new Research Fund and the Centres of Excellence competition, currently in progress. It considers reports from RCN about progress on these and other key tasks, such as the strategic responsibility for the institute sector set out in the statutes.

As with the other ministries, the contact between RCN and the education ministry is strikingly a discussion among administrators. RCN board members are little involved. In so far as these meetings involve the ministries in explaining their requirements and receiving reports about progress, this is unproblematic. To the extent that RCN is supposed to act as a research policy advisor in addition to receiving and following orders, it means that the links among the boards formally responsible for giving advice and the administrative and political levels that should hear that advice are distant.

Where more than one ministry instructs an agency, the 'owner' ministry has an obligation to co-ordinate their actions (*Økonomireglementet*, 1997). The education ministry therefore has overall responsibility for co-ordinating research. The education minister chairs the government's research committee (*Regjeringens forskningsutvalg* – RFU) and the department head responsible for research in the education ministry chairs the ministries' research committee (*Departementenes forskningsutvalg* – DFU).

RFU was effectively inactive for a part of RCN's history, but was galvanised in the preparations for the 1999 White Paper on research. It took strong ownership of this document. During the preparations for the last research White Paper, all the ministries were invited to participate and appear to have done so actively. This appears to have been a key point in getting general agreement in the government about the priority that needs to be attached to research. A ramp-up in spending became firm government policy, and began to be implemented after the 1999 White Paper. This is in clear contrast to attempts over the previous ten years to raise funding, where the intention was widely agreed but not implemented.

Ministries told us that the RFU can be effective when relevant politicians are interested in research questions. At times when this is not the case, it can achieve little which is useful. Since the original intention to transfer general research funds from the other major research-funding ministries to the education ministry has not been realised, these four ministries' control over general research funds has not been reduced. Rather it has continued, and their desire to ensure that these funds are spent in ways directly useful to themselves has encouraged them to continue earmarking research funds. The education ministry, and RCN, have correspondingly less say over the way these funds are spent.

The education ministry's lead role in managing RCN involves weak rather than strong co-ordination. The ministry creates some of the arenas where funding ministries can talk with each other but has no authority over the other ministries. This is clear from the budget process, where the education ministry collates and summarises other

ministries research budget proposals, but exerts no authority over them. The government does not decide on the research budget as a whole, but on the budgets of the funding ministries individually. This has two consequences

- It has been technically difficult to achieve the ramp-up in the government component of national R&D spending about which there is cross-party agreement and which has been an expressed aim of government over the past decade and a half
- The education ministry finds itself, like all other ministries, obliged to earmark its allocation of funds to RCN, in order to defend them from the sectoral interests of the other ministries

An alternative model internationally is to establish a ministry for research, which then has to compete for its budget with the other ministries. In setting up RCN in 1993, the government took the view that this would fail to embed research into the thinking of the remaining ministries, and that it would make the research budget itself more vulnerable. An intermediate solution could be for the education ministry's summary of ministries' research budgets to be the subject of a governmental decision during the annual budgeting process, forcing this component of ministries' budgets to be held constant in subsequent negotiations about sectoral budgets.

We conclude that the current system of governance is an important obstacle to the realisation of the 1993 vision for RCN to be a holistic research strategist and funder. Major needs are

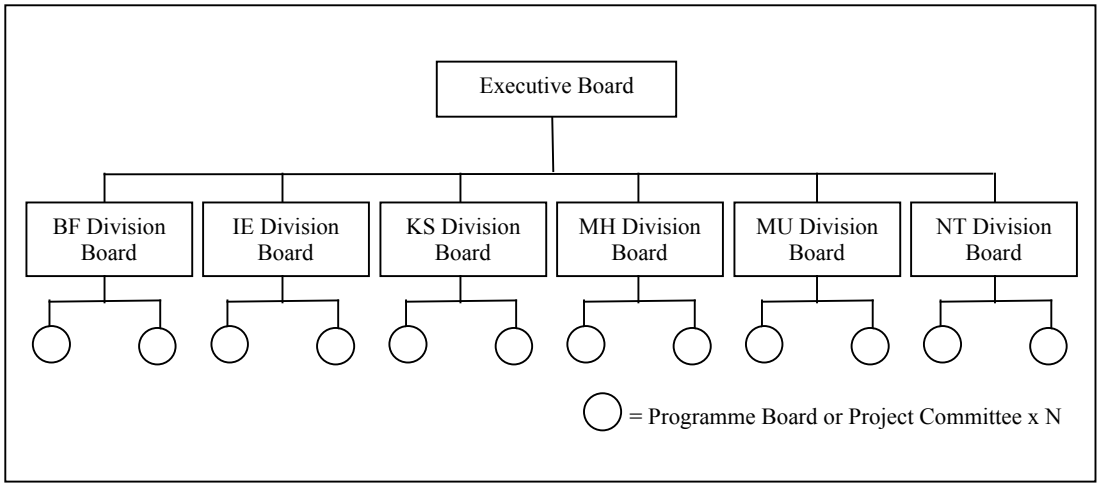
- A national technology foresight exercise, as a start to wider use of foresight in research strategy across the ministries
- Clarification of the sector principle, to include responsibility for long-term research capabilities
- Clearer separation of ministries' roles as patrons and as customers of research
- Reinforcement of the education ministry's co-ordinating role in research policy by making the total R&D spend a matter for decision early in the process of setting the national budget
- Retention of the new Research Fund within RCN, in order to allow the council freedom to operate a research policy within the highly sectorised Norwegian context

5.5 Management and Administration

This section is based on interviews and background documentation collected within RCN as well as on extensive interviews about the history of RCN, both inside and outside the organisation.

Three levels of Boards (or Committees) govern RCN. The various boards and committees generally comprise a mix of representatives drawn from one or more Government Ministries and the Norwegian research community, with RCN staff acting as secretariat. **Exhibit 28** below presents an organisation chart of the Board/Committee structure of RCN.

Exhibit 28 Board Structure of RCN



The 'Executive Board' manages and oversees the operation of the entire Council. The Ministry of Education, Research and Church Affairs (KUF) appoints the members of the Executive Board, who in turn appoint the Director General of RCN and the six Division Boards.

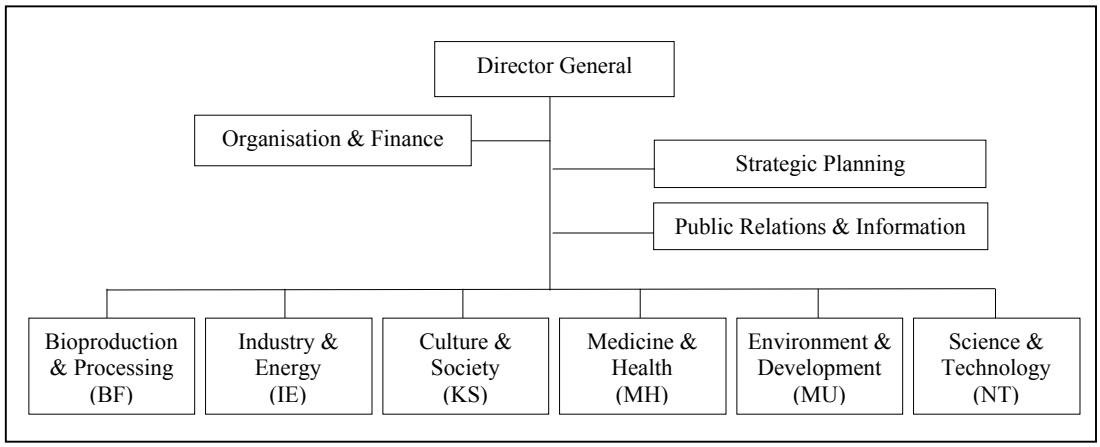
The second layer comprises six 'Division Boards'[66]. These correspond to the six research divisions , and each has primary responsibility for setting and overseeing strategy and steering the research funding activities operated by their corresponding research division. Formally, these Division Boards take decisions about funding individual projects. In practice, they normally approve decisions taken at the third steering level. In the KS division, the Division Board has formally delegated funding decisions to the third level.

The third layer comprises a large number (~115) of 'programme' boards or committees, which have responsibility for overseeing the implementation of programmes and other categories of research funding. These boards often have a strong role in setting priorities within programmes and in making funding decisions for individual research projects.

The Research Council of Norway employs some 280 personnel and is internally organised into nine divisions, each with a distinct set of roles and responsibilities. Six of these divisions are responsible primarily for the administration of scientific research activities, whilst the other three perform 'horizontal' administrative functions on behalf of the Council as a whole. **Exhibit 29** overleaf presents an organisation of the administrative structure of RCN.

[66] Also known as Divisional Boards

Exhibit 29 Administrative Structure of RCN



The Director General and his staff manage the day-to-day administration of the Council, and function as the secretariat to the Executive Board.

The Organisation and Finance division performs a range of functions pertaining to the internal administration of the Council. Responsibilities include financial control and accounting, personnel management, maintenance of facilities equipment including IT systems. The Strategic Planning division assists the Executive Board and the Director General with research policy, internal planning, budgeting and other aspects of RCN's information systems and functions. The Public Relations and Information division manage the production of documents, press and public information. Its responsibilities include activities to promote the public understanding of science.

The six 'research' divisions each have primary responsibility for defining research policies and programmes within their respective spheres of responsibility, procuring and managing research portfolios and reporting results. The separation of responsibilities between the six research divisions is decided by the Executive Board and organised primarily according to disciplinary and/or sectoral boundaries, although these distinctions are blurred at many points within the internal structure. IE manages industry-led, applied research activities, unless these fall within the areas of fisheries and agriculture, in which case BF oversees them. All of the divisions (with the exception of IE) fund researcher-led basic and applied research (IE only funds applied) though NT funds basic research activities which underpin the disciplines covered by all of the other divisions. Each of the divisions within RCN is headed by a divisional Director and sub-divided into a number of different departments (between 2 and 5 per division). As with the divisions themselves, departmental boundaries are, in most cases, organised around disciplinary or sectoral distinctions. However, NT (which has responsibility for basic research funding that underpins all sectors and disciplines) is organised into departments according to different funding modes.

5.5.1 A Three-Level Hierarchy

RCN has three organisational levels. The Executive Board (*hovedstyre*) is effectively appointed by the government, has overall responsibility for RCN strategy and represents it externally. It proposes RCN's overall strategy and budgets to the education ministry. It looks after 'horizontal' questions such as international co-operation and large equipment purchases, sets budgets and approves divisional

strategies, but delegates responsibility for different disciplines and operative responsibility for research to the six divisions.

Each division has a divisional board (*områdestyre*), appointed by the Executive Board. While both researchers and users of research must be represented, the Executive Board decides on the appropriate balance, which can vary from division to division. The divisional board is responsible for initiating, planning, funding, monitoring, evaluating and disseminating results from research in its area, within guidelines set by the Executive Board and the external funders of research. It is supposed to maintain close contact both with researchers and with the ministries, which finance the work.

The 'third steering level' in RCN comprises programme boards (*programstyrer*) with delegated power to allocate funds to projects, and advisory committees for academic disciplines and matter, which advise the division board on project priorities but do not themselves make decisions. The composition of committees at this level is determined by need more than by set rules.

The RCN administration acts as secretariat to all three 'steering levels.' An oddity is that the director general of RCN can call a board meeting at the second and third steering levels.

As we understand the thinking behind the three-level structure, the role of the Executive Board is to steer and manage RCN on behalf of society. While it is important that some of the people in the Board have research competence, the Board's main role is to make sure that top-level priority setting reflects social needs. This is why the Executive Board handles horizontal issues and acts as 'referee' between the divisions. It carries the responsibility of acting as research policy advisor to government. In doing this it is supported both by the divisions and by the council's strategy staff, who have the needed analytical capacity. The division boards' main business is the development and implementation of funding strategies within their areas of competence. Here, research skills are more important, and researchers tend to play a bigger role. The third steering level makes, or recommends, decisions that are more technical in nature.

The early days of the council saw huge controversy over its internal structure. Certain issues were actually structural. The organisational design included the principle that no-one should sit on two different levels of Board, since this would prevent them from being neutral at the upper of the levels at which they sat. (Exceptions were possible at the second and third levels, in cases where a specialised competence was needed.) This had two drawbacks. First, it meant that – while lower level boards send copies of their minutes to higher level boards – vertical communication was poor, especially between the Executive and division boards. Second, it meant that much of the vertical communication was mediated by the administration, which is responsible for preparing the agenda and case documents for the Executive Board. Both of these factors discouraged trust between the top two levels. (In contrast, there have been few disagreements of principle about the division of labour between the second and third steering levels.)

It might have been possible to find a way to live with this structure, were it not for the burdens of history and tradition. The academic community was used to managing NAVF as its own. While board and council appointments were formally in the gift of the government, there were clearly understood unwritten rules that gave universities representation in the various parts of NAVF. The chairs of NAVF's constituent research councils also had seats on the Executive Board, so that the various research communities were **represented** at the highest level in the council. The role of the NAVF administration had been increasing through the life of that council. However, the research community felt itself to be in charge, regarding the administration as a secretariat rather than a management.

Naturally, when RCN was set up, the academic community expected continuity. Even today, in talking with university researchers about history, we had often to ask our discussants whether by "*forskingsrådet*" they meant NAVF or RCN. The expectation was unfortunate, since RCN's responsibilities cover all categories of state-funded R&D while NAVF largely handled basic research (though with a growing element of user-related work appearing in the later years in the social sciences and environment.) To tackle this breadth, and in order to create a body able to construct a research policy for the whole of Norway, RCN was constructed on more of a corporate model. While the statutes make it completely clear that the Executive Board is in charge, they also specify that the director general and staff prepare the meetings of the Board and that the entire administration answers to the director general. The administration has a role in managing RCN in a way that was not the case in NAVF. (The style is actually much closer to the way the former NTNF was run, under a series of extremely active and prominent director generals from Robert Major to Rolf Skår.) The clash between expectations and organisation led to bitter struggles. The chairs of the division boards revolted, wanting to be integrated into the decision making at the level of the Executive Board, as their equivalents had been at NAVF. There were strong disagreements between the first director general and the first chair of the Executive Board about their respective roles. Eventually, the education minister intervened and both the principals resigned.

Since the organisation of the council was set down in the law, it was hard to negotiate a solution. Statskonsult, who were asked to help sort out the organisational situation had few concrete suggestions except to carry on, observed wisely

> The experience from RCN is that it can be unfortunate for Parliament to involve itself in questions of organisational detail, which will have a binding effect on the development of the organisation and the opportunities the organisation will itself have to develop flexible and adapted organisational solutions.[67]

Making peace required a new chair for the Executive Board, Halvor Stenstadvold, who with the Board appointed a new director general, Christian Hambro. The organisational adjustments needed to resolve the conflicts turned out to be surprisingly small. The division chairs were invited to join the Executive Board for all discussions of budget, and could ask to attend the Executive Board meeting on any occasion they felt the need. The division (administrative) directors were allowed to attend the Executive Board meetings and listen to proceedings. The Executive Board

[67] Roar Hind and Johannes Ulltveit-Moe, *Styresystemet i Norges forskningsråd: Kartlegging og forbedringsforslag*, Rapport 1994:5, Oslo: Statskonsult, 1994

chair and the division directors met periodically for an informal discussion of matters of interest. The cost of these changes is that quite a lot more time is now spent in meetings than before. The benefit is that the 'leakage' these extra meetings create between RCN's steering levels has greatly increased the amount of trust in the organisation.

These changes have not been reflected in RCN's statutes. To this extent, the peace is unstable and dependent on the personalities involved. There may ultimately be no organisational defence possible against disagreements among strong personalities (and there are many of these in the research world).

In the second half of the 1990s, RCN board members and administration have largely learnt to live within the three-level organisational structure. Those who objected at the time continue to object today. Newer board members we interviewed who have not gone through the conflicts are reasonably content with the current arrangements. The organisation has largely moved on, though there remains a rumble of discontent about linkage between the Executive and Divisional Boards. Both the experts who reviewed the divisions and industrial members of various boards were puzzled by the insistence in RCN's statutes that people should not sit at more than one steering level. In industrial and research council practice elsewhere, it is quite normal for people to operate at more than one level, and this has a positive effect on information flows. It would be useful at least to formalise the right of the division chairs to attend Executive Board meetings on budget matters, and on other matters from time to time as needed. A neater solution would be to make the Division Board chairs non-voting members of the Executive Board, but those involved would have to consider the high meeting load this would generate for the DivisionalBoard chairs, which could have an excluding effect, especially on industrial members.

5.5.2 Internal Processes and Functioning

The council was established in 1993 in order to improve the co-ordination between funding of basic and applied research, the co-ordination between the different sectors and disciplines, and to develop and co-ordinate national research policy. However, the formation of a unified Council has not been accompanied by a similar rationalisation within the structure of the Ministries or within the structure of the research community itself. Historically, sectoral ministries channelled funds for infrastructure and research through sectoral research councils, which in turn allocated these funds to sectoral research institutes. We have found that in many respects, this situation remains unchanged except for the fact that the sectoral research councils have been turned into sectoral 'divisions' within a unified council.

Furthermore, whilst Norway is a small country, there remains a political will to ensure that all 'parties' within the research community are fully represented. This political imperative means that RCN must support, and be seen to be supporting, all scientific disciplines and industrial sectors. In some cases, the Council must also strive to maintain an appropriate balance in terms of demographic considerations, ensuring that geographical regions, peoples and genders are adequately represented.

RCN has not been able to overcome the constraints imposed by high levels of fragmentation both upstream and downstream, and the requirement to function in a largely 'non-discriminatory' fashion. These constraints have diluted the extent to

which RCN can provide a lead in terms of science policy, why it has difficulty translating its own divisional strategies into real actions and achievements, and why attempts at effective integration and co-operation across divisional boundaries appear weak. However, RCN continues to strive to develop and improve the way it functions within the limitations imposed by external forces.

Certain aspects of the budgeting process, in particular the situation whereby individual research divisions 'compete' with each other on an annual basis for additional funding, has historically undermined parallel efforts to improve co-operation and co-ordination within RCN. Recent moves to improve this situation – through improved 'top-down' direction as to where additional funding should be deployed coupled with explicit requests to the research divisions to come forward with joint proposals – appear sensible.

Earmarking of research funding for specific research fields is common practice within all research funding agencies. However, the process as organised within the Norwegian research funding system appears, at least in some cases, to go down to a level of specificity not witnessed elsewhere. Of more concern is that earmarking sometimes relates to specific institutes, geographical regions, and so on. This can create problems for research administration and cause strategic (relevance) and quality considerations to be disrupted by political concerns.

As things stand, the idea of a research programme as a 'strategic, goal-oriented, co-ordinated and time-limited research effort to generate new knowledge or competence within a defined field (subject or branch)' remains underdeveloped. We found little evidence to suggest that there are clear supporting arguments as to why specific efforts (programmes) were needed in specific areas, nor why the scale and duration of the effort is appropriate to the programme goals. Programme areas and allocations tend to follow historical, sectoral lines, and are only weakly related to the current strategies or research policies.

Programme definition and implementation procedures do not vary by 'type' of programme, but rather according to the personal preferences of the responsible research division or programme board. Whilst there is scope for employing a range of different processes in the ways in which programmes and other categories of funding are managed, such processes should vary according to the nature of the initiative, not the personal preferences of those who operate them. This aspect of RCN's functioning urgently requires overhaul and rationalisation. Clearly defined appraisal and selection procedures, optimised according to the defining features of the programme to which they relate would help to reduce administrative complexity and improve transparency of decision-making processes.

The notion of 'relevance' is not well developed in the appraisal and selection of projects. Where relevance assessments are employed they are much more likely to relate to a proposal's 'fit' within a programme or prioritised area than to its ability to contribute to a programme's objectives. Even where we could find examples of the latter, the programme's objectives tended to be stated in terms of 'funding' objectives (e.g. increase the number of PhD students in the area of mental health) rather than research objectives. There is also evidence to suggest that certain selection criteria are not made explicit to researchers before they apply.

Timescales between the submission of proposals and decisions being relayed to applicants are excessively long. The operation of a fixed deadline for applications in mid-June, coupled with a budgetary process in which finances are not agreed until December, leads to a situation whereby applicants wait some 7–8 months for a decision. This seems excessively long by international standards, and should be addressed.

As with project appraisal and selection processes, programme planning strategies and processes vary by division, with little logical structure behind such differences. There is scope for improved utilisation of standard programme planning tools that have good precedence in other national research councils.

There are several initiatives within the Council to improve strategic planning at both the divisional and Council levels. Currently, every division seems to follow its own approach, although each conducts some consultation with the other divisions. While differences in strategies are justified given the differences in the (implicit) missions of the divisions, current practice implies that there is little strategic, and a risk of diverging strategies. This is reinforced because the Strategic Planning division appears not to be involved in strategy making at the divisional level. We believe there is scope for a more coordinated approach to strategy development, involving better sharing of good practices across the organisation.

Although each of the strategic processes that the research divisions develops have some value they also seem to rely very much on consultation with the usual bodies and people with whom RCN interacts. So, the people that are involved in these processes are also the ones with which RCN interacts to run the procedures, especially the Ministries and the Programme Boards. Opening up the consultative processes to include greater input from international experts and competence centres would bring different perspectives and competencies to bear and help to strengthen RCN's strategic planning and functioning.

Evaluation practices are not well developed within RCN. Some positive examples exist and a sensible evaluation strategy has been developed but has never been implemented. Given the vital role played by evaluation in delivering systematic feedback and learning, this aspect of RCN's internal functioning needs urgently to be strengthened.

Biotechnology has developed as a model in RCN for coordinating cross-divisional areas. Although clear progress has been made in this area in terms of strategy deployment and co-ordination, it is not evident that the same model can be used for other areas. RCN now has prioritised areas – Marine, ICT, Medicine and Health, Energy and Environment – which are arguably in need of more concrete and shorter term forms of strategy making and implementation, which will require more top-down co-ordination.

Certain cross-divisional differences remain as the logical consequence of the different roles of the research divisions in their different sectors. Because of the good working relations between staff from the divisions these differences are no longer a significant

obstacle for RCN to function as one organisation. However, scope remains for improving organisational learning and cross-divisional co-ordination.

There are clear tensions between the six research divisions and the Strategic Planning division. At best, some of the research divisions seek to avoid complying with the requests and efforts of the Strategic Planning division, and at worst they seek to undermine them. The Strategic Planning is often viewed as the cause of large amounts of additional work that adds little value to the day-to-day functions performed by the research divisions.

The administrative workload carried by RCN is substantial, and it is not clear that the human resources available are sufficient (in terms of both number and capability) to carry out all of the necessary functions to a high quality. Recent efforts to control administrative load by rationalising the number of programmes (units) to be managed and increasing the average size of projects are helpful, but can not be carried on indefinitely. If RCN is to continue to face staff cuts, it will have to find ways to supplement its administrative resource or reduce its overall workload.

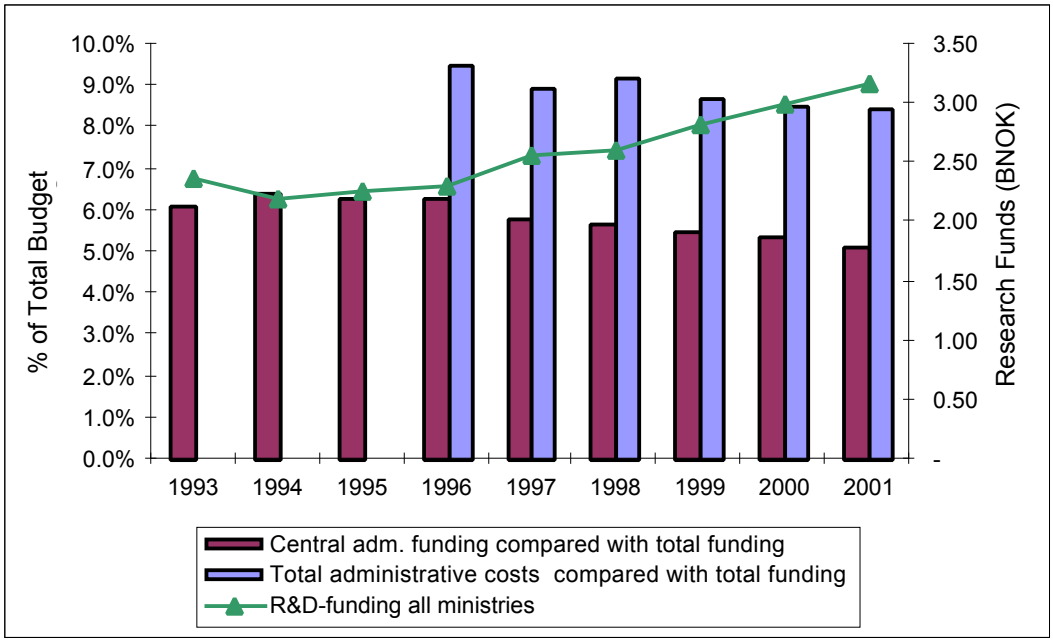
Heavy workloads create additional problems within RCN, which also need to be addressed. If people struggle to find time to perform all of their day-to-day functions, it is difficult to cause them to undertake new or additional tasks, and aspects such as training tend to suffer. If RCN is to improve its processes, increase organisational learning, and become more strategic and results driven, it will require a certain amount of (additional) time and space in order to do this. Current workloads leave little or no time to develop and improve.

5.5.3 Staffing and Administration Cost

Despite the mythology among parts of the research community, staff numbers and administrative costs are decreasing at RCN, while budgets have been flat and (most recently) increasing slightly. This means there is a need to generate administrative economies of scale (which seems to be happening within most of the divisions).

The developments in budgets and administration costs over time are shown in Error! Reference source not found.. Two sets of bars are shown for administrative cost. The lower ones represent the official administrative budget, allocated by KUF. The higher set of bars includes the cost of programme managers and other personnel hired using project budgets. This is especially prevalent in IE, where people with relevant industrial and research experience are hired on fixed term contracts to manage particular programmes. This is normal practice among equivalent agencies internationally. However, it does complicate comparisons of administrative cost. The costs to the taxpayer are not necessarily lower under this arrangement, and there is almost inevitably a negative impact in terms of retention of skills and capabilities. On the other hand, the practice provides an opportunity to exploit individual practitioners and their networks for a shorter period, which may provide more relevant capabilities in programme management than the more generic skills of career civil servants.

Exhibit 30 RCN Administrative Costs and R&D Funding, 1993–2001



Note: Numbers for 1993–2000 are actuals. 2001 numbers are budgets, and may be superseded

Based on published data from other research councils, RCN's formal administrative budget as a percentage of funds granted is within the normal range. Such published data tend to under-count administrative costs. For example, they rarely take account of contract programme management, funded from programme budgets rather than the central administration budget. **Exhibit 31**, which shows published administrative costs as a percentage of the budgets of a range of North European research councils and innovation agencies, is most directly comparable with the 'central administrative cost' bars (ie the lower ones) in Error! Reference source not found.. It is noticeable that the innovation agency and sectoral research council functions are more expensive to administer than the classical research council activity. Since RCN is a combination of all three, and has in addition to play a role as research policy advisor, the published numbers support the idea that its costs of administration are actually too low.

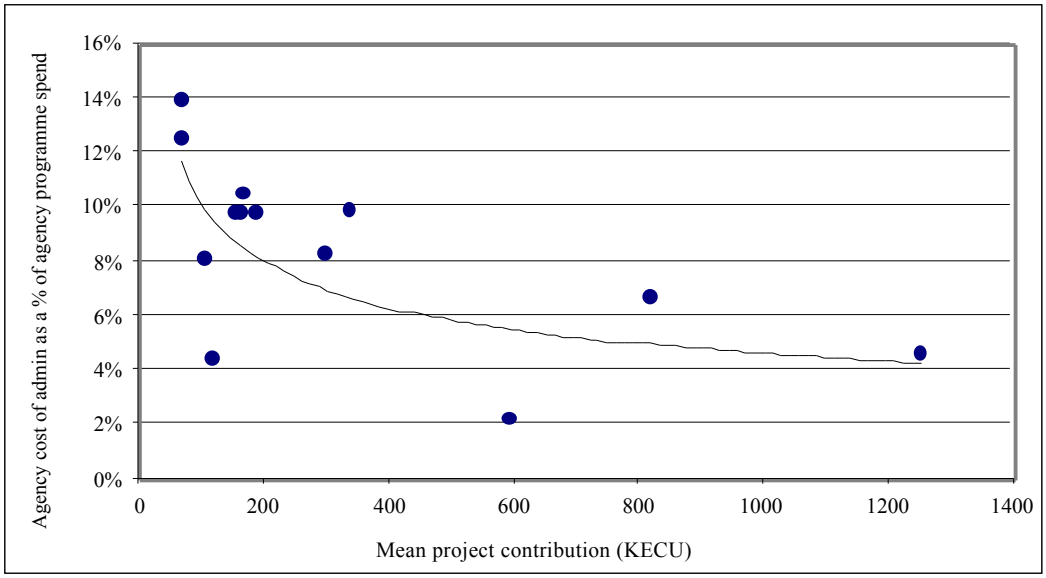
Exhibit 31 Published Costs of Administration as Proportion of Total Costs in Research Councils and Innovation Agencies

Country	Agency	Type of Agency	Administration as a % of Total Costs
Sweden	FAS	Sector RC*	9%
	FORMAS	Sector RC	9%
	Vetenskapsrådet	RC	5%
	VINNOVA	Innovation Agency	11%
Netherlands	NWO	Broad RC	7.3%
UK	BBSRC	RC	5%
	EPSRC	RC	5.3%
	ESRC	RC	5.4%
	MRC	RC	3.5%
Finland	TEKES	Innovation Agency	64%

Source: Websites, Annual Reports, Telephone Interviews. 2000/2001-12-16
*RC = Research Council

Our benchmarking work with R&D funding agencies has identified scale effects in administrative costs, where funding small projects lead to high proportionate management costs. Most of RCN's projects sit left of every other data point on **Exhibit 32**, driven in part by the fragmentation of funding from the ministries and by the fragmentation of the research community.

Exhibit 32 Scale Effects in Programme Management Costs



Source: James Stroyan and Erik Arnold, *Comparative Study on Administrative Burdens and Rules of Procedure between the EU Research Programmes and those of Individual Member States*, Luxembourg, European Parliament: 1999

We would therefore expect their administrative costs to be proportionately very high. Changing RCN's level of administrative cost cannot simply be achieved by telling the staff to work harder or more efficiently. The main driver of cost is the nature of the tasks they are given, so this is ultimately a question about what the ministries want RCN to do.

The implications of scale effects have been recognised in RCN. SIPs/SUPs are identified as 'easy and cheap to manage' in comparison with large numbers of micro-projects that exist within the programme and free project portfolios, and the divisions are all trying to find ways to raise average project sizes.

5.5.4 Cross-divisional co-ordination

There are two forms of cross-divisional co-ordination in RCN: 'strong' co-ordination, via the budget; and 'weak' co-ordination, via inter-divisional groups and activities. There are almost no examples of strong co-ordination, with budgets being jointly managed across division borders. A co-operation between MH and EI on medical technologies is often referred to as an exemplar, but there are few others. It is more typical for horizontal issues to promote a division of labour. For example, IE tackles the technological aspects of developing environment-related technology, while MU handles the 'soft' issues.

Some budgetary co-ordination is achieved at a different level, where individual areas persuade different ministries to fund joint programmes in areas of mutual interest, but this is not an effective way to tackle genuinely horizontal issues affecting multiple divisions, such as environment or gender equality.

Weak co-ordination takes place in two ways: thematic committees; and in fora, focused mostly on processes.

Relatively new thematic committees tackle the national research priorities set out in the 1998–99 White Paper, while older ones consider more traditional horizontal concerns.

Theme	**Responsibility**
Basic research	KS
ICT research	NT
Marine research	BF
Environment and Sustainable Development	MU
Medical and health research	MH
The environmental perspective	MU
Biotechnology	BF
Gender equality	Strategy division
The Regional Perspective	KS

The theme committees concerned with the policy priority areas meet at least six times a year. Thanks to their activities, and the support of the Strategy division, the exchange of information among the divisions is improved and RCN is able to report on the basis of these themes. The other theme committees also meet to exchange information, but their activities are less connected to reporting. However, the committees do not have budgetary authority and they do not make decisions about project funding.

In addition to the theme committees, there are also fora, with varying levels of activity in which each research division is represented, for

- Polar research
- The budget process
- Management By Objectives
- Statistics
- Annual reporting
- Institute policy
- Evaluation
- Producing internal advice about RCN procedures
- Project administration and use of the FORISS database

Most of these fora are led by the Strategy division. While the administrative fora have clearly helped in process development and standardisation internally, we saw little evidence that they affected research policy.

Biotechnology is the case seen internally as that closest to a success story, where – over time – the internal priorities developed at RCN came to be adopted by the funding ministries. Each division has some research on biotechnology and the programmes have their own boards, but the BF has the biggest part. The co-ordination group has two members from each division, one at (sub) director level and one contact person. The group meets approximately six times a year. Its mandate is not very specific. Topics that were discussed recently within the co-ordination group are

- The realisation of the recent Ethics programme, which is financed by all six divisions. The programme is now prepared by an external expert group
- The distribution of applications over the appropriate programme, although most of this is done bilaterally by the programme co-ordinators.
- The preparation of statements on new laws, like the recent law on prohibition of cloning of small animals (which would inhibit the creation of test animals for medical research) and the law on Intellectual Property Rights.

In 1994, NHD's executive general had complained about the neglect of biotechnology by RCN. RCN installed an external expert group to develop a strategy for biogechnology. The group had nine members from university (3), høgskole (2), industry (2), the "research ethics committee" and the "*direktorat for naturforvaltning"*. The members had disciplinary backgrounds in medicine, agriculture, environment, and industry. It also had an advisory member from each of the six research divisions of RCN.

In 1995, the group produced a 10 year plan, *Perspektivanalyse og handlingsplan for bioteknologi 1995–2005.* The group expected that it would be accepted as it was, but there was not a well-defined implementation process. Even the printing of the document took more than half a year. The Directors meeting considered it and decided that RCN should make an own strategy. An internal group with representatives of each research division was formed with the formal task of developing such strategy. This group produced an overall strategy for RCN in the autumn 1996, which was accepted early 1997 (*Strategi for Bioteknologi, Mars 1997*).

The principal objective of RCN for Norwegian biotechnological R&D was determined as

> Norwegian biotechnological research and development shall contribute to utilising the opportunities presented by modern biotechnology for socially beneficial achievements conducted through safe and ethically sound activities. (p.39)

The Council stated that it would

- Increase national competence through an increase in financial resources, develop the research sector through collaborations, networks and evaluation of exchange programmes
- Prioritise biotechnological research for medicine and health, food production and marine biotechnology and help to capitalise on research in these areas
- Integrate evaluations of environment, safety and ethics within biotechnological activities
- Continue a decentralised organisational management of the area

It was decided that biotechnological efforts would be made visible within the budgets. In addition each division would subsequently elaborate on this general strategy and make divisional strategies for biotechnology. Some divisions did this rather quickly. Others did not see this as important. According to the group's leader, the strategy has not been used systematically, but remains important as an overview of what is going on. However, in 1998 the industry ministry (NHD) developed a National Strategy for Industrial Biotechnology (*Nasjonal Strategi for Næringsrettet Bioteknologi).* This strategy is supported by six ministries. RCN was not formally involved, but informally like many other actors. The strategy is based on RCN's and takes over (with explicit reference) RCN's priority areas.

Compared with early days, the strategies have contributed to a shared understanding and responsibility for biotechnology among the divisions. In 1994, when strategy development started, divisions still raised the flag of the old organisations. (In 1993 when BF started an informal biotechnology co-ordination group, it achieved nothing.) Nonetheless, the Programme Boards continue to decide about the contents of their programmes – the co-ordination group has no role in that.

The co-ordination group has also been involved in the FUGE initiative, where the director of the MH division took up the original proposal by the University of Oslo for a large functional genomics initiative. He supported the work to obtain funding for it from outside normal RCN channels, bypassing the budgeting process and going directly to the ministries. In January 2001 the FUGE report was presented to government, which took up the challenge and allocated extra funding – in effect moving this part of the biotechnology effort from weak to strong co-ordination.

Weak co-ordination clearly has value, but, inherently, there are limits to what can be achieved in this way. Such achievements as are possible can take a long time, contributing to RCN's reputation for being slow moving. In contrast, strong co-ordination is a more effective way to achieve action. Committees may talk a lot, but in the end money talks louder.

5.5.5 Evaluation

RCN's statutes say that the Council has to "initiate and follow-up evaluations of research and research-performing institutions" (Article 2). To this end, the Executive Board decided in 1993 to delegate responsibility for disciplinary evaluation to the division boards. In practice, the Industry and Energy division has also taken over the evaluation of the effects of its actions on the national innovation system.

The Strategy Division retains a co-ordinating responsibility for evaluation, to which it devotes half of the time of one individual. It published an evaluation handbook for the Council in 1995 and produced two successive generations of an evaluation strategy for the Council, in 1996 and 2001.[68] The Council as a whole does not have an evaluation budget. The individual divisions determine their own evaluation strategies and spending. In the context of a decentralised evaluation policy, the Strategy division has sometimes struggled to get a complete overview of the activity. There is no organised, systematic use of evaluations for learning within RCN or the communities evaluated, except in the case of the new discipline evaluations, where a process has been defined for the benefit of those evaluated.

Between 1995 and 1999, RCN's annual spend on evaluation appears to have varied between 2 and 10 MNOK, which corresponds at the highest to a third of 1 % of its research budget. In addition, the Industry and Energy division contracts out a significant amount of work to monitor the effects of its user-directed R&D on companies and to try to estimate the economic effects of this investment.

The extent to which there is an evaluation strategy and calendar varies among the divisions. While the centre occasionally arranges 'strategic' evaluations (such as meta-evaluation of RCN's evaluations in general, and separately a specific analysis of its research institute evaluations), most RCN evaluations are commissioned by the divisions. These range from peer review evaluations covering the performance of individual fields of basic science in Norway to customer surveys and economic impact evaluations of individual R&D/Innovation programmes. IE is now developing a computer-based appraisal system for proposals, and is investing the resources it would otherwise have spent on evaluation in implementing this. As a result, with the exception of some smaller programmes aimed at SME development, IE programmes do not tend individually to be evaluated.

RCN has two major, cyclical evaluation processes in place. One is a six-year cycle of evaluation for the institutes under its tutelage. These are evaluated in groups by peer review, accompanied by user surveys. The institute evaluations appear to have some use for the institutes concerned, but do not feed back to resource allocation or to other aspects of RCN's strategic responsibility for the research institutes.

The other major evaluation cycle involves disciplinary evaluations and is managed by the NT division. This is a process that has started within the past 3 years. So far, NT has organised disciplinary evaluations for chemistry, earth science, physics, and biology and biochemistry. The reviews are done by international disciplinary panels. The division board decides who is to be evaluated, the mandate of the committee and

[68] This is formally outside our mandate, but the strategy was published in March and reflects thinking and action over the previous five years, as well as the previous handbook

its scope. When the disciplinary review has been published, the research council sets up a Planning Committee with members from the institutions that were evaluated. Representatives from the Council attend the meetings, but not as members. Our interviews suggest that the discipline evaluations have won a measure of respect in the research and policy communities.

RCN has co-operated with SND to develop and extend the innovation evaluation community in Norway, via an annual 'EVA' evaluation seminar series. However, there is not any systematic evaluation training for RCN staff.

With some exceptions, the evaluation activity of RCN appears to have few consequences and to contribute little to learning. This is partly a result of RCN's comparative powerlessness in matters such as deciding the core funding of certain institutes. Equally, however, mechanisms for organisational learning (such as using evaluation experiences in design reviews of proposed new programmes or having staff attend evaluation panel visits) have not been put in place.

The Council's overall spend on evaluation is low, compared with the informal OECD norm of 1–2% of research budgets, and appears overly focused on peer review. As elsewhere, there is a trend from individual programme and institute evaluation towards evaluating larger entities such as disciplines, groups of institutes and policies. At these higher levels, peer review becomes less appropriate and reliable, and needs to be supplemented with (or substituted by) other techniques.[69] The focus on Nordic peers also excludes wider international perspectives. For these reasons, research funders in Sweden and Finland are increasingly reaching beyond the Nordic area for evaluators, and are doing a growing proportion of their evaluation (and proposal assessment) work in English.

In our view, the evaluation process in RCN is overly decentralised, and this makes it less useful than it should be, both for informing policy and for learning within RCN and the research-performing community. Divisional managers should be involved in, but not in control of, contracting with evaluators, otherwise the evaluators effectively have to work for those they evaluate. Equally, it becomes easier to choose 'friendly' evaluators or those known to be likely to lobby for certain outcomes. A greater degree of centralisation is also needed to maintain even quality standards and consistent issue coverage, as well as to protect the Council's reputation for transparency and objectivity. RCN could also usefully consider establishing an overall evaluation budget, since programme management typically does not prioritise evaluation activities.

5.6 Strategy Development and Policy Advice

RCN is charged with being the government's main advisor on research policy. Reasonably enough, it connects this responsibility with its own work to develop strategy. In practice, however, strategy development at division and overall level are somewhat distinct.

[69] see Erik Arnold, 'Research evaluation: A systems world needs systems evaluations,' *EVA seminar, September 2001*, Forskningsrådet: 2001 (forthcoming)

5.6.1 Divisional Strategies

Every division has started with some strategy development, sometimes because of its specific role in the sector. BF has developed competence profiles of institutes and BF related university research, and wants to implement these profiles through allocation of the SIP funding. In 1998, IE developed a new strategy as well, which it implements through new innovation programmes with support for user controlled research and for industrially relevant strategic research. A key change is, in line with the implications of newer innovation theory, to focus on clusters and networks to a greater extent in funding projects. In the other four divisions, the development of strategy making has been less encompassing. Medicine and Health has focused on improvement of its role as a strategic intermediary through improving the information on 'its' research sector and co-ordinating strategies of other funding bodies. The role of its director in the FUGE initiative is an example. KS has worked on the improvement of programme management through developing a manual. NT has used disciplinary evaluations to promote the development of disciplinary plans. MU has written a number of strategic documents including recently future scenarios for the environment.

Every division seems to follow its own approach, and not be bothered too much by what others have done – although everyone includes some consultation with the other divisions, and some really need this because tasks are related. An example of cross divisional learning is that, like NT, KS and MH are now also preparing disciplinary evaluations for their fields of research. A negative example is the development of future scenarios for health, marine and now environment. Although MU is aware that MH and BF created such future scenarios, it follows its own approach. The main institutional mechanism for cross-divisional learning is the weekly meeting of the division directors.

The development of these divisional strategies seems not to be managed or guided from the top level. Despite its considerable analytic capabilities, RCN's Strategy division is not involved in the development of these divisional strategies. Although each of the strategic processes the divisions develop has some value, they also rely very much on consultation with the 'usual suspects' with whom RCN normally interacts. So the people involved are also the ones with whom RCN interacts to run the procedures, especially the ministries and the programme boards. The processes seem to have little room for systematically engaging other actors in the process. Moreover, sometimes strategies in the same field are or have been developed by other actors in the research system, without much co-ordination with those of the research council. MU is working on a new strategy, but ministry is doing one for themselves internally and that will in the end determine the budget allocation. MU can only hope that ministry will be inspired by their visions and strategy. As we indicated above, a strategy for biotechnology in Norway was initiated by a committee outside RCN. Subsequently RCN started to develop its own strategy for biotechnology.

A positive counter example is are the science plans that are NT asks for in co-operation with universities/ faculties and which include actions to be taken by universities and faculties themselves (KS has similar plans, but actions are likely to refer to KS only). NT claims that universities follow these plans in their decision making on new professorships etc.

5.6.2 RCN Strategy

RCN has used overall strategy formulation since its early days as a way unify the Council, in addition to being a basis for providing research policy advice to government. The overall strategy – *Forskning for Fremtiden* (Research for the Future) – was first published in 1995, then revised in 1996 and 1998. It is currently being revised for publication in 2002.

Up to 1998, the strategies helped explain what the organisation was about, but had little real effect on priorities. The strategy development process is in each case a drawn-out, internal affair. The main effect of the strategy was that it set the agenda for Norwegian research policy and several of the items in this FFF recurred in the government White Paper.

A new FFF is needed because RCN feels the framework conditions for the research council have changed considerably. The aim is that it is both a plan for RCN as well as a strategy of the whole Norwegian Research System, although it is unclear whether this latter objective will be accepted by other actors in the research system. The whole process will have taken 1.5 years. A preparatory phase of half a year (second half of 2000), an internal analytic phase in which the divisions are consulted as well (January toMay 2001) and a strategic phase from June till December 2001.

In the preparatory phase, Strategy Division visited the Dutch research council to learn how they had developed their council strategy, checked external documents and divisional strategies to list main challenges of the council and had an external resource group to discuss these challenges. From these sources five topics were selected for further development in the analytic phase. The choice of the topics was approved by the directors meeting.

The analytical phase started with discussion notes of about 10 pages on these topics from small groups from within RCN. These notes were edited by the Strategy Departdivision and summarised in 10 questions to the Division Boards. The answers of the divisions were subsequently translated in some options for RCN's strategy. E.g. on " research and policy" the divisions had been asked whether society has a mistrust in R&D and whether that is a reason for a low input in R&D. In the answers the need for good communication about the role of R&D was emphasised. A choosing point induced from that was whether RCN should take the lead in communication on science and be a key actor in the Public Understanding of Science, or not consider it as its own role but as a responsibility for the researchers and research performing organisations.

The set of choices was presented in a strategy seminar in the Main Board, which was the first time that Board worked that way. The inclusion of the boards in the internal phase is an improvement over earlier FFFs, which were completely developed within the administration of RCN. At that time, the administration feared that inclusion of the Boards would have led to chaos. Now the Strategy division feels that it is important to include divisional staff and boards in order to create ownership of the outcomes. External groups – notably ministries and research-performing institutions – are expected to be involved only in the last stages of strategy development. The type of more open search for inputs at an earlier stage, when it is still possible for

strategy ideas to be shaped, that is found in many foreign Foresight exercises is absent from this process.

However, while there is scope for further improvement in strategy formulation, RCN's Strategy function also has some very important achievements to its credit. One is to raise the quantity and quality of the statistical indicators available about the National Research and Innovation System, both through internal work and via long-term funding of NIFU and STEP. This not only helps raise the quality of the information available for policy making and for monitoring change, for example in the research institute sector, but also makes it possible to raise the quality of the research policy debate in Norway. This is clearly visible from the extensive use of indicators and research-based analysis in the White Paper at the end of the 1990s, and from RCN's own indicators publications. Further, the division has been able to publish a long series of reports and surveys about individual aspects of research policy.

Especially since the White Paper was published, the division has also been able to develop strategies for cross-council activities. These include the use of Research Fund money to set up centres of excellence in research, an internationalisation strategy (which is finally causing internationalisation to be 'mainstreamed' within the research divisions, and strategy for gender equality. The latter is an issue where the Strategy division plays the key role of 'problem owner' within the Council. .

Perhaps the most important contribution, however, has been to affect the national research priorities set out in 1998–99, and to contribute to the acceptance by government of the idea that Norwegian research expenditure is too low and needs to be increased. Here, however, it is important to recall that a message must not only be delivered but also heard, if it is to have any effect. A key factor in RCN's policy influence at the end of the 1990s was that the government was in a position to listen to good advice.

5.7 RCN and International Collaboration

Article 2 of RCN's statutes says that the Council shall promote international research co-operation. The statutes oblige the Executive Board to prepare a strategy for international research co-operation and to ensure that Norwegian researchers are able to participate in this work.

International co-operation is generally understood to be important for three reasons

- International co-operation can provide access to complementary know-how and tools – otherwise unavailable within the national innovation system – which in turn drives learning, innovation and scientific breakthroughs
- Participation in international consortia can deliver improved financial efficiency through leveraging national budgets and permitting higher degrees of specialisation than would be possible through a unilateral policy
- International researcher mobility can be used to attract and retain the high calibre people and contributing to professional development of indigenous scientists

- International research co-operation is understood widely to be a politically neutral and low cost means through which to demonstrate good intentions and build a bridgehead for improved international relations and trade

As a result, EU and EEA member states view international co-operation as an essential component of first-class research in the natural, physical and social sciences. Indeed, one of the research council's primary tasks has been to lay the foundation for formalised collaboration by establishing relationships with similar organisations in other countries and concluding formal co-operation agreements.

The Norwegian research community, however, faces important challenges with respect to internationalisation, in both the industrial and institutional research areas

- The low proportion of the national product devoted to business expenditure on R&D and the correspondingly small share of Norwegian companies' R&D that is conducted abroad means their exposure to international research is limited, and that it is therefore hard to identify and use knowledge generated abroad. The limited role of foreign multinationals, means Norwegian domestic industry has a very limited 'window on the world'
- In institute research, there has been success in selling to foreign business, though the amount of income obtained from the EU Framework Programme has declined recently. Many of the institutes aim to increase the share of their sales coming from abroad – though it should be noted that equivalent institutes abroad share this ambition
- In terms of publications, Norwegian academic research is less productive than its equivalents in Nordic countries, lying somewhere between the productivity of Germany and the UK. Its impact (in terms of the extent to which others cite it in refereed journals) remains lower than that of research in other Nordic countries, but has been steadily improving through the second half of the 1990s
- Researcher mobility, which is a key driver of internationalisation, has been declining. Up to 20 years ago, provision for PhD training in Norway was poor. People wanting to do a PhD often had to go abroad. The improvement of the doctoral training infrastructure in Norway means there is less incentive to do this today. PhD stipends are generous in Norway, so going abroad would mean reduced income for most. While the reforms in PhD training are intended to bring down the age at which people typically defend their doctorate from the 40s to the 20s, most Norwegians studying for a PhD are old enough to have partners. This means that if they were to travel abroad they would be looking for two jobs, not one. Many are over 35, and therefore too old for EU mobility schemes

There has been a strong foreign policy dimension to international research co-operation, which appears to be becoming less dominant as an active research policy takes hold. This shift in emphasis is evident in most European countries and not just Norway.

Norway and the RCN have increased both the policy emphasis and budget available for international research co-operation, with RCN's budget having increased by around a third from in 290 million NOK in 1996 to 390 million NOK.

International research co-operation has been dominated by inter-Nordic activities historically, but Norway has been an active member of the global scientific community for many years too, with an involvement in a comprehensive portfolio of international scientific organisations from the European Space Agency to CERN. Indeed, membership subscriptions consume a high proportion of total Norwegian spend on international research co-operation. We have a small concern that Norway may be too thinly spread given the present budget, and that RCN and other government departments are struggling to match the subscriptions with national programmes sufficient to exploit those investments. This is the case especially for the two research organisations mentioned.

Latterly, the policy emphasis switched to the EU Framework Programmes, which is an intelligent response to a major new opportunity to secure additional R&D funding from abroad and to extend Norway's scientific relationships and networks in Europe.

RCN's latest internationalisation strategy is committed to building on this success and in particular to pursuing a more broad-based involvement in the thematic programmes. We would signal caution on that point, which, while a laudable ambition, may not be straightforward. Norway's success reflects existing clusters of excellence and capability, which underlines the framework programme's ability to distinguish between strong bids and others. Competition is intense and the Framework Programme is not an ideal mechanism for capability building. The accession countries are seeking to do this – as are other smaller European economies such as Austria – but with limited success. They still exhibit highly skewed profiles reflecting technological comparative advantage in collaborations.

Indeed, this is one reason why countries such as Spain and Portugal are increasing their share of a growing international research co-operation budget, directed to bilateral research co-operation, somewhat against the trend evident in Northern Europe. As with many countries, bilateral research co-operation has been very much a residual category in Norway with the Council spending around 7 MNOK annually on a large number of agreements each supporting a small number of co-operative activities. This small budget is dominated by one bilateral agreement with France (3 MNOK), and tends to support researcher training and exchanges rather than co-operative research projects.

Bilateral R&D agreements often have their origins in foreign policy, which may cement international relations, but can be less relevant from a scientific perspective.

In essence, there has been an assumption that the decisions about if and how to co-operate on an international level should be managed by researchers themselves if possible. intergovernmental agreements and international programmes add little value to informal co-operations while adding huge cost and inertia. Formal research co-operation is relevant only under exceptional circumstances, such as is the case with the EUMETSAT or EUREKA. Many other international scientific organisations – for

example, ESF, IEA – are international debating chambers and co-ordinators rather than international programmes.

That said, we believe it would be short-sighted to abandon bilateral agreements simply because in the past they have been of rather limited importance and many aspects are now covered within for example the human resources schemes of Framework 5. Of especial relevance to Norway, bilateral agreements can be an effective route through which to build capability in a specific area through co-operation with a much stronger partner, in return for preferred access to markets or whatever (there will always be a trade).

Bilateral or trilateral agreements can be a good compromise with respect to multi-sponsor investments in research facilities and equipment. They are easier to set up and cheaper to operate than the equivalent multilateral agreement, while providing a valuable framework from within which to balance demand with the escalating cost of research infrastructure.

We have looked briefly too at researcher mobility, another area where the RCN has been active since its inception and with a good deal of success both through its bilateral programmes and within the Framework programmes. The RCN has its International stipend programme, which covers several types of exchange (short- and long-term) for new post doctoral fellows and more experienced (but younger than 40). There are bilateral agreements with almost 40 countries in a range of geographical regions from the Baltic to the Americas. There are several other bilateral fellowship programmes, too, such as the STA-stipend (Japan) or the Ruhrgas-stipend (Germany). In addition, Norway makes active use of the researcher training and mobility schemes of the European Commission (e.g. Research Training Networks, Marie Curie Fellowships). We understand that Norway's researchers continue to be somewhat less mobile than their counterparts overseas. However, the measures set out in RCN's internationalisation strategy (e.g. a requirement for all PhDs to spend one year of their training at a university or research institute overseas) will make further inroads into this crucial area.

Internationalisation has been on RCN's agenda throughout its existence, with actions to integrate Norway into the EU Framework Programmes being especially important. In 2000, however, the Council decided to increase the priority it gives to internationalisation issues, and endorsed a strategy document explaining how it intended to do this. The strategy made four main recommendations and announced a number of specific actions, but critically stated that internationalisation should be 'mainstreamed,' that is, including an internationalisation dimension across funding modes and including it in the terms of reference of all programmes.

The strategy is well informed and ambitious. Of particular note are the decisions to include internationalisation among the criteria for choosing among applicants and in the conditions attached to those awards: a simple, yet powerful means through which to encourage a majority of researchers in Norway to think more about international co-operation. The danger in such a generic measure is that internationalisation is more relevant in some research fields than others. Forcing people to do things that are not especially useful is a good way to discredit the whole scheme.

The strategy is perhaps too ambitious to be feasible without a substantial – perhaps even twofold – increase in the share of public sector research expenditure devoted to promoting and doing international co-operation. The challenge is even more daunting when one considers that Norway's emphasis has been on internationalisation in general – as a principle – rather than the more focused and utilitarian approach evident in Ireland for example. Ireland's decision to focus on consolidating its national research capability in just two strategic areas – biotechnology and ICT – has permitted the government to implement several major international co-operation measures quickly, such as the decision to join EMBL and the ESRF. We believe that a greater degree of focus on strategic requirements – such as upgrading and linking research infrastructure into the European infrastructure – would be beneficial to the RCN's ability to deliver on its internationalisation strategy.

5.8 RCN in the Diffusion of Results and Public Understanding of Science

Ideas about disseminating the results of research and the 'public understanding of science' vary from country to country, both within Europe and most noticeably between Europe and the USA. In many areas in Europe, there has been a strong swing away from the traditional model of 'educating the public.' This had assumed public acceptance of research and technological development would increase with greater understanding of the science and engineering principles involved. Instead, more countries are moving towards a democratic model, which includes the public in decision-making about science, rather than just telling it about the results. Indeed the older, so-called 'deficit model' is now so condemned in some countries that the term 'public understanding of science' has become politically incorrect, and practitioners prefer the term 'science communication' or 'science and society'. This is particularly noticeable in the UK and in Denmark.

Norway, has much in common with the UK and Denmark in that its citizens have a high level of scientific literacy, but are relatively unenthusiastic about many potential implications of advances in science and technology. This so-called 'information paradox' has profound implications for public understanding of science practice, where the main purpose is to shore up public trust in science. Research has shown that the general public are really a multitude of publics with different attitudes, and the while the education model may be useful for those largely supportive of science and its aims, it is unlikely to reach out to many others.

For science communicators in the UK and in Denmark, the activity is about dialogue. It is argued that people's knowledge, experience and values can provide valuable insights, both in terms of framing issues and questions, and in assessing and evaluating solutions. Without such public involvement, decision-makers operate with incomplete information. In addition, the process of engagement is said to depolarise debate.

For this evaluation, we compared Norwegian policy with five other countries also generally considered to have good practices for public understanding of science. National policies differ markedly.

- In Norway, a major focus is on dissemination of results of research, seeking to legitimise research and addressing the general public's perceived lack of

understanding of the importance of research to the economy. The need to communicate was enshrined in the White Paper of 1992, and an RCN strategy for science communication exists to co-ordinate activities

- Denmark's science communication emphasises engagement with the public, reflecting a strong voting culture and a highly literate population that demands consensus in decision-making
- In France, the focus is on science as part of general citizenship and a belief that scientific literacy is an integral component of national culture
- The Netherlands has a broad-based policy on science communication, covering citizenship and culture, public debate on social issues and the economy. The Netherlands invests in public understanding of science at a much higher rate than most EU member states
- Science communication in the UK continues to be dominated by the scientific establishment's concern to secure public trust in science, which was rocked by a succession of food scandals during the 1980s and 1990s. In addition, the last two government science White Papers have encouraged the scientific community to increase outreach activities for wider economic reasons (the new economy) and to experiment with methods to capture public opinion and use it in decision-making
- The US focuses on scientific literacy. This reflects a concern about future competitiveness of the US due to poor scientific competence (on various international benchmarks) amongst the public and school children in particular. The US has also, hitherto, not had to face the same crisis of public trust in science and its regulation, which has plagued most countries in Europe in the last decade. The US has a more open system of government and advisory systems than most European countries and much scientific information is made publicly available by virtue of the transparency laws

Compared with these other countries, RCN work on public understanding and dissemination of science is at the level of good international practice. RCN has made progress in achieving the goals it set out in its strategy for science communications in 1996 and runs a number of very successful schemes, including *Nysgjerrigper* and the national Research Days. The commitment and involvement of all divisions at the RCN in the new national website, *forskning.no* is very encouraging. *Nysgjerrigper* and the National Science week both appear extremely successful. *Nysgjerrigper* has successfully broadened a competition into an inclusive club with over 100,000 members. The Research Days run for longer and are more wide-ranging than most equivalents in other European countries.

Involvement of the public in priority setting and the direction of future scientific research is, however, lower than would be expected when compared with the UK or Denmark, which have a similar profile in terms of scientific literacy but scepticism of science. Science communication also tends to be rather traditional in form and content in Norway (ie largely lectures, television programmes and press articles). Researchers tend to prefer to meet the public in the safety of their own institutions rather than in public arenas. The new Norwegian Board of Technology (*Teknologirådet*) is an office of technology assessment whose primary customer is the parliament, its use of lay and expert consultations on technology may over time contribute to increased understanding and debate about science.

In Norway, where citizens display the classic information paradox, merely providing more information is unlikely to address the issue of public mistrust. Greater involvement of the public in debating science and setting priorities is likely to be helpful in increasing the public's sense of the accountability of science and scientists. Lessons can be learnt by studying examples of consultation methods in Denmark or the UK's research councils. A central flexible and responsive pot of funding similar to the UK's COPUS grants scheme would facilitate more diverse activities in public understanding of science in Norway and prevent the over-dependence on traditional methods. Norway is not alone in finding that the lack of reward for individual scientific researchers is a disincentive for them to be involved in science communication. Writing in the requirement for dissemination of results into grant proposals will help to solve this. However, there will also need to be a greater commitment from institutions themselves to release scientists from their day-to-day duties and an incentive to do so.

5.9 RCN in the Strategic Development of Institutions: Universities and Research Institutes

About a quarter of Norway's R&D activity is done in the research institute sector and about the same proportion is undertaken in the universities and colleges. This section considers each in turn, although from somewhat different perspectives. RCN has strategic responsibility for much of the institute sector, while the universities and colleges need to be understood as more independent partners in research.

The 1992–93 White Paper[70] on research, which defined the reform to create RCN, said that the Council should "take strategic responsibility for the research institute sector in Norway." This task was incorporated into paragraph 2 of RCN's statutes. The White Paper emphasised the need for increased co-operation among R&D institutions, mobility, and merger and integration as means to improve the institutes' activities. The statutes define RCN's strategic responsibility as including the development of a more holistic policy for the institute sector, *inter alia* through its responsibility for providing core funding to the institutes and by providing advice to ministries funding institutes directly.

About a quarter of Norway's R&D activity is done in the research institute sector – about the same proportion as is undertaken in the university and college sector. Research institutes in Norway perform a proportion of total R&D, which is higher than in most other countries.[71] On a broad definition of 'institutes' there are now in excess of 200 in Norway. NIFU's catalogue of the institute sector[72] shows 133 – about a hundred of which have R&D as their main activity. The structure of the

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70 St. meld. Nr. 43, *Et godt råd for forskning. Om endringer i forskningsrådsstrukturen*, 1991-92

71 There are no good international figures that allow comparison of different countries' R&D expenditures through research institutes. Research institute spending is an unidentified component of government research outside the higher education sector, in the OECD statistics, so it is mixed up with various other kinds of government R&D expenditure, including defence. A study of eight OECD countries based on 1987 data found that only Italy spent a greater part than Norway of its national R&D investment in the institutes. See Ole Wiig, *Forsknings og utviklingsarbeid i Norge og andre OECD-land*, 7/90, Oslo: NIFU, 1990

72 MIFU, *The Institute Sector in Norway: A Catalogue of Non-University Research Institutions*, Repoprt 21/98, Oslo: NIFU, 1998

institute sector is little changed from the early 1990s, when its fragmentation was seen as one of the aspects that RCN should address.

In many respects, RCN's work with the institute sector has been strong. It has

- Brought increased transparency and clearer thinking to the question of base funding for the institutes
- Established a clear set of 'rules of the game' for state funding of research institutes
- Established a mechanism for strategic influence over the development of the institutes, through the use of Strategic Institute Programmes
- Provided both base and project funding to the institutes, using processes which include quality checks and which test for links to user needs
- Established an improved set of indicators, making it more possible to understand the ongoing performance of the institute sector
- Improved the quality and consistency of research institute evaluations
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However, RCN has not been able to

- Have much influence over the structure and composition of the sector, for example through rationalisation and encouraging new types of institutes to appear. Thus, the problem of fragmentation remains little changed from 1990
- Extend its strategic role in relation to institutes closely managed by ministries (irrespective of whether these have been base funded through RCN or been among those institutes where RCN is supposed to play an advisory role only). Nor has it been able significantly to increase the proportion of institutes whose base funding is channelled through it. Unless and until these institutes are placed on a more independent footing, and required to seek more of their income in commercial and international markets, it is difficult to see how RCN can add value to these cases
- Become a respected partner of the institutes in developing strategy
- Make evaluations of institutes have significant consequences, in terms of internal change or – eventually – altered funding levels
- Have a significant influence over the size of the research institute component of the research and innovation system, in different sectors
- Support a broadening of the scope of individual institutes by making available significant cross-divisional funding
- Persuade ministries in any significant degree to fund strategic initiatives beyond 'their' traditional institutes – for example, by taking a cross-sectoral approach to environmental questions
- Raise the international profile and publication rate of the sector

RCN has set in place most of the mechanisms it would need in order to achieve its institute goals. However, the amount of real change it has been able to cause in the sector is limited. The reason for this does not lie in RCN's performance but in the framework conditions. In practice, RCN does not have the power to cause major change because it lacks sufficient authority over institute budgets. The most hopeful area is the techno–industrial institutes, where RCN has freedom to alter the amount of

funding it provides to individual institutes, and can itself decide how and where to allocate strategic resources. However, in this area, RCN's base funding provides a low share of the institutes' total income. This is helpful, in that the institutes become market-driven – and there is encouraging evidence that they are able to tackle international commercial markets, in addition to domestic ones. But the benefit of markets are inseparable from the market failures which drive market-led organisations towards short-term concerns, tending to negate the role of the institutes as knowledge bearers and improvers of the national research and innovation system. RCN needs sufficient leverage to counteract this tendency and while it certainly has an influence over the techno–industrial institutes, which is disproportionate to the amount of money it provides, it is not clear that this is adequate.

Outside the techno–industrial area, RCN's real influence over what the institutes do with the money it provides tends to be lower. In extreme cases, such as CMI, RCN does little more than act as a courier, taking base funding from the ministry to the institute. To a much greater extent than is reasonable, therefore, RCN has to try to exercise influence over the institute sector through persuasion rather than power. Unless a better balance is found between these, it is difficult to see how RCN can achieve more rapid progress.

There has been very significant growth in the number of students attending university and college over the past 30 years. In recent years, university and college budgets have been strongly driven by student numbers. Staff have been recruited, who naturally have ambitions to do research, but the amount of research council money available to provide complementary funding has only very recently begun to go up. In future, a new formula will be used which has separate components for infrastructure, research and student numbers. This appears likely to force more explicit management of these different income streams.

The universities' ability to modernise at the same pace as others in Europe has been constrained by their rather traditional governance models, which make it hard to set priorities and develop strategies. Some of the universities are more flexible in this respect than others. All the universities operate with levels of commercial funding below European norms, partly reflecting the strength of the applied institutes but partly also reflecting choices made by some of the universities. The universities are much more active partners of the state than of industry.

RCN has been able to influence the development of university research capabilities to a certain extent through the use of strategic programmes, and the coming generation of RCN-funded centres of excellence will represent a useful continuation of this trend.

The university colleges, which were created by merging a large number of institutes of further and higher education in 1994, are slowly developing more research capabilities. There are wide differences within the population of university colleges in their ability to tackle research. RCN has done comparatively little to involve them in research funding and research policy.

There is a feeling in a number of the colleges that regional considerations should play a role in the allocation of research funds, so that these are allocated pro rata the number of inhabitants in the regions, rather than according to RCN's traditional

research funding criteria. In our view, this is a dangerous confusion of regional and research policy. Decentralisation of the college infrastructure is a fully legitimate ambition of regional policy. However, reallocating research funding on regional policy principles will damage research environments in both central areas and the regions. The price of setting up a research-performing regionalised college infrastructure of a quality worth having, necessarily includes the set-up costs involved in establishing research which is good enough to qualify for research funding in competition with other research environments. The implication is that significant transitional funding is needed from regional policy budgets, where the benefits of the decentralised college infrastructure can be weighed against other potential uses of funds. To the extent that this is felt to be worthwhile, therefore, KRD could be a major research sponsor in a transitional period, using RCN as a means to obtain the needed quality control.

The RCN reform has meant comparatively little for the scientific colleges, which tend to have close relationships with their ministry (and other) sponsors. Only if RCN can become more of an arena for deciding and implementing research policy will the opportunities inherent in the 1993 reform be realised for them.

There are major policy challenges relating to the respective roles of the institutes and the higher education sector, which need urgently to be addressed. Elsewhere in this evaluation, we argue that there is a policy need to move the institutes significantly closer to the universities, and for some re-division of labour among the universities, institutes and industry. Mechanisms have not been put in place that would achieve this more drastic restructuring, but neither has this been one of RCN's goals. RCN itself clearly understands the need for change in the institute sector and is beginning to talk[73] in terms of merging institutes into larger entities, in order to reap economies of scale and scope and to become more engaged in international research. Some of the institutes also understand the need to act and support these ideas.

A major review of the Norwegian institute structure is well overdue, and needs to be accompanied by measures which further de-couple the institutes from the ministries, if the sector is to evolve structures that can keep pace with accelerating change in knowledge production and in internationalisation. This means moving from the incrementalism into which RCN has been forced through lack of power to a mode where RCN and the institutes are empowered to make significant change.

Reform of governance in the universities should pave the way for a modernisation of that sector, not least in order to increase societal links. If the idea of a 'knowledge society' has any meaning at all, the comparative isolation of the Norwegian universities is not sustainable. This does not in any way mean that the universities have to give up long-term research and devote their entire efforts to helping small companies. Long- and shorter-term research issues are increasingly interrelated. Universities abroad have realised this and increased their engagement with shorter term issues, with interdisciplinary approaches, with problem-driven research and in partnerships with other knowledge producers in their national research and innovation systems. In order to compete in this changing situation, and in order to maintain their significance in knowledge production, the boundaries between the universities, the

[73] *Årsrapport 2000, Forskningsinstituttene Samplerapport*, Oslo: NFR

institutes and other knowledge producers and users need to become more flexible and more permeable. The governance structure of neither the universities nor RCN is sufficiently flexible to achieve this in a timely way. We recommend that this matter should be investigated as quickly as possible, so that adjustments can be made which will not only permit reform but also allow it to be implemented.

5.10 RCN and the Division of Labour in the Innovation Infrastructure

RCN is one of a number of actors in the innovation infrastructure: the institutions that support the processes of creating and using knowledge. The other important actors include SND, which provides grants and loans for economic development; SIVA, which runs science and industry parks, providing needed infrastructure; and various sources of venture capital.

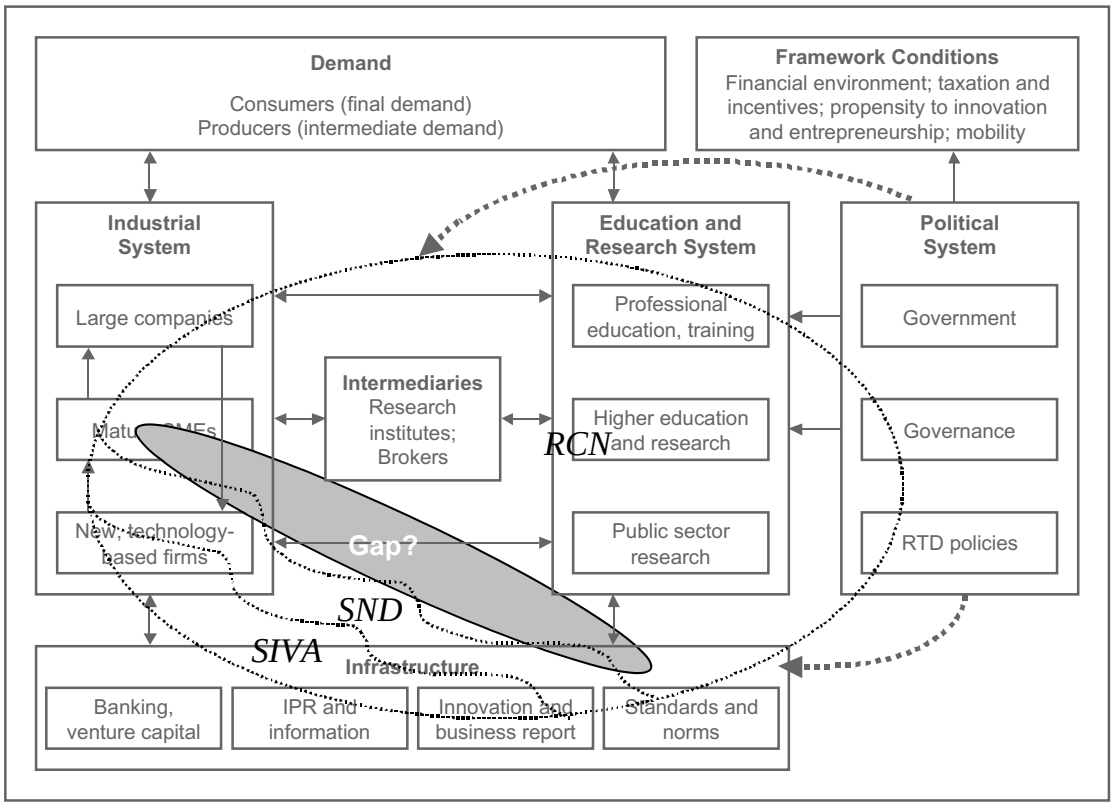
Tackling the industry and innovation challenges described earlier in this report, requires that there is a well-developed knowledge infrastructure in the form of colleges, universities and research institutes, that business capabilities are developed, and that new and existing firms have the 'absorptive capacity' needed to make use of externally generated knowledge. There are significant market and structural failures here, which is why many countries devote a lot of resources to helping these aspects of the innovation system to work well.

RCN, SIVA, the venture capitalists and SND together cover much of the needed policy spectrum. However, there is a gap in the area of an innovation policy authority – something like TEKES in Finland or the former NTNF, which links R&D-based knowledge directly into industrial activity and economic development. This gap currently coincides with the boundary between RCN and SND and is illustrated in **Exhibit 33**. These agencies run some joint programmes in this area, but there is little strategic interconnection and the partnership appears somewhat unloved at the operational level. If the gap widens, and the link between business development and technological capability development becomes weaker than it is today, this will create and important obstacle to company development, reducing the national ability to address the challenges described above. This is especially the case with the 'value creation gap' between likely GDP based on following current trajectories and the GDP growth needed to sustain welfare.

In the Norwegian institutional context, it is not clear that it would be useful to build a new innovation agency, for example on the model of Finland's very successful TEKES.

There appear to be four options. One is, obviously, to leave the situation as it is. It has many imperfections, but the RCN/SND alliance is also achieving progress. However, the joint activities are politically exposed in both organisations, because they are at the edge of the core missions while at the same time representing areas of reduced control for management.

Exhibit 33 A Structural Gap in Norwegian Innovation Policies?



Source: E. Arnold and S. Kuhlmann

A second option is for RCN to take over the programmatic innovation activities of SND, leaving SND with its current mixture of innovation financing and more conventional financing and venture capital. This would separate the development of innovation capability programmes (such as BRO) from complementary business capability development programmes (such as SND's excellent FRAM programme). It would rob the innovation programmes of their distribution channel (SND's district offices), which brings them close to their customers and, therefore, rob them of their sales force in those offices. This would be a major backward step. RCN does not have a regional distribution apparatus, and for most of its activities it does not need one.

A third option is for SND to take over the innovation capability programmes. This would isolate SND's work to develop company capabilities from one of the most central sets of capabilities: innovation and R&D. It would allow increasing concentration in RCN on research and the issues of large, established industry, increasing RCN's distance from the needs of much of the economy. SND does not have the capabilities to develop innovation programmes, and would struggle to link its help to low-capability firms into the broader process of developing firms' technological capabilities. In short, it would be likely to widen the structural gap we identify in the business and innovation infrastructure.

None of these first three options seems to us especially attractive. The fourth is to reinforce the activities at the interface of RCN and SND by dedicating specific budgets to them and allocating joint strategic responsibility to the two organisations. This would make the internal politics of both organisations exciting, by forcing

compromise – and, perhaps, improved co-operation – at the boundary between the two. This improvement is only likely to happen if there is money attached, and a corresponding external reporting relationship. This would transform the activity from being 'nice to have' to becoming part of the core business.

Another issue of division of labour is the respective roles of institute, university and industrial researchers in the National Research and Innovation System. There are reasons to think that it is time to modernise the university sector, bringing it into closer connection with other parts of the knowledge-producing and using system and increasing the role of external funding. At the same time, we suspect that Norway has reached a stage in industrial development where research effort should be moving more from the institutes into companies. Taken together, these ideas would involve significant redefinition of the university and applied technology institute roles in Norway. These should be considered in much more detail by a subsequent study.

6 RCN Performance

In this Chapter, we **evaluate** RCN's performance against its goals and set out our answers to the evaluation questions put to us in our mandate. In each case, we give reasons why we reach particular judgements, but it is worth recalling that these **are** judgements – they are not facts. We would hope that others, faced with the same evidence as we are, would reach the same conclusions. The evaluation and its background reports aim to make as much of the evidence as possible available, so that others can indeed make that test. But there are no 'hard' answers to many of the questions we address.

This Chapter first addresses the extent to which RCN has reached its goals. It then looks at whether the framework conditions under which RCN lives helps or hinders it in reaching its goals. Next, we consider RCN's organisation, and finally its instrumental roles.

In the next and final Chapter, we draw overall conclusions about RCN's performance and make some proposals for the future.

6.1 Goals

In our introduction, we rephrased the complex set of goals and expectations that exist about RCN as follows

- RCN shall produce useful national and sectoral research policy advice to the government, based on an holistic national perspective
- RCN shall fund research to meet social and industrial needs, taking account of users' needs and promoting the uptake of results
- RCN shall fund the high-quality basic and applied research needed in the national system of knowledge production, seeking to integrate the two as far as is appropriate while securing the place of basic research
- RCN is tasked with strategic responsibility for the research institute sector in Norway
- RCN is tasked with promoting the interaction of Norwegian knowledge production with the international knowledge production system
- RCN shall use appropriate and efficient processes (including evaluation) and organisational structures in performing its tasks

In this section, we consider point by point the extent to which RCN has achieved these aims.

6.1.1 Research Policy Advice

RCN has been trying to give research policy advice to government throughout its life. A consistent message from research policy advisors in Norway since the 1980s has been that Norway's national R&D spend should be brought up to the OECD level, and RCN has consistently continued to offer this advice. While it is possible to

quibble about whether the target level proposed is actually the right one, the overall message about the need for increase is correct. It seems finally to have been accepted in action as well as in rhetoric by the government and the majority of the political parties at the end of the 1990s. Research policy advice at a more detailed level was not a strength of RCN during its early years, as it worked to establish its internal organisation and strategy. But it appears to have had a strong influence on the general research priorities set by government in recent years. Whether this change happened because RCN became a better speaker or because the government became a better listener is not material. The point is that you need both, if there is to be communication. A major challenge will be to move from this high level to the level of implementation, in the light of the constraints posed by framework conditions and RCN's internal structure.

Being holistic in advice giving is a tough job. Its advice and actions tend to be incremental. We think there are some more fundamental questions that should be asked, not least about the appropriateness of the existing knowledge infrastructure and the need for modernisation in certain parts of it. Equally fundamental is the question of whether long-term research should continue to be treated as a quasi-monopoly of the universities, or handled more broadly across the knowledge society, as would be implied by the idea of Mode 2 research, which we discussed in Chapter 2. On these more dangerous questions, which threaten the institutional *status quo*, we hear less from RCN. As a 'bottleneck analyst' in the National Research and Innovation System, RCN should be more ruthless.

RCN's sectoral advice role is much less visible than its national policy role. The performance is understandably mixed. Where RCN has a fair amount of activity, it can give or organise sectoral advice which users find helpful. In areas where RCN is itself less active, it is less able to do so.

6.1.2 Research to Meet Social and Industrial Needs

RCN has a wide network of contacts to industry and the public service. It is less well connected to other stakeholder groups in society. Both the way in which some major research stakeholders have sought to by-pass RCN and the absence of the more open style of Foresight process seen in many countries abroad these days, suggest that RCN could do better at being an **arena** where opportunities can be explored – including the kinds of major initiatives that have not fitted with the budget constraints over much of RCN's life. If RCN is not the natural place to discuss new, major research initiatives, it has failed to be the kind of holistic organisation envisaged in the early 1990s.

At the level of establishing and reacting to the needs of identified users through concrete projects, RCN does better. In both the state and industrial sectors, it involves users heavily in project and programme definition. This is **the** most important step in ensuring that results get used. RCN does a good job by international standards in promoting the public understanding of science. It could be more demanding of researchers, as disseminators of research results. But there are limits to what can be achieved by 'broadcasting' information. The link to users provides the receiver needed to hear the transmission.

6.1.3 Basic and Applied Research

RCN has a set of quality procedures in place, which aim to ensure that it funds research that has high scientific quality and that significant parts of its budget are spent on work that is socially relevant – both in the short- and the long-term. A lot of the work it funds is fundamental. There is probably scope to focus this activity more in areas which have strategic relevance, and the growth of the Research Fund provides an opportunity to do so. The balance between strategic and completely 'free' research is political, and has not been debated properly in Norway (or, indeed, in many other places). Better integration between applied and more fundamental research requires more policy experimentation than RCN has so far been able to undertake. Better understanding the limits and opportunities for this kind of integration is an outcome we had hoped would have resulted from the RCN merger.

6.1.4 Research Institutes

RCN was charged with a special strategic responsibility for most of the research institute sector, but only to a limited extent given the resources and freedom needed to exercise that role. It has achieved increased clarity about funding principles, tidying up the system and setting sensible rules. In the NT division, it is beginning slightly to affect the incentive system within which the techno–industrial institutes operate, but overall, RCN has limited authority with which to exercise its strategic responsibility.

6.1.5 Internationalisation

RCN has been very active in setting up a plethora of bilateral international agreements, few of which have much content. More important, it has provided financial and coaching support to bring the Norwegian research community into the EU programmes. Recently, it has started involving an international dimension in many of its activities, such as PhD funding. This is important progress, and can be backed up by further internationalisation of review processes and integration of research providers into international settings, where this gives advantage.

6.1.6 Appropriate and Efficient Processes

RCN operates a wide range of processes. There is probably more diversity than is actually necessary, and transparency would be served by greater consistency. Especially given this diversity, RCN's administrative costs do not appear excessive. If anything, the council is under-staffed, given the shape of the current workload. Evaluation is not properly connected to the work of the Council. Evaluations have too few consequences, and are barely connected into organisational learning.

History at RCN has shown that very similar organisational structures can provoke conflict or provide a setting in which people can muddle through. The divisions and the Executive Board, however, seem somewhat to inhabit parallel universes, talking to different groups outside the Council and having separate concerns inside. It is only in the most recent years that new resources have begun to force these two levels into co-operation, so that overall strategy has practical meaning at the division and programme levels.

6.2 Framework Conditions

6.2.1 Amount and Scope of Resources

There is no international benchmark for the 'right' amount to spend on research. There is plenty of good evidence to show that there is in general a positive connection from R&D to economic and social well-being. Yet the international statistics show that different countries find stable positions, while at the same time spending very different amounts. Sweden spends well above the average on both academic and industrial research, yet has been tumbling down the league table of GDP per head for the past twenty years. Italy spends below the average on both, and has been climbing. As our earlier discussion of National Research and Innovation Systems showed, the connection between research and wealth generation is not a simple one, and depends a great deal on the particular capabilities and histories of nations.

In the Norwegian situation it is quite clear that continued economic and social development depends upon further modernising the structure of industry and increasing its research intensity. This is unlikely to happen spontaneously, but needs to be supported by a measured increase in state expenditure on R&D in both the higher education and the industrial sectors. This needs to be accompanied by measures which 'leverage' the additional expenditure to trigger private R&D investment. Some of these can certainly have a general character, such as tax incentives do. However, a prudent use of funds is to focus investment in R&D in areas where it is reasonable to expect a social return, and where there is a quality-assured process in place for identifying such opportunities.

6.2.2 Composition of Resources

International statistics imply that Norway is spending enough on research in higher education and the institute sector. It fits well within the Nordic pattern of spending on these categories, which is itself above the OECD average. Norway has about as many research workers in higher education per thousand of population as Denmark, and therefore more than most OECD countries, though it trails Sweden, Finland and Switzerland – the world's most academic-research intensive countries. Yet, when we look at the detailed level, there are strong signals that Norway is spending too little. The increase in the number of researchers in higher education over the past decade has by no means been matched by an increase in research council funds to pay for the additional research they are supposed to conduct.

The experts who reviewed RCN's divisions agreed that too little was being spent on response-mode research, and the academic part of the Norwegian research community forcefully makes the same point – both through our researcher survey and in direct lobbying. At the same time, the programmes tend to meet the needs of identified users, many of whom are putting money on the table to pay for them. We recognise that the research community in Norway, as elsewhere, would like to have more money allocated to it to spend as it chooses. This understandable human desire, however, needs to be tempered with the need to orient some of the research being undertaken in a broad way to social goals via investments in strategic research. We therefore see the creation of the Research Fund and the allocation of its money to a combination of basic and strategic research as a positive response to an important need. This money needs to be allocated to RCN and not to the higher education

system, in order to enable the Council to play the needed role as change agent. In the face of the universities' limited ability to develop research strategies, and to co-ordinate these with national needs, the need to manage national R&D investments across a growing number of research performers, and the fragmentation produced by the sector principle, it is especially important in Norway to have a strategic actor at the centre of research policy. In parallel, reforms are overdue within the education system to modernise the university sector, improving its linkages with the rest of society and the individual universities' ability to develop and implement strategies to increase their competitiveness.

The more difficult problem is how to tackle the low R&D spending in industry. The political mood has swung in favour of non-selective measures – in particular a tax credit for industrial R&D expenditure. Better framework conditions for companies are an important contribution, but will not alone trigger the needed industrial restructuring. Neither will attempts by the state in detail to 'pick winners,' as our expensive experiments in European technology policy during the 1960s and 1970s clearly showed. Industry needs a richer selection environment – a better range of technological opportunities to choose from, combined with the internal capabilities to make use of them. The state needs to focus its contributions to R&D-based industrial development on areas relevant to industrial users and on encouraging them to perform R&D in-house, but in constant connection with other companies and the research sector. This means that spending through RCN should be rising, not falling, as it has done over the life of the Council, but also that it should be focused to a greater extent on measures which involve companies in active research efforts, often conducted in co-operation with others. What applies to companies here applies with equal vigour to other productive institutions, such as hospitals and social services. It is not the job of the research infrastructure to take over the R&D functions of these organisations. Rather, it should provide inputs and support their internal capabilities.

On this analysis, RCN will do its job better if it has more general funds at its disposal, for use both in the academic and in the productive sectors.

6.2.3 Freedom to Use Resources

There is a strong belief both at RCN and within the research community that RCN's freedom of manoeuvre is severely constrained by ministries' practice of earmarking funds. There is an element of truth here, but also an element of exaggeration. RCN receives large grants from both the education and the industry ministries, which it can use with minimal constraints. The problem of earmarking can be solved by improved research management practices in the ministries, and is in any case likely to become less important if budgets carry on rising, as they have started to do in the past two to three years.

The central problem is how the sectoral principle should apply in research funding. An important element of the RCN reform was that other ministries should channel funding to support their general research needs to RCN via the education ministry. This element was dropped from the legislation to set up RCN, and has – perhaps unsurprisingly – never been implemented. Persuading ministers and ministries to give budget to each other is not easily achieved in any country. As a result, the 'Langslett doctrine,' that ministries should buy research from a research council and not directly, is honoured in the letter but not in spirit. Ministries have increasingly

granted ‘special funds’ to RCN, retaining close control over how this money is used, while grants of ‘general funds’ have stagnated. The net effect is a reduction in RCN’s strategic freedom, which RCN mitigates by investing a lot of time in very detailed co-ordination with many of the ministries, micro-managing its spending so as to maximise its budget. It is not necessarily clear that RCN should accept small amounts of money generated in this way, given the complexity and high administrative cost that micro-management by the ministries generates.

6.2.4 Management by Ministries

The RCN reform also anticipated a growing research culture and increasing research management capability within the ministries, but did not put measures in place to achieve this. The results have been correspondingly disappointing. Ministers’ interest in research has been sporadic, as the stop–go history of the government research committee (RFU) testifies. Ministries internally co-ordinate their spending via RCN, but few have a systematic foresight process, a research strategy or a systematic approach to managing the use of new knowledge.

In most cases, it follows that the boundary between that research, which should, according to the Langslett doctrine, be acquired via the research council, and other ‘research’ needs is unclear. The boundary between ‘studies’ (*utredning*) and research to produce new knowledge is not well understood. In many cases, short-term concerns ‘crowd out’ longer term needs, and the earmarks accumulate.

What is true of companies and other productive institutions is also true of ministries: they need **absorptive capacity** in order to make use of externally generated knowledge, and ways to integrate external and internal knowledge sources. Extending the Langslett doctrine to cover all their research needs would mean research would not be timely and would undermine their ability to do their work. Equally, expecting the ministries alone to specify the longer term research needed by their sectors would, in most cases, stretch their capabilities and, in all cases, o make poor use of the knowledge of the research communities. The solution is not to alienate the ministries from longer term research concerning their sector by transferring money to KUF, but to ring-fence a proportion of their research spending for RCN to use as it sees fit on longer term research relevant to their sector. At the same time, if there is value in having RCN as a contract research manager for other ministry needs, there is every reason to continue to use its competence in this way. The proviso is that the purchaser should pay the costs of administration, as well as the costs of the research to be bought.

6.2.5 The Role of the Education Ministry (KUF)

The education ministry has responsibility for co-ordinating research policy across the civil service. It provides its agency, RCN, with broad freedom to implement research policy, and is receptive to inputs from RCN in its policy advice role. In this sense, KUF’s relationship with RCN comes a lot closer to the ideals of the new public management than equivalent relationships with many ministries.

KUF’s co-ordinating role is vulnerable to the amount of interest there is in research questions at the political level. It provides ‘weak’ co-ordination because it lacks authority over the other ministries. (Such authority would, in any case, not be

desirable.) Channelling all research funds through KUF, in effect making KUF a research ministry, would undermine the role of research in the other ministries. An intermediate solution where the government takes a decision about the total R&D spend early in the budgeting process, would be a more attractive way to involve other ministries in research policy while defending the total research spend.

6.3 RCN's Organisation

6.3.1 Organisational Levels

A three-level organisation is dictated by a desire to have clearly distinct divisions within RCN. Given this, which defines the need for divisional management, it follows that an upper level is needed to unify the organisation, while a lower level is also required, in order to get the day-to-day work of project funding done.

Historically, the three-level organisation of RCN allowed damaging conflicts to emerge among people at the two higher levels. These were resolved by the departure of the two top people and the introduction of a number of unofficial communication channels between the levels, which made the system more 'leaky' and helped build trust. After a period, it was found to be possible to live in peace within an organisational structure little different from the one that before had proved so contentious.

Those who objected at the time continue to object today. Newer board members are reasonably content with the current arrangements. The organisation has largely moved on, though there remains a rumble of discontent about linkage between the Executive and Divisional Boards. Both the experts who reviewed the divisions and industrial members of various boards were puzzled by the insistence in RCN's statutes that people should not sit at more than one steering level. In industrial and research council practice elsewhere, it is quite normal for people to operate at more than one level, and this has a positive effect on information flows. It would be useful at least to formalise the right of the division chairs to attend Executive Board meetings on budget matters, and on other matters from time to time as needed. A neater solution would be to make the Division bBoard chairs non-voting members of the Executive Board, but those involved would have to consider the high meeting load this would generate for the Division Board chairs, which could have an excluding effect, especially on industrial members.

6.3.2 The Divisions

The divisional reviews considered each division separately, and generally concluded that each was a viable entity. Two significant objections emerged to the present structure

- The MU division tended to become a 'ghetto' for environment issues, providing the other divisions with an organisational reason not to take enough action to integrate such questions into the mainstream of their activities
- The separation of NT and IE got in the way of managing basic and industrial research together. It was understood that the separation was organisationally driven by the need to avoid RCN being, in effect, dominated by the old NTNF

structure, which had combined most aspects of these two divisions. Arguably, this reduced RCN's ability to manage applied and more fundamental research together in these areas

The divisions nonetheless operate as relatively coherent entities, developing their own internal cultures. There are probably several alternative ways in which RCN's divisions could be structured which would work about as well, but no obvious rearrangement of divisional responsibilities that would work significantly better.

IE has worked over the past two years to develop a strategy, which better connects its activities to those of other parts of the council – especially NT. More generally, the amount of administrative activity devoted to cross-divisional co-ordination has been rising, especially during this recent period. However, both the continued objections from users and funders on the one hand, and the comparative absence of major cross-divisional initiatives on the other, suggest that the divisional structure itself is getting in the way of achieving the original vision of an holistic RCN. In reality, the divisions reproduce within a single meta-organisation many of the major rifts between separate organisations in the pre-RCN structure. It is clearly preferable to have these divisions within a single organisation, because this makes it possible to use management to bring the divisions together. We therefore regard RCN's present divisional structure as a necessary but transitional phase on the way to developing a more integrated council.

However, it is also clear that the divisional structure represents a major obstacle to change, through tackling issues that in today's structure are 'horizontal.' These include key aims from the Grøholt period, of holistic research policy and the co-management of applied with more fundamental research. The almost universal description of RCN as a series of "watertight compartments," as well as the co-ordination weaknesses discussed earlier, testifies to the barriers produced by the divisional structure, which largely reproduces barriers among RCN's predecessors. We are tempted to wonder whether, if RCN were to run a new set of main target areas, there would be a new commission to consider reorganising the Council, in view of the difficulty of co-ordination. We suspect that, if the money for new target areas were parcelled out to the existing divisions, the resulting co-ordination would be weak, and there would indeed have to be a new Grøholt commission. If the new areas had separate, horizontal budgets, they could be managed as matrix elements, and a commission would be redundant.

6.3.3 Management and Administrative Systems

RCN has successfully established management and administration systems across its wide remit. A crucial early achievement was the ability to establish RCN without an 'interruption to service' for the user communities. The IE division has done pioneering work in trying to monitor the effects of user-driven R&D in the economy, and more recently in trying to standardise the appraisal of project proposals. RCN is moving into electronic proposal administration and is beginning to implement aspects of Management by Objectives. (These latest developments are outside the scope of this evaluation.) Not least through its membership of the TAFTIE[74] group, its

[74] TAFTIE is a network of European innovation agencies, originally set up under the European Commission's SPRINT programme

practices are having an influence on those of other agencies abroad and RCN itself is receiving important impulses from foreign experience with problems similar to its own.

A key concern in the merger was that applications should not 'fall between stools,' as they could in the pre-RCN systems. While RCN has shown us administrative procedures intended comprehensively to ensure that all proposals are evaluated, and that the administration expends great efforts in making sure this happens in the right place, our survey indicates that the research community is not convinced. RCN was unable to tell us whether application/acceptance ratios differed among applications directed to the 'right' place in the Council and those administratively transferred. Some institutions felt their applications were unwelcome in some parts of RCN, because of their historical affiliation to a certain division or ministry. Again, these claims proved untestable but do at least point to a need for RCN to demonstrate the transparency of its processes as far as possible.

We were unable to obtain a clear picture from RCN at the operational level of how gender and regional biases were avoided in project selection. In our various background analyses, we found no surprises in the allocation of resources. Nor did women have much to say to us via interviews and surveys that differs from what men had to say. Women's access to resources related to their roles and seniority in the research-performing system. Norway is highly advanced in this respect, and we would expect the country to achieve something like professional gender equality sooner than most other places. The regional distribution of funds is biased by the location of the large research-performing institutions. In our view, research funding is investment, not consumption. Deciding to invest in regional capabilities is a perfectly legitimate objective of regional policy (even if it would pose dangers of fragmentation in a research community that is already too fragmented). In the absence of specific initiatives to fund the build-up of regional capabilities, it is not obvious that the pattern of resource distribution should reflect anything other than the strengths and weaknesses of the research-performing sector.

There is scope for improvements in human resource management, through better-developed training and personnel appraisal processes. Staff at lower levels appear to have limited knowledge of other divisions than their own, and could usefully be rotated to them (and to ministries) to broaden their experience.

6.3.4 Unified Administrative Culture

RCN has successfully managed to bring together the diverse systems and practices of its predecessor organisations into a single organisation. This type of organisational integration is a significant task, whose difficulty is easily under-rated. RCN is now taking further steps to unify its administrative processes and culture. The clearest example is the development of a single application form for all classes of applicant and funding instruments. Behind this unified interface, however, is a diversity of practice and process variability, where similar processes are done in different ways. This applies especially to the use of peer review.

In certain cases, administrative unification is being undertaken at real costs to the effectiveness of RCN and to the detriment of its customers. Except for new customers, IE has recently replaced its tradition of constantly open calls for proposals

with an annual deadline, to line up with practice elsewhere in RCN – a fact which has not yet been picked up in user surveys, but which caused negative comments in our interviews. It has also abandoned its past practice of interacting with proposers, improving the quality of proposals and – in many cases – advising those with weak proposals not to apply. Open or frequent calls are standard practice among equivalent Nordic agencies, in order to be able to respond to industrial practice and lead times. Equally, dialogue with industrial customers is widely practised.

RCN needs to become more selective in its work to unify the administration. Common processes should indeed be common, improving efficiency, transparency and RCN's ability to make best use of personnel. But the genuine differences between industrial R&D, response-mode funding of basic research and procurement of policy-related research, for example, require differences in administrative practice. Extending the principle of unified administration to areas where needs are genuinely different would make RCN less effective in the short run and, if persistent, would become an argument for breaking up the organisation.

6.3.5 Efficient Administration

Researchers with no experience of RCN saw it as bureaucratic. Researchers who have actually dealt with RCN are generally negative about the length of time needed to process applications and the lack of feedback when proposals are rejected, but were otherwise rather more positive about RCN administration.

One source of RCN's bureaucratic image is that the Norwegian research funding system – in common with others – has over time increased the amount of effort it devotes to monitoring and reporting the use of taxpayers' money. This process began before RCN was set up, and is consistent with the principles of the New Public Management. RCN's reporting requirements are modest, seen in an international perspective, and justifiable in terms of accountability. None of us likes filling in forms, but sometimes this is necessary.

The more serious aspects of the 'bureaucracy' charge relate to a slow project acquisition process, tied to the annual call for proposals and the budget, where RCN (and the wider system within which it lives) increasingly prioritises its administrative needs over those of its customers. A proposal cycle that takes half a year extends the rigidities of the civil service into the research performing system and will discourage industrial involvement. While, internationally, RCN is not alone in having a slow project acquisition process, best practice levels of 3–6 weeks are being achieved by some agencies in some programme types. RCN is itself demonstrating in its administration of the FUNN scheme that application processing can take weeks, not months.

In fact, a single annual call for proposals builds a huge peak into the administrative workload, which has to be tackled through delay or by hiring in contract staff. The trade-off that has to be made in deciding the length of the proposal cycle is between the interests of applicants on the one-hand in fast processing and the need to accumulate enough proposals to create a meaningful competition on the other. We are not convinced that this trade-off is being made at the right point today, or that deciding that almost all activities in RCN should be appraised annually in fact corresponds with the differing needs of different instruments and fields.

One requirement for a more user-friendly (and, indeed, strategy-friendly) RCN is multi-annual budgeting. Only the state would try to run such a large enterprise as RCN while entering into only annual commitments. (Even these are liable to change during the year, for example as a consequence of the government's mid-year budget review.) Swedish practice, which is also bound by an annual government budgeting process, is each year to authorise agencies to make declining commitments into the future. This helps protect, for example, PhD stipend holders from mood swings in the parliament.

6.3.6 Use of Resources in Administration

There was a widespread belief among those we interviewed that RCN's administration costs had gone **up** since the Council was formed – a belief which no-one could back up with data, and which is contradicted by RCN's own statistics. We speculate that the impression of increased administration stems from the tendency discussed earlier for the academic community to see a continuity between NAVF and RCN and to see that RCN does, indeed, have a bigger administration than NAVF, since it handles many more tasks.

The data presented earlier are unambiguous. RCN's administrative efficiency has been increasing through the life of the Council. The head count has been going down RCN's administrative costs are comparable to those of equivalent organisations elsewhere. Given the complexity and scope of RCN's tasks, we argue that it is, if anything, under-staffed for its role and that the administrative budget could usefully rise.

6.4 Instruments

6.4.1 RCN as a Strategic Advisor

RCN has improved the factual and analytic base, on which research policy can be made in Norway. This has been achieved through a combination of the work of the Strategy division of RCN and projects contracted to key institutes such as NIFU, STEP and Møreforskning. A visible part of this work has been two major indicator reports, which explain what is happening within Norwegian research and set it in international context. Less visible is the large body of analysis RCN has funded of its own practice, such as meta-evaluations, reviews of instruments and of aspects of research institute policy. It has also studied a number of other systems – recently, for example, having published a review of research policy in the USA. The amount and quality of information available through these studies is very high, compared with other countries. Not only through the institutes mentioned but also because of others in Norway, the amount of national research capability in questions of research and innovation is also unusually high.

At the level of national policy influence, RCN's achievements were limited up to the late 1990s. The Council has constantly promoted the goal of raising R&D as a percentage of GDP up to the OECD level, though this idea predates RCN. As is clear from RCN's own budget development during the period, this had no practical effect

on government policy. From 1998–99, however, RCN began to find an attentive ear in government, and it set much of the agenda for the 1998–99 White Paper. Was the change due to an improvement in the quality of RCN's message or of the government's hearing? We suspect it was a little of both. Certainly the reinvigoration of the government's research committee (RFU) in 1998–99 was crucial in creating a **forum** where research policy in total could be considered. The parliament's education (KUF) committee urged the following year that a national plan to build up to the OECD average level of R&D expenditure[75] should be assembled and presented, in order to enable RCN to have a more co-ordinated policy. But we believe that adding up the research expenditures across the ministries alone will not enable change. The Finnish experience of placing a Science and Technology Policy Council, chaired by the Prime Minister, **above** the level of the ministries reinforces the lesson of experience with 'horizontal' questions in organisations everywhere: namely, that without powerful champions, these get lost. (RCN, in turn, has handled some horizontal issues unconvincingly for exactly the same reason.)

In many of our interviews with senior figures in Norwegian research policy, RCN was accused of focusing on questions of value creation, at the expense of other aspects of research policy. Ironically, therefore, while government's view of research and the budgets it allocates have moved in a positive direction over the past 2–3 years, this upwards trend has largely been confined to academic and policy research. Various governments over the past ten or more years have found themselves caught up with questions of principle about industrially-oriented research that have made it hard to support all of RCN's efforts. (As the massive cuts to activities in SND activities previously funded by the industry ministry have demonstrated, this applies also to technology transfer and other activities that build industrial capability.) There is a tendency to view this as a subsidy, and therefore as undesirable. This contrasts with the view taken in countries that have been more successful in trying to upgrade industry's technological capabilities and technological level, which have treated these expenditures as **investments**. Since industrial research funding is seen as subsidy, it has systematically been oriented in such a way that 'industrial' subsidy is actually spent in the state sector, primarily by the research institutes. Our analysis of Norway's spend on resources on R&D showed that it is precisely in the business sector that the greatest shortfalls lie. There is no convincing theoretical or practical reason why we should imagine that reduced policy attention and investment in tackling this problem is going to improve the situation. RCN and other commentators on research policy in Norway have more work to do in this area.

6.4.2 RCN as a Sectoral Advisor

RCN's role in providing sectoral advice is bound up in its relationship with the ministries. Except for what appears in the annual report, little of this is documented, but it is nonetheless an important part of RCN's role in the existing system.

Our work with the ministries indicated varying satisfaction levels with RCN's ability to provide sector-specific advice on research policy. The critical factor appeared to be the amount of sector-related research activity contracted through RCN, so that larger research users tended to be more satisfied than smaller ones. There is an obvious circularity here, in that it becomes possible for RCN to develop the domain

[75] Innst. S. nr. 110 – 1999 - 2000

understanding, networks and 'know-who' required to be a discussion partner for a sector ministry first when there is an adequate volume of work. Up to that point, it is unattractive for RCN to make the investment in capabilities and unattractive for the user ministries to increase their research spending via RCN, which would justify such investment.

It seems to us that RCN's attitude here has to be a fundamentally economic one. Where ministries fund low levels of research, an explicit choice needs to be made about whether it is better to develop longer-term research management expertise within RCN as well as within the ministry. Placing such expertise within RCN is a logical consequence of the Langlsett doctrine, but – equally logically – this requires that a programme of sector-related research be financed within the Council.

6.4.3 Securing Quality in Research

We can think about 'quality in research' in two ways: as a practical issue; and as a rhetorical device. We tackle these in turn.

In practical terms, RCN has many measures in place to ensure that the quality of the research it funds is appropriate. Peer review is widely used, if sometimes a little inconsistently. Greater separation of peer review and project procurement would be helpful, as would increased standardisation of review processes in cases where the criteria and objectives of assessment are actually similar. Project outputs are not peer reviewed, so RCN does not have the opportunity to increase its understanding of quality after the event. However, it is arguable that applicants' track records contain information about past research quality, and that this information is already inspected at the point where it has operational relevance for RCN as a research funder: namely, when the researcher next makes an application for a research grant. Parts of RCN's work, especially in IE and BF divisions, involve the building of capabilities – both in research institutions (including via SIPs and SUPs) and in industry. Here trade-offs have to be made between scientific quality as it would be judged by peers and other considerations, including the need to **develop** such capability. In the ideal case, projects satisfy both quality and relevance criteria, but not all cases will be ideal. Recent NT practice in allocating SIPs may stray beyond what is strategically useful, by making SIPs fully competitive across the applied technology institute sector and using scientific quality as the dominant funding criterion. This is likely to limit the ability of institutes to enter new fields where, by definition, they are not established and their quality at the outset is likely to be low.

Fragmentation of the research community, and of RCN grants, is a problem in terms of quality, since there are many (perhaps a growing number of) fields where it is hard to make progress without a large team. RCN can make a further contribution to quality by making fewer, larger grants and encouraging more clustering within the research community.

'Quality in research,' however, is not only a practical but also a rhetorical issue. As a general principle it is hard to disagree with. Who would want to stand up and be counted on the side of bad research? But used indiscriminately in a funding context, the principle systematically crowds out new fields, interdisciplinary work and research done for socio–economic purposes, such as industrial development. It is understandable, therefore, if those in the basic science community who see

themselves as under-funded, should use 'quality in research' as a slogan in promoting their own interests. Equally, outside the context of funding response-mode or 'free' research, it is important that 'quality in research' is used as a principle that applies in different ways in different contexts.

6.4.4 Securing the Place of Basic Research

Basic and so-called 'free' research is another area where the rhetoric of debate about different interest groups' access to money tends to cloud the issue. In many cases, 'securing the place of basic research' is the same as making sure that university scientists get money to do the research they want, preferably with no strings attached. In our interpretation, 'securing the place of basic research' means making sure that the longer-term and more 'fundamental' research that needs to be done in the National Research and Innovation System is actually performed.

Analysis of RCN's use of resources and of the publication pattern shows that RCN is successfully funding a significant amount of basic research, and that this proportion is not out of line with that found in other countries. Our bibliometric case studies of marine sciences and biotechnology showed that RCN funded publications were more likely than others to be in basic research, and that the basic research content of RCN funded workers' publications was higher than the world norm. The share of basic research in the institutes with base financing from RCN has been rising and the proportion of development work has been falling, indicating an incremental move towards a more long-term oriented research portfolio in the institutes under RCN influence. Overall, we find that RCN has worked to secure the place of basic research within the knowledge producing system.

At the same time, the expansion of the higher education and research system over the past decade, and the inclusion of many additional institutions as potential research funding recipients in the reform of the colleges (*Høyskolereformen*), has led to increased demand and therefore intensifying competition. (There was no increase in research funding to cope with increased demand.) There is therefore a policy choice, between retaining the present level of basic research funding and raising funding to satisfy more of the demand. Maintaining the present level will perpetuate the present relations of mis-trust between much of the research community and the research council, and undermine the intentions of recent reforms to broaden the research-capable base within the higher education sector.

In our understanding, basic and other types of research are in many fields moving closer, and therefore becoming harder to distinguish. This is supported by the results of the recent Norwegian researcher census, where almost a third of respondents were unable to classify their work[76] as basic or applied. Our researcher survey indicated that people highly dependent on user-oriented funds found it hard to find the right balance between applied and basic work, suggesting that there are few opportunities to do basic or 'underpinning' research in the institute sector, where most of these people work. More generous core and strategic funding could tackle this, as could tighter links with university research. The corollary is to recognise that basic research

[76] see *Forskningspolitikk*, 3/2001

is not done only in the universities, and that it would be undesirable to try to confine it to the campus, or indeed to imagine that it only happens in the public sector.

6.4.5 Identifying and Meeting the Needs of Industry

The early part of this report identified some important lock-ins in the Norwegian industrial structure and its pattern of R&D performance. It is important that RCN listens to what industry has to say about its needs, but also that RCN itself contributes input to the discussions to compensate for some of the effects of these lock-ins. RCN obtains a detailed level of information about existing user-needs through the programme preparation and steering committees. Reducing the number of these, as IE is currently doing, will correspondingly reduce the amount of industrial input obtained. However, the high reliance in IE's consultative arrangements during much of the 1990s on existing industry led to important gaps in perception, not least of the importance of industrial biotechnology, to which RCN as a whole reacted slowly and under external pressure from key ministries. The fact that funding levels have been declining and that much of the existing money is locked-up in a succession of related initiatives to provide 'wall-to-wall' coverage of existing industrial needs does not make it easier to react. The fact that the oil and energy ministry has taken matters out of RCN's hands by setting up its OG21 initiative backs up our impression of an organisation that has had difficulty in identifying and reacting to change needs.

It is much more difficult to consult on the needs of what IE is now calling "unborn industry" and on new but struggling branches of industry, which may or may not turn out to be important. There is an urgent need to broaden RCN's knowledge inputs so that it provides more of a policy arena and less of a planning agency in industrially-related R&D. IE has made a good start here in detaching itself from some of the more traditional sequences of follow-on programmes for the benefit of the usual suspects. It urgently needs the benefits of a technology foresight initiative, to establish its role as an arena where new and significant research policy initiatives can be discussed, and it needs the financial flexibility to implement such initiatives. The corollary is that there needs to be a set of initiatives in place to ensure that there is absorptive capacity in existing industry and that new technology-based firms are nurtured. These, rather than indiscriminate measures to publicise the results of research, are what is needed to ensure that industry makes use of both the new and the existing stock of knowledge.

6.4.6 Identifying and Meeting the Needs of the State

In the current division of labour, the needs of the state are defined and represented to RCN through the ministries. The ministries are themselves responsible for identifying and securing their knowledge needs, in order to make evidence-based policy. The quality and degree of formalisation of the processes for achieving this vary.

The ministries make use of research outputs both in legislation and in defining their own future knowledge needs. They make almost no effort to disseminate results further, arguing that this is primarily the responsibility of the researchers. RCN makes significant efforts to 'broadcast' results, both by encouraging scientific publication and through publications like Tell'Us, which are intended to popularise advances in research. Increasingly, RCN is using debates about research issues, for

example GMOs, to stimulate interest in research among the general public. The ministries were able to identify no specific initiatives to channel new knowledge to users.[77]

6.4.7 Division of Labour in the Research and Innovation System

There are at least two important issues in the division of labour in the National Research and Innovation System that need to be resolved. One is the boundary between RCN's industrially oriented activities and those of other agencies. The other is the division of labour among the universities, the research institutes and industry.

Our review of the role of different actors in the National Research and Innovation System identifies a gap between RCN's increasingly research-oriented activities and those of SND. There – especially since the recent change of government – the centre of gravity has swung significantly away from general business development and towards regional development.

The gap could be filled by a variety of quite heterogeneous initiatives, such as

- Targeted measures aiming at strengthening the **absorptive capacities**, in particular of less R&D oriented SMEs
- Targeted support for the **internationalisation** of R&D and innovation strategies of companies
- National or sectoral **foresight exercises** (future technologies, societal demand, markets), raising the awareness of industry, in particular of larger companies

The unresolved policy issue is not only a lack of programmatic initiatives of the above character (i.e. additional or strengthened funding streams) but also, and in particular, a **lack of institutional responsibility for strategically oriented innovation policies**. A strategic innovation policy mission could either be located within RCN – which would require an extended scope of innovation policy orientation inside the Council – or outside. If outside, the industrially oriented divisions or units within RCN should be linked strongly to the outside authority. There are quite a number of examples of strong innovation policy bodies located outside of the classical Research Council model, take e.g. the Ministry for Economic Affairs in the Netherlands (MinEZ) as a government body, or TEKES in Finland as an agency type of body. It is noteworthy, however, that TEKES and the Academy of Finland are increasingly working together on strategic programmes linking their areas of interest. The recent review of the role of the state in the Danish National Research and Innovation System proposed integrating the strategic innovation function with the research councils in a new organisation that will look remarkably similar to RCN. Both organisational forms appear to be possible.

The other issue of division of labour highlighted in this study is the respective roles of institute, university and industrial researchers in the National Research and Innovation System. There are reasons to think that it is time to modernise the university sector,

[77] Examples of this from the UK would include the National Institute for Clinical Excellence (NICE), which publishes guidance on what advances mean for clinical practice , and the (now closed) Supernet service, which connected industry to sources of knowledge in the higher education and research sector

bringing it into closer connection with other parts of the knowledge-producing and knowledge-using system and increasing the role of external funding. At the same time, we suspect that Norway has reached a stage in industrial development where research effort should be moving more from the institutes into companies. Taken together, these ideas would involve significant redefinition of the university and applied technology institute roles in Norway. These should be considered in much more detail in subsequent studies.

6.4.8 International Co-operation

The pattern of Norwegian scientific publications is internationalising at about the same rate as that in other countries, during a period when scientific work and publication is becoming more international. Both the growing ease with which researchers can communicate and the efforts of the European Union to 'Europeanise' its research community help explain the growing internationalism of the research community. RCN has performed about as well as comparable bodies abroad in linking the research community with international funding and research opportunities.

While Norwegian industry is export-intensive, its R&D is far from being internationalised. This limits its research perspectives and ultimately its development prospects. The IE division of RCN has recognised this, and Norway is now among the leading countries in its willingness to fund R&D across the national borders. There is little that RCN can do about the framework conditions in Norway that discourage inward investment, but these clearly make a contribution to industry's limited international research perspectives.

Especially since the decision to 'mainstream' internationalisation across the Council, RCN appears to be doing the right things to encourage it. These efforts need to be complemented by similar initiatives in the business support system.

7 The Future

In this final Chapter, we draw some conclusions, focusing first on what needs to be done to improve the performance of RCN in its present form. However, we regard this form as transitional. RCN in its present shape is unlikely to realise the vision that lay behind its creation. We therefore suggest how it might move towards realising its mission of holism and diversity.

7.1 Conclusions and Short Term Improvement Opportunities

RCN today has many achievements to its credit, but it falls quite a long way short of realising the challenging ambitions with which it began. Of course, imperfection is built into all human activity, but the fact that limited progress has been made is not a result of poor performance by RCN, so much as of inconsistency between the aims and mission given to the Council, and the means put at its disposal. The framework conditions under which RCN has operated for most of its existence mean that many of the more radical ambitions for the reform are simply 'mission impossible.' We cannot, therefore, think about changes at RCN without also considering the framework conditions.

When RCN was set up it was, in effect, five research councils and an innovation agency, with a common umbrella council and staff. Given a birthday present of a large budget cut, followed by several years of apparent government indifference, the organisation locked itself in internal battles and budget struggles. While the public rhetoric was that of the new public management, the ministries were dragged into the conflict to defend their sectoral interests through micro-management. Neither the promised money nor the required autonomy were granted to RCN, which settled into a routine of over-planning small things because it was not free to do the big ones. Its inability to deliver the expanding budgets expected by the research community means that RCN is widely blamed for national failures of research policy.

Following the White Paper of 1998–99, there was a clear change at RCN. The end of the budget stagnation of the 1990s created the breathing space and 'slack' in the organisation to allow innovation in policy instruments, and the beginnings of improved horizontal co-operation. The delivery of the new research resources planned from this period is an absolute precondition for RCN to make further progress towards realising its goals as well as for the success of national research policy in addressing the considerable challenges we describe at the start of this report. *Noko særmerkt* – something singular – is indeed required.

In the short-term, in order to build on the positive events of these past few years, several things must happen inside RCN

- The Research Fund should be retained within RCN and used as a basis for setting new agendas across the scope of the Council
- RCN should champion and initiate an open Foresight process, inviting a wider than normal debate about priorities and empowering more parts of society in relation to the national research agenda

- Stronger co-ordination measures, involving the use of 'horizontal' budgets are needed in order to break down internal barriers
- Divisions should be represented in a non-voting capacity at the Executive Board, in order to secure the vertical lines of communication within the council and build the ability to interrelate overall and specific policies
- Evaluation should be more centralised and better coupled to learning in RCN and the organisations evaluated. Evaluation should have consequences. Positive and negative incentives are required
- Unnecessary process diversity should be reduced, increasing both efficiency and transparency. This applies also to the use of peer review
- Long application processing times and long periods between calls for proposals are a convenience for RCN and an inconvenience for its customers. There should be more dates at which calls are open, and a faster, more efficient appraisal process
- The administrative resource should be reviewed, in the light of the expected workload
- More attention needs to be paid to human resource development and training for the specifics of the rather unusual kind of work that is done at RCN
- Reviews should be launched to consider university modernisation, the structure of the institute sector and the division of labour between the universities, institutes and industry in R&D
- RCN should use its increased budgetary freedom to establish itself as an **arena** for policy initiatives, and not solely as a planner

At least as important are those changes that need to happen outside

- The sectoral principle should be articulated, so that it is clear that ministries are responsible not only for obtaining short-term knowledge for policy implementation but also to ensure the availability of relevant research capabilities.
- The practical distinction between ministries' short- and longer-term research needs has to be better explored, and used as a basis for protecting general funds against earmarking. Without this freedom, RCN can never achieve the horizontal activities expected of it or realise the aim of holistic management
- This means taking the principles of delegated powers within the new public management much more seriously than is the case today
- A specific and significant budget needs to be attached to the 'innovation agency' function, in which RCN should continue to co-operate with SND as its distribution and delivery partner
- Multi-annual budgeting should be introduced on the Swedish model, with RCN allowed to commit at least parts of its budget forward into coming years
- RCN must retain its analytic capabilities and continue to advise government on research policy, but there is no reason why it should be assumed to have a monopoly on this function
- The role of the RFU should be strengthened and made more permanent – potentially by involving the Prime Minister in the chair, on the Finnish model

7.2 Future Directions

We regard the creation of RCN as a big and very exciting experiment. No-one had really tried to find out before whether all the functions of research councils and innovation agencies could be combined into a single organisation. Our first reaction when we saw how little real integration had taken place during the life of the Council was one of disappointment. Once we began to see the constraints in the framework conditions for RCN, especially the budget cuts and the strength of the sector principle, and to learn in more detail about the effects of tradition and the time it takes for adaptation, we began to understand why things had moved comparatively slowly. Over the past two years or so, when budgets had begun to move upwards and the Research Fund gave the promise of future growth, it became possible to see that this was an organisation now in a better position to do the original experiment.

For us as evaluators, this is of course very frustrating. We had expected to be able to see whether the experiment had worked, but it is in an important sense just beginning at the point where our evaluation mandate runs out. We see two possible conclusions for our work. One is to say that, if it takes eight years to achieve only a modest movement towards an integrated research council, it is unlikely that such a goal will ever be achieved. Our other possibility is to say that the experiment is worth doing properly, and to make some suggestions about how the next stage could develop.

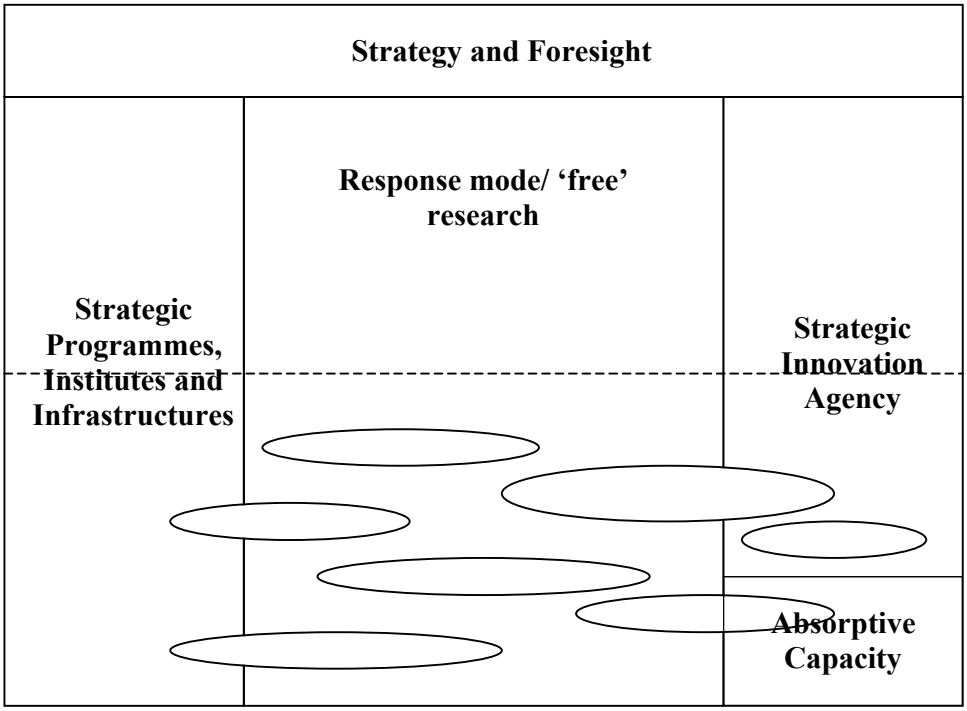
If the Norwegian government decides to stop the experiment now, the probable implication is that RCN should be split up into its constituent cultures. The result would look rather like the new Swedish research funding organisation, with an umbrella research council for basic research, an innovation agency and two or so applied research councils handling agriculture, fishing and the environment – areas which do not fit in a basic research council. An immediate effect will be to recreate the problems in tackling 'horizontal' things like the 1980s Main Action Areas, which led to the formation of RCN in the first place. It will probably be cheaper and quicker to cut RCN up than it was to create it, but the costs of another organisational change will still be very high, and should be measured primarily in the paralysis of policy development that takes place during such changes. RCN is filled with intelligent and competent people. Just as in 1993–1994, business as usual will not stop. But the next two or three major opportunities – the 'next FUGE,' for example – to improve Norwegian research will be missed.

However, the evidence we have seen does not suggest a uniform pace of change. It suggests that the way RCN was set up and the transitions it had to go through for much of the mid-1990s stopped any real integration in its tracks. Now the experiment begins. Given this, and the growing need for holistic research policies to which the RCN organisation was intended to respond, our preference is for the experiment to continue. This is not just a matter of curiosity. The indications are that knowledge production and use are becoming much more heterogenous, that in many areas the distinction between the fundamental and the applicable is reducing and that the ability to work both within and between disciplines is becoming more important. This means we need nimble researchers and agile research funders, able to bring together the powers of the most distant and dissimilar disciplines.

That said, we are not optimistic that the RCN experiment can succeed if it continues on an incremental basis. 'Stretch goals' are needed, in order to overcome the inertia

caused by the existing divisional structure and the strength of the sectoral principle, which has so far defeated attempts to establish RCN as an independent agency of the state, in the way envisaged in the new public management. These goals must involve adapting RCN's structure to its mission and weakening the links to the sectors. We therefore propose that, in 3 – 5 years time, RCN should have something like the structure set out in **Exhibit 34**.

Exhibit 34 Suggested RCN Structure: 2005



We do not, by and large, see the specialisations of the present divisions as necessarily permanent. Research needs change over time, and should not be legislated into the institutional structure of a research council. We therefore think RCN should evolve into a body organised by **function**, and ready to change its structure to meet evolving needs.

The structure distinguished between permanent and transitory needs. There is a permanent need for strategy and foresight. Our team is divided about whether **the** role of providing research policy advice to government should be allocated to RCN or to an independent, external body. Were such an external body to be created, RCN would still need to devote considerable efforts to strategy and foresight.

A large part of the RCN resource should be devoted to ten or so large thematic areas. These will encompass the national research priorities and other clusters of effort, for example issues related to making health and social policy. They should be time-limited, each defining an appropriate time scale at the outset, in the range 5–10 years. This will build in the churn and debate necessary to focus attention on change in national research needs, and competition for resources to help ensure the most important and promising areas receive priority.

One can argue that, given the existence of basic funding in the university and given better base funding in parts of the institute sector, much of the long-term work could be left to find its own way – and this way might well be to find a place within current themes. We suspect this may be hard to swallow. Longer-term research must generally have a funder in a binary funding system, so one function of RCN should be to provide response-mode funding, based on quality. A coarse division of knowledge into broad fields will be necessary in order to manage peer review, and allow the Council to function as an 'aggregation machine.' Individual long-term research questions will move easily between response-mode and theme funding.

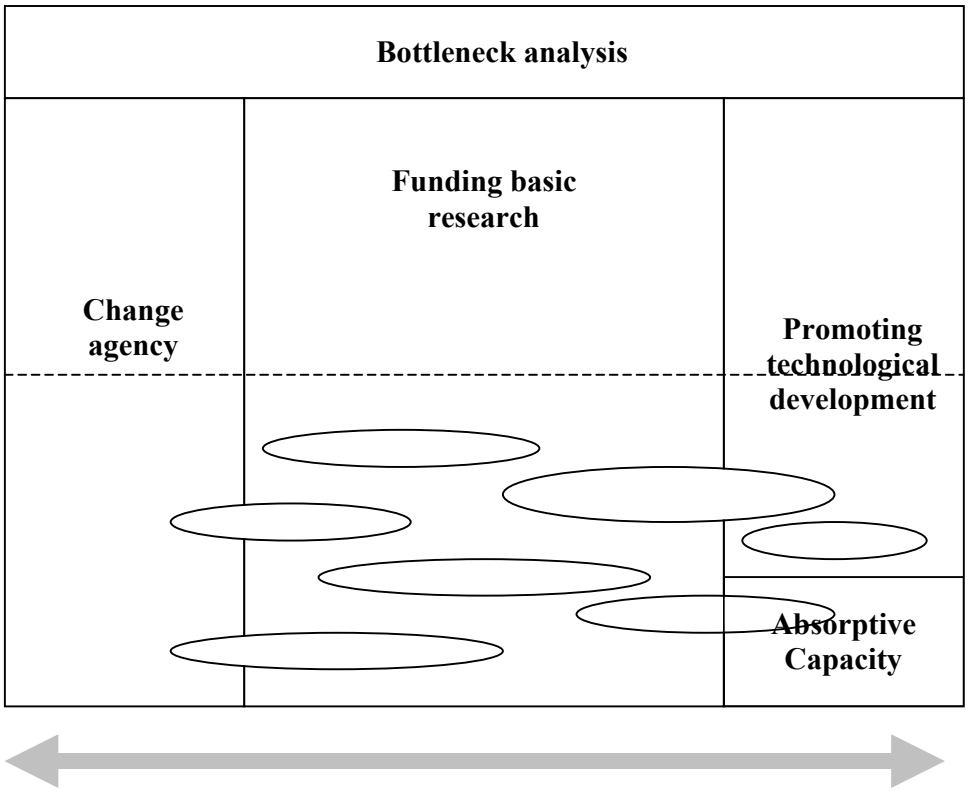
There will be a tendency for the response-mode area in RCN to fund Mode 1 and the Thematic area to fund Mode 2 research. A device will be needed to encourage the modes to be mixed – especially in the thematic areas. This could be achieved by mixing general and specific funds.

Someone has to look after the change needs and infrastructures in the research performing system – providing money to start new areas, as the SIPs and SUPs do today, and funding large infrastructures. This should be a separate area within RCN, which therefore builds and maintains a good knowledge of the capabilities of the overall research system.

The innovation agency function is vital to national development, and needs to constitute its own area within the broader Council, because it operates partly under different rules to the other parts. The kind of excessive convergence we see today between IE administrative practice and that elsewhere needs to be reversed. A proactive style will be needed in the innovation area, and it may need to consider additional funding instruments to cope with the lock-ins it faces, such as Strategic Industry Projects, by analogy with the existing SIPs and SUPs. The other key role of the innovation area will be to promote the development of absorptive capacity within industry, developing active measures to complement the expected growth in general passive measures, such as tax concessions for R&D. Both the change needs and infrastructures area and the innovation agency area should be able to co-fund themes, where appropriate. This area needs a budgetary and operational link to the complementary activities of SND.

Exhibit 35 shows how the proposed areas map back to the various state roles needed in managing the National Research and Innovation System, giving full coverage of the roles we identified earlier.

Exhibit 35 Roles of the RCN Areas in Managing the NRIS



The organisational implications of the new structure are comparatively simple. A three-tier structure remains appropriate, with an Executive Board, boards for each of the areas identified and a third level of committee to handle discipline clusters in the response-mode area and themes in the thematic area. A third level will also be needed, in order to make the innovation agency manageable.

Creating this kind of structure will require some important changes in framework conditions

- Higher quality research management in the ministries, more clearly distinguishing short and long-term needs and more actively engaging in debates about establishing themes in RCN
- Ring-fencing general funds for research in a greater number of ministries
- Increased freedom for RCN to manage the institute sector, for example to reallocate funding based on evaluation results
- Multi-annual commitment of research budgets
- Delivery by government of the larger resources planned for research in the build-up plan towards the OECD R&D average
- A strong and permanent research policy champion, such as an extended RFU, at the highest level of government, able to support RCN and KUF in their efforts

The structure also presupposes that RCN is able to act as more of an arena for research policy debate, taking on and championing new ideas like FUGE, and that it maintains the budgetary flexibility both to launch and to shut down themes.

The consequences of such an organisation would be that RCN would have to shift its structure from the current mix of functions and themes, to one where functions predominate. A strong personnel core will be needed, able to work with a changing set of thematic specialists. A strong strategy function and professional financial and project administration capabilities are preconditions for operating with a shifting structure. Upstream funders will have to deal with RCN at a more central level, rather than with dedicated specialists. The amount of thematic expertise provided to customers will be in proportion to the customers' spend and commitment to individual themes.

It will take a time and work to evolve the organisation in this way. This needs to be explored within RCN itself. The transition can begin quite quickly, by introducing funded themes into the present structure. The structure of RCN will start to change, as themes change, reflecting the dynamics of knowledge production.

Holism and diversity in a singular organisation, indeed.

Appendix A Terms of Reference

Unauthorized translation from Norwegian

EVALUATION OF THE RESEARCH COUNCIL OF NORWAY

Competitive tender conditions

The Ministry of Education, Research and Church Affairs

24 May 2000

Evaluation of the Research Council of Norway

1 Background

The Research Council of Norway was established by decision of the Storting on the basis of a recommendation to the Storting (Innst. S. nr. 231 (1991–92) following a report to the Storting (St. meld. nr. 43 (1991–92) *Et godt råd for forskning* (good council for research)). Its establishment involved the merger of five former research councils (the Royal Norwegian Council for Scientific and Industrial Research, the Norwegian Research Council for Science and the Humanities, the Agricultural Research Council of Norway, the Norwegian Council for Fishery Research, and the Norwegian Research Council for Applied Social Science. The political treatment was based on the report of the Grøholt Commission (NOU (Norwegian Official Reports) 1991:24 *Organisering for helhet og mangfold i norsk forskning* (organizing for unity and multiplicity in Norwegian research) and wide-ranging public consultations. Reconsideration of the research council structure was first proposed in a report to the Storting, St. meld. nr. 28 (1988–89) *Om forskning* (On research).

The Research Council of Norway is a national executive and consultative body with responsibility for increasing the general knowledge base and for contributing to meeting society's needs for research by promoting basic and applied research in all areas. All Norwegian Ministries allocate funds to the Research Council out of their budgets. The Ministry of Education, Research and Church Affairs (KUF) exercises the overall administrative responsibility, while the Research Council reports to all the Ministries concerning their respective budget items.

Report to the Storting St. meld. nr. 39 (1998–99) *Forskning ved et tidsskille* (Research at the beginning of a new era) stated that the research council reform would be subject to a broad independent evaluation around the turn of the century. The evaluation will serve as a basis for subsequent political treatment of the research council reform.

The Ministry of Education, Research and Church Affairs will award the evaluation assignment following international competitive tendering according to the Act relating to Public Procurement and the appurtenant regulations. The procurement procedure *Kjøp etter forhandling* (negotiated procedure) will be followed.

The assignment was announced in the Norsk Lysingsbald/Norwegian Gazette no. 75 of 29 March 2000, the Norsk Lysingsblad/Norwegian Gazette's procurement supplement EØS/WTO (EEA/WTO) no. 13 of 31 March 2000, the Supplement to the Official Journal of the European Communities, and the TED database.

Together with the announcement, the present document states the conditions under which tenders are to be submitted for the evaluation of the Research Council of Norway.

2 The evaluation assignment

The evaluation of the Research Council of Norway is to cover the period from its establishment on 1 January 1993 to 31 December 1999, both dates inclusive. It shall give an overall evaluation of the Research Council in the light of the principal objectives laid down in report to the Storting St. meld. nr. 43 (1991–92), recommendation to the Storting Innst. S. nr. 231 (1991–92), and the statutes (articles of association) of the Research Council.

The evaluation shall analyse the connection between the Research Council's framework conditions, organization and instruments, and the objectives laid down for its activities. Assessments shall be empirically grounded, among other things in the experiences of central groups of actors in the Ministries, research institutions, the commercial sector and the Research Council itself. In the light of this analysis, the evaluation shall consider what the Research Council's framework conditions should be, how the Research Council ought to be organized, and what steps the Council itself should take, so that one may be as well equipped as possible to meet the future challenges confronting Norwegian research.

2.1 Objectives

The objectives on which the evaluation shall be based are laid down in the following documents:

- Report to the Storting St. meld. nr. 43 (1991–92) *Et godt råd for forskning*
- Recommendation to the Storting Innst. S. nr. 231 (1991–92)
- The statutes of the Research Council of Norway
- Report to the Storting St. meld. nr. 36 (1992–93) *Forskning for fellesskapet* (research for the common good)
- Recommendation to the Storting Innst. S. nr. 192 (1992–93)
- Report to the Storting St. meld. nr. 39 (1998–99) *Forskning ved et tidsskille*
- Recommendation to the Storting Innst. S. nr. 110 (1999–2000)

In the evaluation, special importance shall be attached to:

- The role of the Research Council as an adviser on research policy
- The efforts of the Research Council to promote quality in research
- The work done by the Research Council to secure the position of basic research
- The efforts of the Research Council to ensure that research is utilized in the commercial and public sectors
- The work of the Research Council to promote cooperation and division of labour in the research system, and

· The steps taken by the Research Council aimed at better coordination of Norwegian participation in international research cooperation.

Possible further specifications of these objectives are contained in a separate annex.

2.2 Framework conditions for the work of the Research Council

The Research Council of Norway is subject to control at three levels (legislative assembly, government, and ministry). Administratively, the Research Council is a public administrative body with special powers, which reports to the Ministry of Education, Research and Church Affairs (KUF). The Research Council's administration funds are allocated by KUF, while all Ministries, including KUF, channel research funds through the Research Council.

The evaluation shall assess to what extent the Research Council's framework conditions have given it opportunities to perform its duties and achieve its principal objectives, especially with regard to the objectives emphasised in the present document.An assessment shall be made of the scale and composition of the financial allocations. Special attention shall be given to the degree of freedom of action permitted to the Research Council by its financial allocations. The evaluation shall also consider the appropriateness of the management practices adopted by individual Ministries. A special assessment shall be made of the role of the Ministry in charge of coordination and administration.

2.3 Organization of the Research Council of Norway

The Research Council of Norway came about when the existing research councils were merged with a view to creating an organization which would be unified while at the same time leaving scope for area-specific variations.

The Research Council is divided into three management levels: an Executive Board, Divisional Research Boards, and Programme Boards. The Executive Board and the Divisional Research Boards (of the Divisions of Industry and Energy, Bioproduction and Processing, Environment and Development, Medicine and Health, Culture and Society, and Science and Technology) are the Research Council's permanent management bodies. The Research Council's administration serves as the secretariat for the Executive Board and the Divisional Research Boards. The statutes contain fuller provisions concerning various aspects of the Research Council's organization.

Is the organization of the Research Council, including its management and administrative systems, suitable for the performance of its duties and the achievement of its objectives, in particular the objectives emphasised in the present document?

The analysis shall consider how tasks and responsibilities are divided between the management levels and divisions, how this division has been handled, and how well it has worked in practice.

In the assessment of the administrative system, special attention shall be paid to its links with the management system, and to whether there are

a) a uniform administrative culture,
b) an efficient organization, including whether resources relating to Research Council activities are efficiently used.

2.4 Research Council instruments

In order to perform the duties laid down for it, the Research Council has developed a set of procedures and instruments.

Are the working methods, procedures and instruments adopted by the Research Council appropriate to its assignments and objectives, in particular the objectives emphasised in the present document?

2.5 The tasks of the Research Council

On the basis of the assessments called for in paragraphs 2.2–2.4 above, an opinion is also requested on whether there are tasks of which the Research Council should be relieved or which it should be given. The extent to which a simplification of the research council system has been successfully achieved should also be considered.

2.6 The Research Council of the future

Report to the Storting St. meld. nr. 39 (1998–1999) notes that in the years ahead Norwegian research will have major challenges to face in improving research quality, advancing research across sector boundaries, and promoting innovation. The evaluation should contain proposals regarding the future role of the Research Council in those areas.

In the light of the analysis, the evaluation shall consider what the Research Council's framework conditions should be, how the Council ought to be organized, and what steps the Council itself should take, so that one may be as well equipped as possible to meet the future challenges confronting Norwegian research. Eventual proposals for changes in the Research Council must be specific in their wording. The advantages and disadvantages of proposed changes, if any, must be discussed.

3 The organisation of the evaluation assignment

The evaluation assignment shall be submitted in the form of one main report in which the evaluation is presented as a whole. Part reports can be produced covering aspects completed, either during the assignment period or on completion of the whole assignment.

The assignment can be submitted in Norwegian, Swedish, Danish or English.

The assignment shall be completed by 15 December 2001 at the latest, and within an upper financial limit of NOK 7 million.

3.1 The principal evaluator

The Ministry of Education, Research and Church Affairs wishes to contract with one evaluator (principal evaluator) with overall responsibility for the performance of the whole evaluation assignment.

The principal evaluator may choose one or more sub-contractors to carry out parts of the assignment. Under no circumstances will the employment of a sub-contractor relieve the principal evaluator of responsibility for the evaluation or the fulfilment of the contractual obligations.

3.2 Reference group

Plans are in hand for the establishment of a small reference group. The main purpose of such a group will be to make sure that the principal evaluator, and part evaluators if any, have a local base with access to thorough knowledge of various parts of the Norwegian research system. A reference group will participate in discussions and open doors for the evaluators. It should be noted that the reference group will not operate in any kind of management capacity. The terms of reference and the composition of a reference group, if any, will be entered in the contract between the Ministry of Education, Research and Church Affairs and the principal evaluator following discussions between them.

4 Tender requirements

The deadline for submissions of applications to tender was 4 May 2000. The Ministry of Education, Research and Church Affairs has assessed the applicants in relation to the requirements mentioned in the announcement of the evaluation assignment, and invites selected tenderers to submit tenders for the evaluation assignment.

Only tenders for the assignment as a whole can be submitted. Tenders for performance of parts of the assignment will not be considered. Alternative tenders will be considered.

Tenders shall be submitted in the form of roughly 10 to 15 page (A4) outlines. No financial compensation will be paid for the preparation of outlines for submission.

The tender must state how light will be shed on the particular themes and problems in the assignment. The choice of method for each problem and the assumptions underlying that choice must be explained. This includes explanations of

- how the problems are operationalised

- what sort of data collection methods will be used in connection with each problem
- the analytical approach chosen.

If the assignment is to be carried out by more than one principal evaluator, the distribution between them of main and subsidiary problems must be indicated.

The quality assurance of the assignment must be accounted for, including the quality assurance of individual part analyses.

A work schedule, in the event with milestones, must be prepared, and the tender must state how the Ministry of Education, Research and Church Affairs will be informed of progress.

The tender must state whether or not a reference group is wanted, and if so what tasks and characteristics it should have.

The tender must contain a quotation.

Tenders can be submitted in Norwegian, Swedish, Danish or English.

The deadline for the submission of tenders is 13 June 2000 at noon. The tenderer is obliged to abide by the tender until 15 October 2000 (earliest withdrawal date).

5 The selection process

Negotiations are envisaged with one or more tenderers. In the course of such negotiations, the preparation of more detailed tender documents may be required. The awarding authority reserves the right to present a basis for negotiations incorporating points taken from several of the outlines submitted.

The awarding authority will select the tender which is considered most advantageous. This implies that importance will be attached to the following criteria: the professionality of the evaluation plan in the tender, the quality of the plan, its relevance, the choice of methods and the price.